EDUWAT
Development of a Modern Higher Education System for Water Engineering in Syria

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Development of a Modern Higher Education System for Water Engineering in Syria

511251-TEMPUS-1-2010-1-DE-TEMPUS-SMHES

Annex 1

Modules Compendium

M&S UMWELTPROJEKT GMBH
www.mus-umweltprojekt.de

STAATSMINISTERIUM FÜR UMWELT UND LANDWIRTSCHAFT
Freistaat SACHSEN

Stadtentwässerung Dresden
WIR KLÄREN DAS FÜR SIE

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein	Tempus

ANNEX 1

Workpackage 1.4 - Development of higher education structure for Syria - Development of new curricula

1. Damascus University, Faculty of Civil Engineering

- Module Compendium Hydrology - Science and Engineering (HSE)
  Bachelor programme
  Master Programme
- Module Compendium Soil and Groundwater - Science and Engineering (SGW)
  Bachelor Programme
  Master Programme
- Module Compendium Water Engineering and Management (WEM)
  Bachelor Programme
  Master Programme

2. Tishreen University Lattakia, Faculty of Civil Engineering

- Module Compendium Bachelor of Water Engineering and Environment (BWEAE)
  Quality Management Bachelor of Water Engineering and Environment (BWEAE)
- Module Compendium Master of Harbor Construction and Coastal Engineering (MHCCE)
  Quality Management Master of Harbor Construction and Coastal Engi-neering MHCCE
- Module Compendium Master of Sanitary Engineering (MSE)
  Quality Management Master of Sanitary Engineering (MSE)
- Module Compendium Master of Water Resources Management (MWRM)
  Quality Management Master of Water Resources Management (MWRM)
- Module Compendium Master of Water Structures (MWS)
  Quality Management Master of Water Structures (MWS)
- Training Courses of suggested programmes

3. University of Aleppo

Faculty of Agricultural Engineering

- Module Compendium Agricultural Water Management (AWM)
  Bachelor Programme
  Master Programme

Faculty of Civil Engineering

- Module Compendium Water Engineering (WE)
  Bachelor Programme
  Master Programme

4. Al Baath University Homs

Faculty of Agriculture

- Module Compendium Water & Soil Engineering and Environment (SGW)
  Bachelor Programme
  Master Programme

Faculty of Civil Engineering

- Module Compendium Water Engineering (WE)
  Bachelor Programme
  Master Programme

EDUWAT – Basic contents of the education profiles		
Water Engineering	**Rural engineering, Hydraulic engineering**	**Water protection, Water management, Hydrology**
Focus of work: Water supply, urban waste water disposal, water protection areas, hazardous to water materials	**Focus of work** Agricultural irrigation and drainage, river engineering, storage engineering, water maintenance	**Focus of work:** water monitoring, water management, water remediation, storage management
Application fields: • Water authorities • Public utilities • Industrial enterprises • Enterprises for planning, calculation and construction of plants	**Application fields:** • Agricultual and water authorities • Farms • Enterprises for planning, calculation and hydraulic engineering	**Application fields:** • Water authorities • Storage operator • Enterprises for planning, controlling, calculation and hydraulic engineering
Main focus of education • Drinking water supply (water recovery, water treatment and water distribution) • Industrial water supply • Urban waste water disposal • Industrial waste water disposal • Water protection areas (for drinking and medicinal water) • Plants and regulations for handling with hazardous to water materials • Mining water engineering (mining and remediation) • Process engineering, plant construction, hydraulics, hydrochemistry, hydrobiology	**Main focus of education** • Agricultural irrigation systems • Agricultural drainage systems • River engineering • Flood protection • Storage engineering • Statics, construction, soil engineering, hydraulics, geohydrolgy, concrete construction, nature-orientated construction methods • Soil • Groundwater	**Main focus of education** • Water monitoring (sampling, valuation) • River, lake and storage management (quantitative and qualitative) • Groundwater management (quantitative and qualitative) • Remediation of rivers, lakes, storages and rroundwater • Storage management (flood, low water and water quality) • Hydrology, hydrobiology, hydrochemistry, geohydrology

Basic education for all education profiles		
Environmental law and water rights Hydro biology Waste water treatment Water management	Hydrology Water supply Land improvement Soil and groundwater sciences	Hydro chemistry Water treatment Hydraulic engineering (river engineering, storage engineering, agricultural hydraulic engineering)

Syrian Arab Republic
Ministry of Higher Education
Tishreen University
Directorate of
International, Cultural and Public
Relations

الجمهورية العربية السورية
وزارة التعليم العالي
جامعة تشرين
مديرية العلاقات الدولية والعامة والثقافية

Tishreen University
Prof. Dr. Hani shaaban
President of the Tishreen University

To:
Project Leader
EU-TEMPUS 511251-TEMPUS-1-2010 EDUWAT
Technische Universitaet Dreden

Confirmation letter

Hereby we confirm the installation of following study programs

Degree	Field	Start
Bachelor	*Water Engineering and environment*	*September 2015*
Master	*Water Resources Management*	*September 2015*
Master	*Harbor Construction and Coastal Engineering*	*September 2015*
Master	*Water Structures*	*September 2015*
Master	*Sanitary Engineering*	*September 2015*

These study programs have developed in the frame of the EU-TEMPUS project, 511251-TEMPUS-1-2010, „Development of a Modern Higher Education System for Water Engineering in Syria".

Lattakia 11.03.2015

President of the Tishreen University

Special University Letterhead

(Aleppo University)

President of the Aleppo University

To

Project Leader

EU-TEMPUS 511251-TEMPUS-1-2010 EDUWAT

Technische Universitaet Dresden

Confirmation letter

Hereby we confirm the installation of following study programs

Degree	Field	Start
Bachelor	*Agricultural Water Management*	*September 2016*
Master	*Agricultural Water Management*	*September 2015*

These study programs have developed in the frame of the EU-TEMPUS project, 511251-TEMPUS-1-2010, „Development of a Modern Higher Education System for Water Engineering in Syria".

Aleppo, March 11th 2015

Vice President of the Aleppo University

for Scientific Affairs

President of Damascus University
Syrian Arab Republic

To

Prof. Dr.-Ing. habil. Peter-Wolfgang Gräber (Graeber)

Project Leader

EU-TEMPUS 511251-TEMPUS-1-2010 EDUWAT

Technische Universitaet Dresden

Confirmation Letter

Hereby Damascus University confirms the installation of following study programs:

Degree	Field	Start
Bachelor	• Water Engineering and Management • Soil and Groundwater -Engineering • Hydrology - Engineering	Academic year 2016-2017
Master	• Water Engineering and Management • Soil and Groundwater - Engineering • Hydrology - Engineering	Academic year 2015-2016

These study programs have been developed in the frame of the EU-TEMPUS project, 511251-TEMPUS-1-2010, "Development of a Modern Higher Education System for Water Engineering in Syria".

President of Damascus University
Prof. Dr. MHD HASSAN ALKURDI

UNIVERSITY OF DAMASCUS ★ PRESIDENT OF UNIVERSITY ★

Place and date: Damascus,

11-3-2015

Syrian Arab Republic

Al - Baath University

Homs

No. : 527

Date : 11-3-2015

الجمهورية العربية السورية

جامعة البعث

حمص

الرقم ...

التاريخ ...

President Office

مكتب الرئيس

AL-Baath University

President of AL-Baath University

To

Project Leader

EU-TEMPUS 511251-TEMPUS-1-2010 EDUWAT

Technische Universitaet Dreden

Confirmation letter

Hereby we confirm that AL-Baath university have finished all preparation actions and still waiting the final approval of the Ministry of Higher Education to the installation of following study programs.

Degree	Field	Start
Bachelor	*Water Engineering*	*September 2015*
Master	*Water Management*	*September 2015*
Bachelor	*Soil & Ground Water Engineering*	*September 2015*
Master	*Soil & Ground Water Management*	*September 2015*

These study programs have developed in the frame of the EU-TEMPUS project, 511251-TEMPUS-1-2010, „Development of a Modern Higher Education System for Water Engineering in Syria".

Homs, 10th Mar 2015

AL-BAATH UNIVERSITY PRESIDENT OFFICE

AL-BAATH UNIVERSITY PRESIDENT OFFICE

Signature

President of AL-Baath University

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ص.ب : ٧٧

هاتف : ٢١٣١٨٤٧ (٠٣١) - فاكس : ٢١٢٦٧١٦

MODULE COMPENDIUM

Hydrology - Science and Engineering

(HSE)

Bachelor Programme

Damascus University

Faculty of Civil Engineering

2015

EDUWAT: 511251-TEMPUS-1-2010-1-DE-TEMPUS-SMHES

Development of a Modern Higher Education System for Water Engineering in Syria

Preface

This course in one of three water courses designed in the framework of the EU-TEMPUS project: EDUWAT: *Development of a Modern Higher Education System for Water Engineering in Syria*, TEMPUS 1-2010-1DE TEMPUS SMHES No. 511251.

The three developed courses are designed for Bachelor and Master Degrees in three engineering fields according to Bologna process, they are:

- Water Engineering and Management
- **Hydrology Science and Engineering**
- Soil and Groundwater Science and Engineering

The study period is 3 years for a Bachelor degree and 2 years for a Master degree. As the entire study period will be limited to 5 years. The majority of students **should** complete the Master degree to be qualified as engineers in the study filed of their choice.

Three working groups were given the responsibility of developing the three courses, each of three staff members from the Department of Water Engineering at The Faculty of Civil Engineering, Damascus University. A similar plan is made by Al Bath, Tishreen and Aleppo Universities. The resulted courses are being discussed frequently with the Ministry of Higher Education to set a procedure for implementation.

The work group responsible for this course; ***Hydrology Science and Engineering*** consists of the following staff members of Damascus University:

1. **Dr. Mohamad Hecham TAJJAR** (group coordinator)
   Faculty of Civil Engineering, Damascus University

2. **Dr. Kutaiba SAADI**
   Faculty of Civil Engineering, Damascus University

3. **Dr. Imad ASSAF**
   Faculty of Civil Engineering, Damascus University

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Content

Preface

1. Introduction
2. Rationale
3. Learning Outcomes
4. Specific Outcome Objectives

Curriculum for B.Sc. in Hydrology Science and Engineering (HSE)

5. General Structure
6. Details of Modules (Core Modules – Elective Modules)
7. Course Requirements

1. Introduction

This course is based on EU-TEMPUS project **“Development of a Modern Higher Education System for Water Engineering in Syria - EDUWAT”**,Nr. 511251-TEMPUS-1-2010-1-DE-TEMPUS-SMHES, in the duration between 15 of October 2010 and 14 of April 2015.

The **EDUWAT** project aims to:

- Increase higher education opportunities for all
- Develop high-quality curricula and educational programs
- Establish a quality assurance system
- Create an innovation environment for higher education and scientific research
- Increase the productivity of the Syrian scientific research and link it to development needs of the country
- Encourage partnerships among universities on national and international level
- Improve and modernize intermediate education

2. Rationale

Many regions of the world are increasingly facing challenges when it comes to managing water. Although all challenges are related to water, the nature of the challenge differs from one location to another. It may relate to having too little water while water demands are growing explosively (water scarcity), too much water (flooding), and water of poor quality rendering them unfit to sustain the ecosystem or challenges related to providing water for people, industry and agriculture. What complicates matters further is that these challenges are all interdependent and influence each other. For example, water scarcity can impact water quality and the ability to provide water. Addressing these challenges requires that water engineers and managers apply an integrated and interdisciplinary approach, involving hydrological, biophysical, chemical, economic, institutional, legal, technical, policy-making and planning aspects.

Syria is considered as an arid to semi-arid country, about two third of its area is considered as very arid. The rainfall in Syria is characterized by high rate of variability. The annual average is less than 300 mm in more than 90% of the country.
Syria’s water resources are under growing pressure from rapidly population growth, urbanization, the impacts of climate change and an expanding agricultural sector. Available water per capita is constantly decreasing (**AWPC** was about $800m^3$/ca in 2010 and it is likely to be reduced by about half up to 2050) and rainfall is becoming more irregular and scarce.

3. Learning Outcomes

a. Provide breadth of knowledge of basic principles and concepts
b. Provide depth within specialized areas
c. Provide an understanding of experimental/research design and methodology
d. Develop approaches for integration of information
e. Encourage critical thinking and hypothesis building
f. Provide skills in writing and communication
g. Provide contemporary information
h. Encourage appreciation of scientific values

4. Specific Outcome Objectives

Hydrological engineering, also called water resources engineering, is a civil engineering specialty offered at both the undergraduate and graduate levels. Hydrological engineering is chiefly concerned with the flow and storage of water. Topics commonly covered include urban drainage, water supply, wastewater treatment, river management and coastal protection. Hydrological engineering also focuses on preventing floods and lessening the effects of floods, droughts and other natural disasters.

Students learn how to use science and mathematics to design water storing, moving and conserving systems. Course topics in a hydrological engineering program include water cycle management, flood control, soil physics, probability and numerical analysis.

More recently, the flow implications for water quality have become of greater concern, and the transport of sediment, nutrients, and pollutants in natural or engineered watercourses has received greater attention.

Research opportunities are also available to both undergraduate and graduate students. Research projects might focus on a number of topics, including watershed hydrology, contaminant transport, turbulent flows and environmental hydraulics.

The Hydrologic Faculty members are particularly interested in applying the latest software and hardware technologies to investigate, understand, and model fundamental flow and transport processes with the widest range of applications. Research opportunities may be found in projects dealing with Sediment transport, watershed hydrology, Watershed planning, environmental hydraulics, and contaminant transport.

1. Understand physical hydrology and the hydrologic basis of water resources
2. Examine dams and reservoirs, drought, water geochemistry, water quality and pollutants, and the economic and political aspects of water resources
3. The scientific method will be presented and consistently applied for all topics discussed
4. Present and discuss relevant topics in real-time (e.g., weather phenomena, floods, pollution issues, natural disasters) using information available through the media
5. Present case studies of local interest as it relates to study course material
6. Apply the basic principles of mathematical and hydrologic sciences, physics, soil, agricultural engineering, chemistry and construction engineering to the understanding of water resources and socioeconomic development

Curriculum for B.Sc. in Hydrology Science and Engineering (BHSE)

5. General Structure

	Credits	%
Modules with Basics in Mathematics and Natural Sciences	43	24
Modules with Basics in Engineering	35	19
Modules with Basics in Hydro Sciences	32	18
Modules with specialized Basics	24	13
Elective Modules	10	6
Modules for General Qualification	10	6
Practical Training /Project	14	8
Bachelor examination	12	7
Total	**180**	**100**

Module Semester	**1**	**2**	**3**	**4**	**5**	**6**	**Total/ ECTS**
Basics in Mathematics and Naural Sciences	25	13	5				**43**
Basics in Engineering	5	17	13				**35**
Basics in Hydro Sciences			12	5	15		**32**
Specialized Basics				15		9	**24**
Elective Modules				5	5		**10**
General Qualification				5		5	**10**
Practical Training/ Project Study					10	4	**14**
Bachelor Theses incl. Defense						12	**12**
Total	**30**	**30**	**30**	**30**	**30**	**30**	**180**

Module Nr.	Course Semester	1	2	3	4	5	6	Total/ ECTS
	Basics in Mathematics and Natural Sciences	**25**	**13**	**5**				**43**
BHSE.01	Mathematics	5	5	5				15
BHSE.02	Probability and Statistics	5						5
BHSE.03	Computer Science	5	4					9
BHSE.04	Physics	5						5
BHSE.05	Soil and Water Chemistry	5						5
BHSE.06	Engineering Geology		4					4
	Basics in Engineering	**5**	**17**	**13**				**35**
BHSE.07	Engineering Graphics	5						5
BHSE.08	Applied Hydraulics		4	4				8
BHSE.09	Geotechnics		4	4				8
BHSE.10	Statics and Dynamics		5	5				10
BHSE.11	Topography/Geodesy		4					4
	Basics in Hydro Sciences			**12**	**5**	**15**		**32**
BHSE.12	Hydrogeology			4				4
BHSE.13	Meteorology			4				4
BHSE.14	Hydrology				5			5
BHSE.15	Waste Water Treatment			4				4
BHSE.16	Hydraulic Structures					5		5
BHSE.17	Groundwater					5		5
BHSE.18	Urban Water Management					5		5
	Specialized Basics		**0**	**0**	**15**	**0**	**9**	**24**
BHSE.19	Flood Risk Management				5			**5**
BHSE.20	Aspects of Irrigation and Drainage				5			**5**
BHSE.21	Land Use Planning						4	**4**
BHSE.22	Fundamentals of Hydrologic Modeling				5			**5**
BHSE.23	Climate Change and Water Resources Management						5	**5**
	Elective Modules	0	0	0	5	5	0	**10**
BHSE.24	Water Protection/Protection Areas				5			
BHSE.25	Environmental impact Assessment				5			
BHSE.26	GIS and Remote Sensing in Water Mana-gement					5		
BHSE.27	Watershed management					5		
	General Qualification				5		5	**10**
BHSE.28	Language				5			**5**
BHSE.29	Technical and Financial Reports						5	**5**
BHSE.30	Practical Training/ Project Study					10	4	**14**
BHSE.31	Bachelor Thesis with Defense						12	**12**
	Total	**30**	**30**	**30**	**30**	**30**	**30**	**180**

Curricula Structures - Bachelor Course Hydrology Science and Engineering

Semester 1	Mathematics	Probability and Statistics	Computer Science	Physics	Soil and Water Chemistry	Engineering Graphics	
Semester 2	Mathematics	Computer Science	Engineering Geology	Applied Hydraulics	Geotechnics	Statics and Dynamics	Topography/Geodesy
Semester 3	Mathematics	Applied Hydraulics	Geotechnics	Statics and Dynamics	Hydrogeology	Meteorology	Waste Water Treatment
Semester 4	Hydrology	Flood Risk Management	Aspects of Irrigation and Drainage	Fundamentals of Hydrologic Modeling	Elective Modules	Language	
Semester 5	Hydraulic Structures	Groundwate	Urban Water Management	Elective Modules	Practical Training/ Project Study		
Semester 6	Land Use Planning 4cr	Climate Change and Water Resources Management	Technical and Financial Reports	Practical Training/ Project 4cr	Study Bachelor Thesis incl. Defense 12cr		
Credits	5	5	5	5	5	5	

- Modules in Natural Sciences 25%
- Modules inTechnical Sciences 25%
- Modules in Economic & Social Sciences 25%
- Modules in Variable Sciences 25%

6. Module description (Core Modules – Elective Modules)

Module Number	**Module Name**	**Professor in Charge**
BHSE.01	**Mathematics**	**Dr. ………**
Contents and qualification aims	**Contents:** Limits, continuity, and their applications: chain rule, Implicit differentiation, related rates, increase decrease, concavity. Extreme. Newton's method, Roll's theorem, Mean-Value Theorem, definite and indefinite integrations, fundamental theorem of calculus, Area and volume, inverse functions, Exponential and logarithmic functions with their derivatives , conic sections. Inverse trigonometric and hyperbolic functions. Techniques of integration, by parts, trigonometric integrals, trigonometric substitutions, partial fractions, quadratic expressions, general substitutions. Improper integrals. Infinite series, convergence and divergence, convergence tests, Maclaurin and Taylor series. Polar coordinates: definition, arc length, area, conic sections. Systems of linear equations. Elimination methods (Gauss and Jordan). Matrices (operations and properties). Elementary matrices and the inverse of matrix. Matrix methods for solving linear systems. Determinants. Vector spaces and subspaces. Linear independence. Basis and Dimension. The four main fundamental subspaces of a matrix. Inner product spaces. Orthonormal bases. Eigenvalues and eigenvectors. Diagonalization. Jordan form. General linear transformation. Inverse of a linear transformation. Kernel and range. Applications. **Qualification aims:** Upon completion of the course, students will be able to: • Acquire the necessary mathematical concepts and skills for everyday life, and for continuous learning in mathematics and related disciplines • Develop the necessary process skills for the acquisition and application of mathematical concepts and skills • Develop the mathematical thinking and problem solving skills and apply these skills to formulate and solve problems • Recognize and use connections among mathematical ideas, and between mathematics and other disciplines • Develop positive attitudes towards mathematics • Make effective use of a variety of mathematical tools (including information and communication technology tools) in the learning and application of mathematics • Produce imaginative and creative work arising from mathematical ideas • Develop the abilities to reason logically, to communicate mathematically and to learn cooperatively and independently	
Module character	**3 hours** of lectures per week **2 hours** tutorial per week	
Prerequisite of attendance	None	
Applicability	The modules are compulsory for the Bachelor **Hydrology**	

	Science and Engineering
Prerequisite achieve credit points	Having passed the module examination in each semester. The module exams are written examinations (120 minutes for each)
Credit points and grade	The modules earn **15 credits** The grade for the examination equals the module grade
Frequency of the module	The module is offered annually in winter term
Work load	The work load is **450** hours
Duration of the module	The course takes **three semesters**
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering. **Recommended:** • H. Anton, I. Bivens, and S. Davis. Calculus, 8th Edition. John Wiley and Sons, 2005 • H. Anton. Calculus, 7th Edition. John Wiley and Sons, 2002 • James Stewart. Calculus Early Transcendentals, 5th edition. Thomson, 2003 • R. Larson, R. Hostetler, and B. Edwards. Calculus, 7th edition. Houghton Mifflin Company, 2002 • H. Anton. Calculus, 7th Edition. John Wiley and Sons, 2002 • E. Swokowski, M. Olinic, and D. Pence Calculus, 6th Edition. PWS Publishing Company,1994

Module Number	**Module Name**	**Professor in Charge**
BHSE.02	**Probability & Statistics**	**Dr. ………**
Contents and qualification aims	Statistics: introduction to descriptive statistics, statistical data and its display, central tendency measures, deviation measures, simple correlation measures, linear regression, introduction to sampling theory: random sample, sampling methods, sampling distributions, point estimation: unbiased estimates, efficient estimates, interval estimates for statistical parameters, tests of hypotheses, nonparametric tests using Chi square distribution: observation comparison tests, goodness of fit test. Probability: random experiment probability space: elementary event space, event algebra, probability function, conditional probability and event independence: conditional probability definition and properties, law of exact probability, Bayes formula, event independence, random variable and its probability distribution function, discrete random variables: Bernoulli distribution, binomial distribution, geometric distribution, hyper geometric distribution, Poisson distribution, continuous random variables: continuous uniform distribution, exponential distribution, normal distribution, Chi square distribution, characteristic values of random variables: expectation, variance, moment generating function, central limit theorem, random vector and its probability distribution function.	
Module character	**3 hours** of lectures per week **2 hours** tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor **Hydrology Science and Engineering**.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (1)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** • Jay L. Devore, Student Solutions Manual for Devore's Probability and Statistics for Engineering and Science, 8th, 2011, ISBN-13: 9780840065391 • Walpole R. E. & al., Probability & Statistics for Engineering & Scientists, Pearson, 8^{th}, 2007,	

Module Number	**Module Name**	**Professor in Charge**
BHSE.03	**Computer Sciences**	**Dr. ………**
Contents and qualification aims	**Contents:** Introduction to computers, problem solving and algorithm development. Design, code, debug and document programs using techniques of good programming style and C++ programming language. Laboratory experiments and examples will be used to illustrate and reinforce concepts taught in the lectures. Continuation of CSI 1430. Introduction to basic aspects of arrays, pointers, classes, inheritance, polymorphism, virtual functions, linked lists, stacks, queues, and binary trees. **Qualification aims:** Upon completion of the course, students will be able to: • Understand and be able to apply the underlying principles of Computer Science to a variety of problem domains • Develop good communication skills so that they can solve problems and communicate their solution • Develop strong analytical skills so that they can quickly assess how to solve problems • Work in groups and appreciate the dynamic and collaborative nature of problem solving • Be equipped with a thorough understanding of the development process of software including design, implementation, documentation, and testing • Appreciate the role that computers play in society and to be able to direct the use of technology in a beneficial way and to solve new problems	
Module character	**3 hours** of lectures per week **2 hours** tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor **Hydrology Science and Engineering**.	
Prerequisite achieve credit points	Having passed the module exam in each semester. The module exam are written examinations (120 minutes for each)	
Credit points and grade	The modules earn **9 credits** The grade for the examination equals the module grade	
Frequency of the module	The modules are offered annually in winter term	
Work load	The work load is **270 hours**	
Duration of the module	The course takes **two semesters (1,2)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ **Yale N. Patt and Sanjay J. Patel**, Introduction to Computing Systems: from bits and gates to C and beyond, McGraw-Hill Publishers, SECOND Edition, 2004. ISBN: 0-07-246750-9-ISBN 0-07-121503-4 \\(ISE) ▪ **Robillard**, **M.P., & al.**, Recommendation Systems in Software Engineering, Springer, Th. Edition, 2014.	

Module Number	**Module Name**	**Professor in Charge**
BHSE.04	**Physics**	**Dr. ………**
Contents and qualification aims	Contents: Motion in One Dimension, Vectors, Motion in Two Dimensions, The Laws of Motion, Circular Motion and Other Applications of Newton's Laws, Work and Kinetic Energy, Potential Energy and Conservation of Energy, Linear Momentum and Collisions, Rotation of a Rigid Object About a Fixed Axis, Rolling Motion and Angular Momentum. Charge and matter. Electric field. Gauss law. Electric potential. Capacitors and dielectrics. Electromotive force and electric circuits. Magnetic field. Ampere's law. Faraday's law of induction. Self-induction. Maxwell's equations. Qualification aims: ▪ Provide students with a college level physics experience ▪ Develop and reinforce strong problem solving and critical thinking skills ▪ Develop and reinforce a collaborative problem solving approach ▪ Develop and reinforce laboratory skills including: questioning, developing an experimental procedure, observing, data collection, and data analysis, including graphical analysis ▪ Develop and reinforce appropriate laboratory safety skills ▪ Develop an understanding of how we experience physics in our everyday lives and of how physics is applied in the real world	
Module character	3 hours of lectures per week 2 hours tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor Hydrology Science and Engineering.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (1)	
Reference Materials	Essential: Reference Materials available at Faculty of Civil Engineering, Damascus University Recommended: ▪ F. Reif, Fundamentals of Statistical and Thermal Physics (McGraw-Hill, 1965, QC 175.R43) ▪ F. Mandl, Statistical Physics, Second Edition (Wiley, 1988,) ▪ D.L. Goodstein, States of Matter (Prentice Hall, 1975; Dover, 1985, QC 173.3.G66) ▪ C. Kittel and H. Kroemer, Thermal Physics, Second Edition L.D. Landau and E.M. Lifshitz, Statistical Physics, Third Edition, Part 1 (Pergamon,1980,)	

Module Number	**Module Name**	**Professor in Charge**
BHSE.05	**Soil and Water Chemistry**	**Dr. ………**
Contents and qualification aims	Contents: The ability of soil to function as a medium for plant growth and/or waste disposal, a purifier of water, a determinant of contaminant fate and transport, etc. is inextricably tied to chemistry. Applying basic principles of chemistry to processes that occur commonly in soil/water systems is, thus, fundamental to understanding and optimizing soil functions. Successful approaches range from applied (empirical) to basic (theoretical) studies and conceptualizations. This course utilizes the full range of approaches, with emphasis on the soil solution and the various soil components and chemical processes influencing its chemistry. Qualification aims: ▪ Strengthen the student's understanding of basic chemical principles. ▪ Teach students how to apply the principles to soil/water chemical processes ▪ Demonstrate how chemical knowledge helps explain soil functions	
Module character	3 hours of lectures per week 2 hours tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor Hydrology Science and Engineering.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (1)	
Reference Materials	Essential: Reference Materials available at Faculty of Civil Engineering, Damascus University. Recommended: ▪ Soil and Water Chemistry: An Integrative Approach, 2004, by Michael E. Essington, University of Tennessee, [CRC Press]. ▪ Environmental Soil Chemistry, 2003 (2nd Edition), by Donald L. Sparks, University of Delaware, [Academic Press]. ▪ Soil Chemistry, 2001 (3rd Edition), H.L. Bohn, B.L. McNeal, and G.A. O'Connor [John Wiley & Sons, Inc.] – available as an e-book. ▪ Chemical Equilibrium, 1966, by A.J. Bard [Harper & Row Publishers]	

Module Number	**Module Name**	**Professor in Charge**
BHSE.06	**Engineering Geology**	**Dr. ………**
Contents and qualification aims	**Contents:** Engineering geological consideration, description of soils and rock masses. Classification of rock masses for engineering purposes. Engineering geological maps and their applications. Requirement of conducting Engineering Geological studies and Writing Reports, Rock and soil improvement such as grouting, drains and reinforcement of ground (2days Field Trips) **Qualification aims:** At the conclusion of this course: • To outline the contribution of engineering geology to the civil and mining works • To explain the classical approach to solve an engineering geological problem • The extensive uses of engineering geology maps • The role and effect of engineering geology in the improvement of earth materials	
Module character	**2 hours** of lectures per week **2 hours** tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor **Hydrology Science and Engineering.**	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **4 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is **120 hours**	
Duration of the module	The course takes **one semester (2)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Engineering Geology and Geotechnics by BELL, F. G., 1980 ▪ Engineering Geology: Rock Engineering in Construction by GOODMAN, R.E., 1993 ▪ Engineering Geology: An Environmental Approach by RAHN, P. H., 1986 ▪ Engineering Geology by ZARUBA, Q., and MENCL, V., 1976	

Module Number	**Module Name**	**Professor in Charge**
BHSE.07	**Engineering Graphics**	**Dr. ………**
Contents and qualificati-on aims	**Contents:** Instruments of Drawing, Graphic geometry (Lines, Letters, Numbers, Tangency Construction). Intersections, Types of Projection, Dimensioning, Plane Sectioning. Steel Structure Drawing, Projection of Water Structure at Water-way Intersection. Pumping station Drawing. Dams Drawing AutoCAD program. **Qualification aims:** Upon completion of the course, students will be able to: • Understand theory and practice of surveying and leveling and to develop skills to use modern survey instruments	
Module character	**1 hours** of lectures per week **4 hours** tutorial per week	
Prerequisite of attendan-ce	None	
Applicability	The module is compulsory for the Bachelor **Hydrology Science and Engineering.**	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a writ-ten examination **(180 minutes)**	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (1)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Gary Robert, Eric N wiebe "Fundamentals of graphics" Communications", McGraw Hill, 2006 ▪ William Howard, Joe Musto " Introduction to solid Modeling " Using Solid Works, McGraw Hill , 2005	

<table>
<tr><th>Module Number</th><th>Module Name</th><th>Professor in Charge</th></tr>
<tr><td>BHSE.08</td><td>Applied Hydraulics</td><td>Dr. ………</td></tr>
<tr><td>Contents and qualification aims</td><td colspan="2">Contents: Open channels flow, channel geometry, steady uniform flow in open channels, energy principles in open channel (total energy and specific energy, specific energy diagram, critical flow and depth, critical slope, applications of energy principle, gradually varied flow in open channels, derivation of gradually varied flow equation, water surface profiles, computation of water surface profiles (direct step method, finite difference method), weirs and spillways, momentum principles in open channels, Hydraulic jump, fluid measurements, Sediment Transport, Wave Theory, River Engineering, Coastal Engineering, Principle of non-steady flow in open channel.

Qualification aims:
• Provide and understating of hydraulics principles and how they apply to irrigation systems
• Exposes the student to an expansive suite of topics and methods within the field of hydraulics, hydrologic and hydraulic concepts</td></tr>
<tr><td>Module character</td><td colspan="2">2 hours of lectures per week
2 hours tutorial per week</td></tr>
<tr><td>Prerequisite of attendance</td><td colspan="2">Mathematics</td></tr>
<tr><td>Applicability</td><td colspan="2">The module is compulsory for the Bachelor Hydrology Science and Engineering.</td></tr>
<tr><td>Prerequisite achieve credit points</td><td colspan="2">Having passed the module exam in each semester. The module exams are written examinations (120 minutes)</td></tr>
<tr><td>Credit points and grade</td><td colspan="2">The module earns 8 credits
The grade for the examination equals the module grade</td></tr>
<tr><td>Frequency of the module</td><td colspan="2">The module is offered annually in winter term</td></tr>
<tr><td>Work load</td><td colspan="2">The work load is 240 hours</td></tr>
<tr><td>Duration of the module</td><td colspan="2">The course takes Two semesters (2,3)</td></tr>
<tr><td>Reference Materials</td><td colspan="2">Essential:
Reference Materials available at Faculty of Civil Engineering, Damascus University.
Recommended:
▪ B.F. White, Fluid Mechanics, McGraw Hill, 1994
▪ Subramanya, K, Flow in Open Channels. TATA McGraw Hill New Delhi (1993).
▪ Chow, Open Channel Flow, McGraw Hill, 1975
▪ Frabzini, Fluid Mechanics with Engineering Applications, McGraw Hill, 1997
▪ Garg, Irrigation Engineering and Hydraulic Structures, Khanna Publishers, 1992
▪ H.M. Chaudhry, Open Channel Flow, Prentice Hall of India, 1998
▪ Roberson, John A., John J. Cassidy and M. Hanif Chaudhry. Hydraulic Engineering. 2nd ed. Wiley, 1998
▪ V.L. Streeter and E.B. Wylie, Fluid Mechanics, McGraw Hill, 1997</td></tr>
</table>

Module Number	**Module Name**	**Professor in Charge**
BHSE.09	**Geotechnics**	**Dr. ………**
Contents and qualification aims	Contents: Composition and structure of soils, Phase relations and index properties, soil classification, soil compaction, principle of effective stress, stresses due to self-weight, stresses due to applied loads, soil permeability, seepage: one and two dimensional, flow net, consolidation theory and consolidation settlement analysis, secondary compression, shear strength of soils (introductory). Specific gravity test, Dry screening using sieve analysis, wet analysis (Hydrometer test), water content, Atterberg Limits: Liquid limit, Plastic limit, and Shrinkage limit, standard and Modified Proctor compaction tests, in situ field test, Permeability test (constant and falling head tests), Triaxial shear test, unconfined compression test, direct shear test. Students present the report of one experiment using data show. types of shallow foundations, bearing capacity of foundations: equations and correlations, settlement, geometric design of isolated footings, special types of footings, rectangular combined and strap footings and mat foundations, lateral earth pressure and retaining walls, introduction to deep foundations. Qualification aims: Upon completion of the course, students will be able to: • Understand soil structure Soil classified • Estimate the soil bearing capacity • Estimate the soil settlement • Choose footing type and Design of footings • Understand seepage and drowning the flow net	
Module character	2 hours of lectures per week 1 hour tutorial per week 1 hour laboratory training	
Prerequisite of attendance	Engineering Geology	
Applicability	The module is compulsory for the Bachelor Hydrology Science and Engineering.	
Prerequisite achieve credit points	Having passed the module exam in each semester. The module exam are written examinations (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is 240 hours	
Duration of the module	The course takes two semesters (2,3)	
Reference Materials	Essential: Reference Materials available at Faculty of Civil Engineering, Damascus University. Recommended: ▪ Das, B.M. (2006). Principles of Geotechnical Engineering. Geotechnical Engineering Principles & Practices: International Edition, 2nd Edition Donald Coduto, Man-chu Ronald Yeung, William Kitch Jun 2010, Paperback, 816 pages	

Module Number	**Module Name**	**Professor in Charge**
BHSE.10	**Statics & Dynamics**	**Dr. ………**
Contents and qualification aims	**Contents:** General Principles , Force Vectors, Equilibrium of a Particle, Force System Resultants, Equilibrium of a Rigid Body, Structural Analysis, Internal Forces, Friction, Center of Gravity and Centroid, Moments of Inertia, Virtual Work, Kinematics of a Particle, Kinetics of a Particle: Force and Acceleration, Kinetics of a Particle: Work and Energy, Kinetics of a Particle: Impulse and Momentum, Planar Kinematics of a Rigid Body, Planar Kinetics of a Rigid Body: Force and Acceleration, Planar Kinetics of a Rigid Body: Work and Energy, Planar Kinetics of a Rigid Body: Impulse and Momentum, Three-Dimensional Kinematics of a Rigid Body, Three-Dimensional Kinetics of a Rigid Body, Vibrations, Three-Dimensional Kinetics of a Rigid Body. **Qualification aims:** Upon completion of the course, students will be able to: • Determine the magnitude and direction of resultant force • Calculate the center of mass for an asymmetric cross-section • Calculate support reactions for cantilever and simple beams • Calculate and draw load, shear and moment diagrams	
Module character	**3 hours** of lectures per week **2 hours** tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor **Hydrology Science and Engineering**	
Prerequisite achieve credit points	Having passed the module exam in each semester. The module exam are written examinations (120 minutes)	
Credit points and grade	The module earns **10 credits** The grade for the examination equals the module grade.	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is **300 hours**	
Duration of the module	The course takes **two semesters (2,3)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ J. M. Gere, Mechanics of Materials, Sixth Edition, Thomson Press, Toronto, Canada, 2006 ▪ R. C. Hibbeler, Engineering Mechanics: Dynamics, 10th Edition, Prentice Hall. ▪ R. C. Hibbeler, STATICS, Eleventh Edition, Pearson Prentice Hall, New Jersey USA, 2004 ▪ R. C. Hibbeler, Engineering Mechanics STATICS & DYNAMICS, Eleventh Edition, Pearson Prentice Hall, New Jersey USA, 2007	

Module Number	**Module Name**	**Professor in Charge**
BHSE.11	**Topography/ Geodesy**	**Dr. ………**
Contents and qualification aims	**Contents:** Concepts of geodesy and surveying, earth's gravity field and the geoid, and measurement techniques applied to geomatics are examined. Field studies include the use of the level, the total station, and GPS for doing distance and angle measurements, leveling, traversing and topographic surveying. **Qualification aims:** • To provide the students a basic understanding of Geodesy and Surveying theory, the shape, motion and gravity field of the earth; to familiarize with surveying instruments and operations, to apply typical surveying computations	
Module character	**2 hours** of lectures per week **2 hours** tutorial per week	
Prerequisite of attendance	Basic knowledge of mathematics	
Applicability	The module is compulsory for the Bachelor **Hydrology Science and Engineering.**	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is **120 hours**	
Duration of the module	The course takes **one semester (2)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Jack C. McCormac, Wayne Sarasua, William Davis, 2012. Surveying, 6th Edition, John Wiley & Sons, Toronto, ISBN 978-0-470-49661-9, 379pp ▪ Charles D. Ghilani and Paul R. Wolf, 2012. Elementary Surveying – An Introduction to Geomatics, 13/e, Prentice Hall, Toronto, ISBN-10: 0132554348, 984pp ▪ Barry F. Kavanagh, 2009. Surveying: Principles and Applications, 8/e. Prentice Hall, Upper Saddle River, NJ, ISBN-10: 013236512X, 816pp	

Module Number	**Module Name**	**Professor in Charge**
BHSE.12	**Hydrogeology**	**Dr. ………**
Contents and qualification aims	**Contents:** Hydrologic and geologic factors controlling the occurrence and dynamics of groundwater on regional and local scales. Introduction to groundwater flow through porous media, Notions of fluid potential and hydraulic head, Darcy flux and Darcy's Law, Physical properties of porous media and their measurement, rock porosity and fluid-solid relations in porous media, integration of the elementary equations, the diffusion equation, and consolidation, aquifer systems, steady state solutions of the diffusion equation, transient solutions of the diffusion equation, pumping tests, and measurements of aquifer properties, multiphase flow of immiscible fluids, flow of miscible fluids: dispersion, retention, and heat transfer, Geostatistic and stochastic approach in hydrogeology, numerical solutions of the flow and transport equations.. • **Qualification aims:** Acquaint the students with principles and processes governing the movement of water through the hydrologic cycle, including atmospheric moisture flow, surface runoff, infiltration, and groundwater flow; and hydrologic statistics, and frequency analysis techniques applied to problems of water resources engineering.	
Module character	**2 hours** of lectures per week **2 hours** tutorial per week	
Prerequisite of attendance	Engineering Geology	
Applicability	The module is compulsory for the Bachelor **Hydrology Science and Engineering**.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **4 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is **120 hours**	
Duration of the module	The course takes **one semester (3)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ De Marsily, G. **Quantitative Hydrogeology.** Academic Press Inc., Harcourt Brace Jovanovich, Publishers. (1986). ▪ Todd D.K., Ground Water Hydrology, John Wiley and Sons, 2000	

Module Number	**Module Name**	**Professor in Charge**
BHSE.13	**Meteorology**	**Dr. ………**
Contents and qualification aims	**Contents:** Overview of current weather maps; structure of the atmosphere and the role of moisture in the development of dew, clouds, and precipitation; air masses, fronts, cyclones, thunderstorms, tornadoes, and hurricanes. Elements of weather forecasting, instrumentation and communication. **Qualification aims:** • Introduce the students the fundamental principles of meteorology and weather as a principal factor in hydrological cycle.	
Module character	**3 hours** of lectures per week **1 hour** tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor **Hydrology Science and Engineering.**	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **4 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is **120 hours**	
Duration of the module	The course takes **one semester (3)**	
Reference Materials	**Recommended:** ▪ Aguado, E. Burt, J. 2006. Understanding Weather and Climate. Prentice Hall, London. ▪ Ahmad, Q. K. 2005. Climate Change and Water Resources in South Asia. CRC Press, Boca Raton, Florida, USA. ▪ Garbrecht, J. and T. Piechota. 2005. Climate Variations, Climate Change, and Water Resources Engineering. American Society of Civil Engineers, USA. ▪ Taylor, F. W. 2005. Elementary Climate Physics. Oxford University Press. ▪ Kininmonth, W. 2004. Climate Change: A Natural Hazard, Multi-Science Publishing Co. Ltd.	

Module Number	**Module Name**	**Professor in Charge**
BHSE.14	**Hydrology**	**Dr. ………**
Contents and qualification aims	**Contents:** Introduction: hydrologic cycle and its components, climatic factors and their measurements, Precipitation; types and forms of precipitation and their measurement. Rainfall and runoff estimation, runoff and its components, rainfall-runoff relations, factors affecting runoff, stream flow, interpretation of stream flow data, evaporation and transpiration, evapotranspiration and its estimation using different methods. Hydrologic analysis: Hydrograph and its characteristics, hydrographs for various durations, hydrograph separation, unit hydrograph development and application, unit hydrographs from complex storms, rainfall frequency and duration analysis, flood frequency and duration analysis. Hydrologic Models: definition, classification of models, development, calibration, verification and application of models. **Qualification aims:** • Acquaint the students with principles and processes governing the movement of water through the hydrologic cycle, including atmospheric moisture flow, surface runoff, infiltration, and groundwater flow; and hydrologic statistics, and frequency analysis techniques applied to problems of water management	
Module character	**3 hours** of lectures per week **2 hours** tutorial per week Excursion 8 hours total	
Prerequisite of attendance	Mathematics and Applied Hydraulics	
Applicability	The module is compulsory for the Bachelor **Hydrology Science and Engineering**.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (4)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University **Recommended:** ▪ D.R. Maidment, Handbook of Hydrology (1992), published by McGraw-Hill, Inc. ▪ L. W. Mays Water Resources Engineering (2001), published by John Wiley & Sons Inc. ▪ Chow, Maidment and Mays, Applied Hydrology (1988), published by McGraw-Hill Inc.	

Module Number	**Module Name**	**Professor in Charge**
BHSE.15	**Waste Water Treatment**	**Dr. ………**
Contents and qualification aims	**Contents:**Problems and fundamental principles of wastewater and rainwater drainage, Types and characteristics of wastewaters, Types of drainage and sewerage systems, Recipient's characteristics and conservation of water resources. Schemes of drainage/ sewage systems, Calculations of relevant wastewater and rainwater quantities, Designing drainage/sewage systems. Limitations in designing, Dimensioning drainage/sewage networks, Structures of drainage/sewage systems: relieving structures, pumping stations, retentions etc. Construction of sewage systems. Testing water tightness of sewers, Wastewater disposal structures: types, dimensioning, calculation and construction, Drainage/sewage systems maintenance and management, Wastewater treatment plants. Treatment processes (mechanical, biological and physical-chemical processes), Sludge treatment. **Qualification aims:** Students will be able to: ▪ Properly identify the critical issues and challenges in planning, design and operation of modern wastewater treatment facilities to meet not only current but also anticipated regulatory requirements ▪ Develop reasonable working knowledge and hands -on experiences that can be used to devise and design the efficient, cost-effective treatment and water reuse systems ▪ Gain the independent learning skills and enhance your ability to work effectively in teams through PBL format	
Module character	**2 hours** of lectures per week **2 hours** tutorial per week (Excursion and report 8 hours total : visit a Waste water treatment station)	
Prerequisite of attendance	Surface Water Horology and Applied Hydraulics	
Applicability	The module is compulsory for the Bachelor **Hydrology Science and Engineering**.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **4 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is **120 hours**	
Duration of the module	The course takes **one semester (3)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Wastewater Treatment: Advanced Processes and Technologies Author / Editor: D. G. Rao; R. Senthilkumar; J. Anthony Byrne; S. Feroz , Published: July 09, 2012 ▪ Steel, E. W., Mc Ghee T. J.: Water Supply and Sewerage, Mc Graw Hill Book Company, London, 1988.	

Module Number	**Module Name**	**Professor in Charge**
BHSE.16	**Hydraulic Structures**	**Dr. ………**
Contents and qualification aims	**Contents:** Introduction, Importance of Hydraulic Structures; Classification of Hydraulic Structures according to use; Design of inlet and outlet structures for irrigation canals; Cross structures, culverts, inverted siphons and aqueducts; Energy dissipation below hydraulic structures; Spillways; Design of dams. **Qualification aims:** Upon completion of the course, students will be able to: • Use the knowledge and skills studied previously, especially, on fluid mechanics, hydraulics and hydrology into this course • Recognize the different types of hydraulic structures, to understand its purpose and function and to select the most appropriate structure and location for a specific problem • Design, to analyze and to proof that the hydraulic structure is save and economical • Broaden skills in team work, communication and planning through small projects	
Module character	**3 hours** of lectures per week **2 hours** tutorial per week (Excursion 8 hours total)	
Prerequisite of attendance	Static and Strength of Materials, Hydraulic and Surface Water Hydrology	
Applicability	The module is compulsory for the Bachelor **Hydrology Science and Engineering.**	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (5)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering. **Recommended:** ▪ Novak, P., Moffat, A. Nalluri, C. and Narayanan, R., Hydraulic Structures, 4th Ed., 2007 ▪ Varshney, R., Gupta, S. and Gupta, R., Theory and Design of Irrigation Structures, 1982 ▪ Ray, K., et al, Water Resources Engineering, McGraw-Hill, 1992 ▪ U.S. Bureau of Reclamation, Design of Small Dams, U.S. Government Office, 1987. CE 423 Hydraulic Structures – KSU-Coo- A. Alhamid 1432/1433H	

Module Number	**Module Name**	**Professor in Charge**
BHSE.17	**Groundwater**	**Dr. ………**
Contents and qualification aims	Contents: • Background: Hydrologic Cycle, Water Budgets • Groundwater: Darcy's Law and Hydraulic Potential, The Steady-state Groundwater Flow Equation, Streamlines and Flow Nets, Regional Flow and Geologic Controls on Flow, Transient Flow, Aquifer Storage and Compressibility, Unconfined Flow, Groundwater Interaction with Streams and Lakes, Numerical Methods, Flow in Fractured Rock • Well Hydraulics: Thiem and Theis Equations, Pump Tests and Slug Tests • Contaminant Transport: Advection and Dispersion, Sorption and Diffusive Mass Transfer, Aquifer Remediation • Vadose Zone Hydrology: Unsaturated Flow, Retention Curves and Richard's Equation, Infiltration and Evapotranspiration • Couples Flow and Transport: Density Driven Flow, Freshwater/Saltwater Interaction, Heat Transport and Groundwater Flow • The Role of Groundwater in Large-scale Water and Chemical Budgets Qualification aims: • Acquaint the students with principles and processes governing the movement of water through the hydrologic cycle, including atmospheric moisture flow, surface runoff, infiltration, and groundwater flow; and hydrologic statistics, and frequency analysis techniques applied to problems of water management	
Module character	**3 hours** of lectures per week **2 hours** tutorial per week	
Prerequisite of attendance	Soil and Water Chemistry, Hydraulic and Hydrogeology	
Applicability	The module is compulsory for the Bachelor **Hydrology Science and Engineering.**	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (5)**	
Reference Materials	Essential: • Reference Materials available at Faculty of Civil Engineering, Damascus University Recommended: • Bear J., Hydraulics of Groundwater, McGrow-Hill International, 1979 • Todd D.K., Ground Water Hydrology, John Wiley and Sons, • Driscoll, F., Groundwater and Wells, St. Paul, Minnesota, • Raghunath H.M., Ground Water Hydrology, Wiley Eastern Ltd., Second reprint, 2000	

Module Number	**Module Name**	**Professor in Charge**
BHSE.18	**Urban Water Management**	**Dr. ………**
Contents and qualification aims	**Contents:** The module overviews the systems of urban water management as well as methods for drawing of untreated water, water treatment and distribution. The main aspects of the module include dimensioning of water treatment reactors and distribution nets, and analysis and optimization of operation and maintenance. Understanding of the basics and engineered realization are weighted equally. One half-day excursion to water supply facilities is offered. The module includes an overview of the system of waste water disposal, consisting of waste water und rain water discharge (urban hydrology) as well as waste water and sludge treatment. The focus lies on models to describe the relevant processes and the techniques to dimension and efficiently operate waste water structures. Water pollution, raised by waste water disposal, is characterized as the target of optimization. The mechanisms of the contamination with matter are described. Additional approaches for integrated optimization of the operation are discussed taking into account the interaction between the subsystems of water supply. One half-day excursion to waste water facilities is offered. The students are able to identify and implement important processes of the urban water system, to design and optimize plants of water supply, to picture important processes of the urban water system, to dimension plants of water supply and wastewater disposal, and to estimate the impacts for the affected water body.	
Module character	**3 hours** of lectures per week **2 hour** tutorial per week	
Prerequisite of attendance	Applied Hydraulics	
Applicability	The module is compulsory for the Bachelor Water Engineering and Management	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (5)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Parkinson J. N., Goldenfum J. A., Tucci C.. (2010), Integrated Urban Water Management: Humid Tropics: UNESCO-IHP. CRC PRESS ▪ Wagner I., Marsalek J., Breil P., Aquatic Habitats in Sustainable Urban Water Management: Urban Water Series - UNESCO-IHP (2007), CRC PRESS.	

Module Number	**Module Name**	**Professor in Charge**
BHSE.19	**Flood Risk Management**	**Dr. ………**
Contents and qualification aims	**Contents:** Risk management of flood events requires complex, integrated approaches. The module therefore focuses on the understanding of relevant physical processes during and after flood events. The module provides information about several process parts such as development, pathways, and receptor areas. An introduction to first measures and instruments for societal governance are finally considered and practical examples are discussed. A flash flood is analyzed as an example flood type in a case study workshop. To develop and interpret management strategies for flood risk reduction demands an extensive risk management and complex transdisciplinary solutions. The whole of physical processes of flood events as well as the societal governance have to be considered. The integrated flood risk management consists of 3 major parts: risk analysis (material to describe the flood risk system), risk evaluation (including risk perception) and risk mitigation (with risk prevention and communication, crisis management and maintenance). • The students know the fundamental elements of the flood risk system and are able to determine risk as a negative consequence of hazard and vulnerability. • The students are able to understand all relevant components of flood risk management with respect to vulnerability. They can determine a tolerable level of risk, they are able to develop and interpret management strategies and different options for flood risk reduction. Case studies of river floods and coastal floods are discussed in two flood type oriented workshops.	
Module character	**3 hours** of lectures per week **2 hours** tutorial per week	
Prerequisite of attendance	Surface Hydrology – Groundwater Hydrogeology	
Applicability	The module is compulsory for the Bachelor **Hydrology Science and Engineering.**	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (4)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Gareth Pender , Hazel Faulkner (2010). Flood Risk Science and Management. Wiley-Blackwell	

Module Number	**Module Name**	**Professor in Charge**
BHSE.20	**Aspect of Irrigation and Drainage**	**Dr. ………**
Contents and qualification aims	**Contents:** Soil Physical Properties; Soil Water Content; Soil Plant Water Relationship; Irrigation and Water Management; Surface Irrigation Systems; Sprinkler irrigation system; Drip irrigation system; micro irrigation system; Irrigation Scheduling; Irrigation System Selection Issues. Importance of drainage to agricultural system; The types of drainage, i.e. surface drainage and subsurface drainage. The basic design parameters of the surface and subsurface drainage. **Qualification aims:** • Provide knowledge and skills in conveyance and distribution of water, design criteria of irrigation system, water distribution structures • Equip the students with detailed knowledge of water logging and salinity problems, drainage investigation and design of surface, sub-surface and vertical drainage systems	
Module character	**3 hours** of lectures per week **2 hours** tutorial per week	
Prerequisite of attendance	Soil and Water Chemistry, Hydraulics and Hydro Structure Engineering	
Applicability	The module is compulsory for the Bachelor **Hydrology Science and Engineering**.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (4)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering. **Recommended:** ▪ Frederick Haynes Newell (2010).Principles of Irrigation Engineering. McGraw-Hill Publication ▪ Etcheverry (2010). Irrigation Practice and Irrigation Engineering. McGraw-Hill Publisher ▪ Larry G. James (2004) Principles of Farming Irrigation System Design. Washington State University (Wiley) ▪ Schwab, Fangmeier, Elliot and Frevert (1992). Soil and Water conservation Engineering Wiley	

Module Number	**Module Name**	**Professor in Charge**
BHSE.21	**Land Use Planning**	**Dr. ………**
Contents and qualification aims	**Contents:** Understanding How Land Use Planning Contributes to Sustainable Urban Development; Institutions, Policies and Tools for effective Land Use Planning; Land Use Planning and its impacts on hydrological cycle; Climate Change and Land Use Planning.. **Qualification aims:** Upon completion of the course, students will be able to: • Gain detailed knowledge of water delivery process, flow control systems, role of organization and monitoring and evaluation of irrigation systems performance	
Module character	**2 hours** of lectures per week **2 hours** tutorial per week	
Prerequisite of attendance	Irrigation and Drainage and Water Demand Management.	
Applicability	The module is compulsory for the Bachelor **Hydrology Science and Engineering**.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **4 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in summer term	
Work load	The work load is **120 hours**	
Duration of the module	The course takes **one semester (6)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Steinnocher K. 2012. Land Use: Planning, Regulations, and Environment. Nova science Publishers ▪ Randolph J. 2004. Environmental Land Use Planning and Management. ISLANDPRESS.	

Module Number	**Module Name**	**Professor in Charge**
BHSE.22	**Fundamentals of Hydrologic Modeling**	**Dr. ………**
Contents and qualification aims	**Contents:** Applying Hydrologic Modeling to examine water flow, estimate hydrological parameters, and determine solutions to problems and testing future scenarios. How to build models, interpreting models and using models in problem-solving, Different types of models are covered. **Qualification aims:** Upon completion of the course, students will be able to: • Learn and understand principles, process, and necessary techniques for assessment, mitigation and monitoring	
Module character	**3 hours** of lectures per week **2 hours** of seminar per week	
Prerequisite of attendance	Hydrology	
Applicability	The module is compulsory for the Bachelor **Hydrology Science and Engineering**.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in summer term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (4)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ **Morris, P. and R. Therivel. 2009.** Hydrological Modelling and the Water Cycle, Springer Sorooshian, S., Hsu, K.-I., Coppola, E., Tomassetti, B., Verdecchia, M., Visconti, G. (Eds.) ▪ **Eslamian Saeid. 2014**. Handbook of Engineering Hydrology: Modeling, Climate Change, and Variability. CRC Press.	

Module Number	**Module Name**	**Professor in Charge**
BHSE.23	**Climate Change and Water Resources Management**	**Dr. ………**
Contents and qualification aims	**Contents:** Atmospheric structure, overview of earth system processes, earth‘s energy balance, meso, micro, macro climate, atmospheric circulation and climate, clouds and climate, carbon cycle, anthropogenic and natural forcing, radiative forcing and global warming, greenhouse gases and greenhouse effect history of past climate, recent climate change, carbon dioxide and energy use, surface temperature record, connections with our world, trend analysis of meteorological and oceanographic parameters, future predictions and impact, comparison of computer simulations of past climate with temperature records, computer projections of future climate change, the role of the hydrological cycle in the climate system, decade long precipitation variations and water resources, water availability and demand in south Asia, climate change and water resources, climate change and future water challenges, hydrologic models, global warming and the acceleration of the hydrological cycle, assessing of hydrology on regional and smaller scales, advantages and limitations of hydrologic models in climate, application of hydrologic models for climate change impact, application of models in Syria. **Qualification aims:** • Provide introduction to climate change, its causes and effects, knowledge about the greenhouse process responsible for climate change • Help in understanding the impact of climate change on water resources	
Module character	**2 hours** of lectures per week **2 hours** of seminar per week	
Prerequisite of attendance	Basic knowledge in meteorology, hydrology, physics, chemistry, and mathematics	
Applicability	The module is compulsory for the Bachelor **Hydrology Science and Engineering**.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in summer term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (6)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Freeman, W. H. 2008. Earth's Climate: Past and Future. University of Virginia, USA. ▪ Aguado, E. Burt, J. 2006. Understanding Weather and Climate. Prentice Hall, London. ▪ Ahmad, Q. K. 2005. Climate Change and Water Resources in South Asia. CRC Press, Boca Raton, Florida, USA.	

	▪ Garbrecht, J. and T. Piechota. 2005. Climate Variations, Climate Change, and Water Resources Engineering. American Society of Civil Engineers, USA. ▪ Taylor, F. W. 2005. Elementary Climate Physics. Oxford University Press. ▪ Kininmonth, W. 2004. Climate Change: A Natural Hazard, Multi-Science Publishing Co. Ltd. ▪ Peixoto, J. P., Oort, A. H. 1992. Physics of Climate. Springer ▪ Oke, T. R. 1988. Boundary Layer Climates. Routledge.

Module Number	**Module Name**	**Professor in Charge**
BHSE.24	**Water Protection/ Protection Areas**	**Dr. ………**
Contents and qualification aims	**Contents:** Introduce to the principle and practical aspect of water protection and water quality assessment and monitoring, Regulations and the basics of water protection and methods to delineate protection areas of water sources. **Qualification aims:** Upon completion of the course, students will be able to: • Learn and understand principles, process, and necessary techniques for assessment, mitigation and monitoring	
Module character	**3 hours** of lectures per week **2 hours** of seminar per week	
Prerequisite of attendance	None	
Applicability	The module is one of 4 **optional** modules for the Bachelor **Hydrology Science and Engineering.**	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in summer term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (4)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ **Clark**, Robert M., **Hakim**, Simon, **Ostfeld** . 2012. Handbook of Water and Wastewater Systems Protection, Springer.	

Module Number	**Module Name**	**Professor in Charge**
BHSE.25	**Environmental Impact Assessment**	**Dr. ………**
Contents and qualification aims	**Contents:** Overview of environmental impact assessment. Selection of scientific and socio-economic factors in environmental impact assessment. Environmental impact indicators. Baseline study; air, water, soil, sediment. Identification of quantitative and qualitative environmental evaluation criteria; application of traditional and modern techniques. Approaches for identifying, measuring, predicting, and mitigating environmental impacts. Environmental management plan. Environmental standards and the environmental impact assessment process; methodologies for incorporating environmental impact assessment into management decision-making. Public hearing steps and procedures. Environmental evaluation of policies. **Qualification aims:** Upon completion of the course, students will be able to: • Learn and understand principles, process, and necessary techniques for assessment, mitigation and monitoring	
Module character	**3 hours** of lectures per week **2 hours** of seminar per week	
Prerequisite of attendance	None	
Applicability	The module is one of 4 **optional** modules for the Bachelor **Hydrology Science and Engineering.**	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in summer term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (4)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Morris, P. and R. Therivel. 2009. Methods of Environmental Impact Assessment. Routledge, Oxon, UK. ▪ Therivel R, J. Glasson and A. Chadwick. 2009 Introduction to Environmental Impact Assessment. Routledge, Taylor & Francis Group, Kentucky, USA. ▪ Lawrence, D. P. 2005. Environmental Impact Assessment. John Wiley & Sons, Inc., Hoboken, New Jersey.	

Module Number	**Module Name**	**Professor in Charge**
BHSE.26	**GIS and Remote Sensing in Water Management**	**Dr. ………**
Contents and qualification aims	**Contents:** Role of RS and GIS as tools for IWRM: data generation, limitations and outlook **Geospatial data required for water management** Introduction: remote sensing components Platforms and sources of RS-GIS data GIS components: spatial data, coordinates and projection Building a GIS Database: maps and spatial data **Spatial and non-spatial data processing** Image pre-processing techniques: Geometric correction, enhancement, noise removal and filtering Information extraction: Digital and visual interpretation principles of digital classification Basic spatial analysis: operations and output, spatial selection operations, Dissolve, Proximity functions and buffering - Overlay: Raster overlay, Vector overlay, clip, intersect and union **Data analysis and presentation** Remote sensing applications in IWRM, monitoring and mapping of natural resources Spatial estimation, interpolation, prediction and core area delineation. Sampling and sampling patterns Interpolation Methods: Nearest Neighbor, Fixed Radius and Inverse Distance Weighted **Analysis, design and implementation of Information Systems** Applications of RS data for monitoring vegetation, water and land se/cover mapping Terrain Analysis and hydrologic models in GIS: slope and aspect, Hydrologic functions, watershed and view sheds **Qualification aims:** Upon completion of the course, students will be able to: • Access the main sources of geospatial data required for water management • Obtain and process spatial and non-spatial information related to water and land resources management • Use different instruments for analyzing and presenting spatial data • Understand the main steps of data modeling: analysis, design and implementation of Information Systems	
Module character	**3 hours** of lectures per week **2 hours** tutorial per week	
Prerequisite of attendance	All compulsory modules	
Applicability	The module is one of 4 **optional** modules for the Bachelor **Hydrology Science and Engineering.**	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	

Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade
Frequency of the module	The module is offered annually in summer term
Work load	The work load is **150 hours**
Duration of the module	The course takes **one semester (5)**
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Liu, J. G., and P. Mason. 2009. Essential Image Processing and GIS for Remote Sensing. John Wiley & Sons Inc., New York, USA. ▪ Weng, Q. 2009. Remote Sensing and GIS Integration: Theories, Methods, and Applications: Theory, Methods, and Applications. McGraw-Hill Professional, Dubuque, IA, USA. ▪ Chang, Kang-Tsung. 2006. Introduction to Geographic Information Systems. McGraw-Hill Higher Education, Columbus, Ohio, USA ▪ Shamsi, U.M.. 2005. GIS Applications for Water, Wastewater, and Stormwater Systems CRC, Boca Raton, FL, USA ▪ Jensen. J. R. 2004. Introductory Digital Image Processing. Prentice Hall, Inc., New Jersey, USA. ▪ Bernhardsen, T., A. Viak and A. Norway. 2002. Geographic Information System: An Introduction. John Wiley & Sons Inc., New York, USA ▪ Maidment, D. R. 2002. Arc Hydro: GIS for Water Resources. ESRI, Inc., USA ▪ Dijk, A. van, M. G. Bos. 2001. GIS and Remote Sensing Techniques in Land and Water Management. Springer, USA ▪ ICIMOD. 2001. Application of GIS and RS in Planning for Mountain Agriculture and Land Use Management. International Centre for Integrated Mountain Development (ICIMOD), Nepal ▪ Lyon, J. G. 2001. Wetland Landscape Characterization: GIS, Remote Sensing and Image Analysis. CRC, Boca Raton, FL, USA. ▪ Rees, W. G. 2001. Physical Principles of Remote Sensing (Topics in Remote Sensing) Cambridge University Press, UK ▪ Jensen, J. R. 2000. Remote Sensing of the Environment. Prentice Hall, New Jersey, USA

Module Number	**Module Name**	**Professor in Charge**
BHSE.27	**Watershed management**	**Dr. ………**
Contents and qualification aims	**Contents:** The module will develop the students' competence for integrated watershed management. Using irrigation farming as an example the problem and the process of management will be introduced and discussed. Methods of data collection and analysis, of determination and forecast of supplies as well as methods to obtain water demand are introduced. The fundamentals of development and application of methods to dimension and simulate reservoirs and flood protection measures are explained. Need and concepts of integrated flood protection are discussed. Decision support systems are imparted to aggregate the single elements of watershed management. The students know the main procedures and tools for integrative watershed management (data acquisition, analysis, forecast, dimensioning, simulation) regarding balancing between demand and supply using typical control elements as dam and absorption reservoirs.	
Module character	**3 hours** of lectures per week **2 hours** of seminar per week	
Prerequisite of attendance	None	
Applicability	The module is one of 4 **optional** modules for the Bachelor **Hydrology Science and Engineering.**	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in summer term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (5)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** • Naiman. R. J. 1994. Watershed Management: Balancing Sustainability and Environmental Change. Alibris • Brooks K. N., Ffolliott P. F., Magner J. A. 2012. Hydrology and the Management of Watersheds. Alibris	

Module Number	**Module Name**	**Professor in Charge**
BHSE.28	**Foreign Language**	**Dr. ………**
Contents and qualification aims	**Contents:** Basics of Grammar; Parts of speech and use of articles; Sentence structure, active and passive voice; Practice in unified sentence; Analysis of phrase, clause and sentence structure; Transitive and intransitive verbs; Punctuation and spelling; Paragraph writing (Practice in writing a good, unified and coherent paragraph); Essay writing (Introduction); CV and job application (Translation skills , Arabic to English); Presentation skills; Essay writing (Descriptive, narrative, discursive, argumentative; Academic writing (How to write a proposal for research paper/term paper, How to write a research paper/term paper (emphasis on style, content, language, form, clarity, consistency); Technical Report writing; Progress report writing. **Qualification aims:** • Enhance language skills and develop critical thinking • Enable the students to meet their real life communication needs • Enhance language skills and develop critical thinking	
Module character	**3 hours** of lectures per week **2 hours** of tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor **Hydrology Science and Engineering**	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in summer term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (4)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 1. Third edition. Oxford University Press. 1997 ▪ Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press. 1997. ▪ Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 0 19 435405. ▪ Reading. Upper Intermediate. Brain Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992.. ▪ Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press 1986.	

Module Number	**Module Name**	**Professor in Charge**
BHSE.29	**Technical and Financial Reports**	**Dr. ………**
Contents and qualification aims	**Contents** - Report Writing - Developing Business Cases - Developing Feasibility Studies - Business Planning - Peer Reviewing - Effective Communication Skills - Oral Reporting & Presentations - Budgeting - Financial Statement Analysis **Qualification aims:** • The course will provide tools and techniques that help students work step-by-step through workplace problems and scenarios. Along with operators, this course will be of value to any water sector workers and front line supervisors	
Module character	**3 hours** of lectures per week **2 hours** of seminar per week	
Prerequisite of attendance	Have passant the Foreign Language course	
Applicability	The module is compulsory for the Bachelor **Hydrology Science and Engineering.**	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in summer term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (6)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Alfredson, K., K. Leo, P. Pacter, R. Picker, J. Radford, Applying International Accounting Standards, Wiley, 2005 ▪ Eddey, P., N. Arthur and J. Knapp, Accounting for Corporate Combinations and Associations, 5th ed., Prentice Hall, 2001 ▪ Godfrey, J., A. Hodgson, S. Holmes and A. Tarca, Accounting Theory, 6th ed., Wiley, 2006 ▪ Henderson, S. and G. Peirson, Issues in Financial Accounting, 11th ed. Longman, 2004 ▪ Henderson, S., G. Peirson and K. Harris, Financial Accounting Theory, Pearson, 2004 ▪ Sims, M. A. and T. Heazlewood, Reporting the Bottom Line: Financial Accounting, Issue 3, Prentice Hall, 200	

Module Number	**Module Name**	**Professor in Charge**
BHSE.30	**Practical Training/ Project Study**	**Dr. ………**
Contents and qualification aims	The Student must carry out practical training about one Problem belongs to subjects of Hydrology Science and Engineering in one or more institution or incorporation, and he must present full study about this problem.	
Module character	Practical Training/ Project Study: 28 Hours tutorial per week	
Prerequisite of attendance	Basic Knowledge of Practical Training/ Project Study, the student must be in the 5th Semester.	
Applicability	The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite achieve credit points	Having passed the module seminar and presentation before commission.	
Credit points and grade	The module earns 14 Cr. The final Grade is generated with 100% as presentation in front of committee.	
Frequency of the module	The module is offered annually.	
Work load	The workload is 420 hours.	
Duration of the module	The module takes two terms starting in Semester 5.	
Reference Materials	▪ James E. Mauch and Namgi Park: Guide to the Successful Thesis and Dissertation, A Handbook for Students and Faculty.2003. 5th ed., Copyright ©2003 by Marcel Dekker. ISBN: 0-8247-4288-5. ▪ Louis Cohen; Lawrence Manion and Keith Morrison: Research Methods in Education, 2005, 5th ed., ISBN 0-203-22434-5 Master e-book ISBN.	

Module Number	**Module Name**	**Professor in Charge**
BHSE.31	**Bachelor Thesis including Defense**	**Dr. ………**
Contents and qualification aims	The Student must work Bachelor Thesis with Defense about one Problem belongs to the subjects of Hydrology Science and Engineering in the semester, he must present full study about this problem.	
Module character	Bachelor Thesis with Defense: 24 Hours tutorial per week.	
Prerequisite of attendance	Basic Knowledge of Bachelor Thesis with Defense, the student must be in 6th. Semester.	
Applicability	The module is suitable for the professional and research oriented studies in civil and environmental engineering	
Prerequisite achieve credit points	Having passed the module presentation before a commission.	
Credit points and grade	The module earns 12 Cr. The final Grade is generated with 100% as presentation in front of committee.	
Frequency of the module	The module is offered in 6 th Semester.	
Work load	The work load is 360 hours.	
Duration of the module	The module takes one term starting in Semester 6.	
Reference Materials	• James E. Mauch and Namgi Park: Guide to the Successful Thesis and Dissertation, A Handbook for Students and Faculty. 2003. 5th ed., Copyright ©2003 by Marcel Dekker. ISBN: 0-8247-4288-5. • Louis Cohen; Lawrence Manion and Keith Morrison: Research Methods in Education, 2005, 5th ed., ISBN 0-203-22434-5 Master e-book ISBN. • Derek Swetnam: Writing Your Dissertation, How to plan, prepare and present successful work. 2007, 3rd ed. ISBN: 978 1 84803 126 5. • 4. Old Master and Bachelor thesis, which are available in the Libraries of the University.	

7. Course Requirements

Assignments
Assignments will be due either one or two weeks after they are handed out depending on their length. Grades will be reduced 10% for each day late.

Exams
In-class midterm and a final examination.

Grading

Activity	**Percentage**
Assignments	20%
In-class Midterm Exam	10%
Final Exam	70%

Below is a table that lists University letter grades (last column) and the equivalent percentages The Instructor will use for grading. All numerical grades will be rounded up or down to the nearest integer. The Instructor reserves the right to adjust the scores of any exam or the cumulative average in the students' favor if necessary, i.e. The Instructor reserves the right to add a few percentage points to every student's grade. No work for extra credit shall be given. An "Incomplete" grade will not be given to students who have missed exams.

Grading Matrix

Numerical value		**Equivalent University Letter grade**
greater than or equal to (%)	**and less than (%)**	
90	100	A
87	90	A-
84	87	B+
80	84	B
77	80	B-
74	77	C+
70	74	C
67	70	C-
64	67	D+
60	64	D
---	60	F

MODULE COMPENDIUM

Master Programme

Hydrology - Science and Engineering

(HSE)

Damascus University

Faculty of Civil Engineering

2015

EDUWAT: 511251-TEMPUS-1-2010-1-DE-TEMPUS-SMHES

Development of a Modern Higher Education System for Water Engineering in Syria

Preface

This course in one of three water courses designed in the framework of the EU-TEMPUS project: EDUWAT: *Development of a Modern Higher Education System for Water Engineering in Syria*, TEMPUS 1-2010-1DE TEMPUS SMHES No. 511251.

The three developed courses are designed for Bachelor and Master Degrees in three engineering fields according to Bologna process, they are:

- Water Engineering and Management
- **Hydrology Science and Engineering**
- Soil and Groundwater Science and Engineering

The study period is 3 years for a Bachelor degree and 2 years for a Master degree. As the entire study period will be limited to 5 years. The majority of students **should** complete the Master degree to be qualified as engineers in the study filed of their choice.

Three working groups were given the responsibility of developing the three courses, each of three staff members from the Department of Water Engineering at The Faculty of Civil Engineering, Damascus University. A similar plan is made by Al Bath, Tishreen and Aleppo Universities. The resulted courses are being discussed frequently with the Ministry of Higher Education to set a procedure for implementation.

The work group responsible for this course; ***Hydrology Science and Engineering*** consists of the following staff members of Damascus University:

4. **Dr. Mohamad Hecham TAJJAR** (group coordinator)
   Faculty of Civil Engineering, Damascus University

5. **Dr. Kutaiba SAADI**
   Faculty of Civil Engineering, Damascus University

6. **Dr. Imad ASSAF**
   Faculty of Civil Engineering, Damascus University

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein

Content

Preface

8. Introduction

9. Rationale

10. Learning Outcomes

11. Specific Outcome Objectives

Curriculum for M.Sc. in Hydrology Science and Engineering (HSE)

12. General Structure

13. Details of Modules (Core Modules – Elective Modules)

14. Course Requirements

8. Introduction

This course is based on EU-TEMPUS project **“Development of a Modern Higher Education System for Water Engineering in Syria - EDUWAT”**,Nr. 511251-TEMPUS-1-2010-1-DE-TEMPUS-SMHES, in the duration between 15 of October 2010 and 14 of April 2015.

The **EDUWAT** project aims to:

- Increase higher education opportunities for all
- Develop high-quality curricula and educational programs
- Establish a quality assurance system
- Create an innovation environment for higher education and scientific research
- Increase the productivity of the Syrian scientific research and link it to development needs of the country
- Encourage partnerships among universities on national and international level
- Improve and modernize intermediate education

9. Rationale

Many regions of the world are increasingly facing challenges when it comes to managing water. Although all challenges are related to water, the nature of the challenge differs from one location to another. It may relate to having too little water while water demands are growing explosively (water scarcity), too much water (flooding), and water of poor quality rendering them unfit to sustain the ecosystem or challenges related to providing water for people, industry and agriculture. What complicates matters further is that these challenges are all interdependent and influence each other. For example, water scarcity can impact water quality and the ability to provide water. Addressing these challenges requires that water engineers and managers apply an integrated and interdisciplinary approach, involving hydrological, biophysical, chemical, economic, institutional, legal, technical, policy-making and planning aspects.

Syria is considered as an arid to semi-arid country, about two third of its area is considered as very arid. The rainfall in Syria is characterized by high rate of variability. The annual average is less than 300 mm in more than 90% of the country.
Syria’s water resources are under growing pressure from rapidly population growth, urbanization, the impacts of climate change and an expanding agricultural sector. Available water per capita is constantly decreasing (**AWPC** was about $800m^3$/ca in 2010 and it is likely to be reduced by about half up to 2050) and rainfall is becoming more irregular and scarce.

10. Learning Outcomes

i. Provide breadth of knowledge of basic principles and concepts
j. Provide depth within specialized areas
k. Provide an understanding of experimental/research design and methodology
l. Develop approaches for integration of information
m. Encourage critical thinking and hypothesis building
n. Provide skills in writing and communication
o. Provide contemporary information
p. Encourage appreciation of scientific values

11. Specific Outcome Objectives

Hydrological engineering, also called water resources engineering, is a civil engineering specialty offered at both the undergraduate and graduate levels. Hydrological engineering is chiefly concerned with the flow and storage of water. Topics commonly covered include urban drainage, water supply, wastewater treatment, river management and coastal protection. Hydrological engineering also focuses on preventing floods and lessening the effects of floods, droughts and other natural disasters.

Students learn how to use science and mathematics to design water storing, moving and conserving systems. Course topics in a hydrological engineering program include water cycle management, flood control, soil physics, probability and numerical analysis.

More recently, the flow implications for water quality have become of greater concern, and the transport of sediment, nutrients, and pollutants in natural or engineered watercourses has received greater attention.

Research opportunities are also available to both undergraduate and graduate students. Research projects might focus on a number of topics, including watershed hydrology, contaminant transport, turbulent flows and environmental hydraulics.

The Hydrologic Faculty members are particularly interested in applying the latest software and hardware technologies to investigate, understand, and model fundamental flow and transport processes with the widest range of applications. Research opportunities may be found in projects dealing with Sediment transport, watershed hydrology, Watershed planning, environmental hydraulics, and contaminant transport.

7. Understand physical hydrology and the hydrologic basis of water resources
8. Examine dams and reservoirs, drought, water geochemistry, water quality and pollutants, and the economic and political aspects of water resources
9. The scientific method will be presented and consistently applied for all topics discussed
10. Present and discuss relevant topics in real-time (e.g., weather phenomena, floods, pollution issues, natural disasters) using information available through the media
11. Present case studies of local interest as it relates to study course material
12. Apply the basic principles of mathematical and hydrologic sciences, physics, soil, agricultural engineering, chemistry and construction engineering to the understanding of water resources and socioeconomic development

Curriculum for M.Sc. in Hydrology Science and Engineering
12. General Structure:

	Credits	%
Modules in Mathematics and Natural Sciences	10	**8%**
Modules in Engineering	10	**8%**
Modules in Hydro Sciences	20	**17%**
Modules with Specialization	20	**17%**
Elective Modules	15	**13%**
Modules for general Qualification	5	**4%**
Practical Training /Project	10	**8%**
Master Thesis plus Defense	30	**25%**
Total	**120**	**100%**

Module Semester	1	2	3	4	Total/ ECTS
Mathematics and Natural Sciences	5	5			10
Engineering	5	5			10
Hydro Sciences	5	10	5		20
Specialization	10	5	5		20
Elective Modules	5	5	5		15
General Qualification			5		5
Practical Training/ Project Study			10		10
Master Thesis plus Defense				30	30
Total	30	30	30	30	120

Module Nr.	Course Semester	1	2	3	4	Total/ECTS
	Mathematics and Natural Sciences	**5**	**5**			**10**
MHSE.01	Mathematics	5				5
MHSE.02	Biology-Ecology		5			5
	Engineering	**5**	**5**			**10**
MHSE.03	Dams	5	5			10
	Hydro Sciences	**5**	**10**	**5**	**0**	**20**
MHSE.04	Reservoir (Regulating Flow in Rivers)	5				5
MHSE.05	River Morphodynamics		5			5
MHSE.06	Water Quality Monitoring and Management			5		5
MHSE.07	Flood Protection in Lowland Areas		5			5
	Specialization	**10**	**5**	**5**	**0**	**20**
MHSE.07	Automation and Control in irrigation Projects	5				5
MHSE.08	Groundwater Modelling		5			5
MHSE.09	River Basin Development			5		5
MHSE.10	Unsaturated Zone Hydrology	5				5
	Elective Modules	**5**	**5**	**5**		**15**
MHSE.11	Integrated Hydrological and River Mo delling		5			5
MHSE.12	Introduction to Coastal Science and Engineering		5			5
MHSE.13	Service Oriented Management of Irrigation Systems	5				5
MHSE.14	Pumping Stations			5		5
MHSE.15	Water Resources Development	5				5
MHSE.16	Water Supply and Sanitation			5		5
	General Qualification			**5**		**5**
MHSE.17	Writing of proposals for water projects			5		5
MHSE.18	**Practical Training/Project study**			**10**		**10**
MHSE.19	**Master Thesis plus Defense**				**30**	**30**
	Total	**30**	**30**	**30**	**30**	**120**

Curricula Structures - Master Course Hydrology Science and Engineering

Semester 1	Mathematics	Dams	Reservoir (Regulating Flow in Rivers)	Automation and Control in irrigation Projects	Unsaturated Zone Hydrology	Elective Modules
Semester 2	Biology-Ecology	Dams	River Morphodynamics	Flood Protection in Lowland Areas	Groundwater Modelling	Elective Modules
Semester 3	Water Quality Monitoring and Management	River Basin Development	Elective Modules	Writing of proposals for water projects	Practical Training/ Project Study	
Semester 4	Master Thesis					
Credits	5	5	5	5	5	5

Modules in Natural Sciences 10% - 25%	Modules inTechnical Sciences 10 - 25%
Modules in Economic & Social Sciences 5% - 15%	Modules in Variable Sciences 55% - 70%

13. Details of Modules (Core Modules – Elective Modules)

Module Number	**Module Name**	**Professor in Charge**
MHSE.01	**Mathematics**	**Dr. ………**
Contents and qualification aims	**Contents:** **Complex analysis:** complex variables and complex functions, complex point sets and complex number representation, limit, derivative and continuity of a complex function, analytic functions, singular points, elementary complex functions, complex integrals, Cauchy's integral theorem and formulas. **Complex series:** Taylor's expansion, Laurent expansion, classification of singularities. Residues theorem: evaluation of complex integral using residues theorem, evaluation of real-definite integrals using residues theorem. **Mappings and its representation**: complex mapping and function, analytic function representation, conformal mapping, general conformal mappings. Fourier series and integral: trigonometric series, complex form of Fourier series, harmonic analysis, Fourier integral, generalized Fourier series. Special functions: Gamma function, Beta function, error function, Fresnel function, sine and cosine integrals, Bessel functions of first and second sort, Legendre's polynomials. Laplace transform and its applications: Laplace transform, inversion of Laplace transform, Laplace transform of some special functions, Laplace transform applications, relationship between Fourier integral and Laplace transform, Z transform. **Partial differential equations:** partial differential equations with direct integral ability, partial differential equation of the first order, partial differential equations of high orders with two independent variables and constant coefficients, vibrating string wave equation, two-dimensional heat transfer equation, circular membrane and Bessel equation. **Qualification aims:** A course should: ▪ Develop a variety of skills in modeling, logical reasoning and problem solving ▪ Encourage student interest and satisfaction through the development and use of mathematics in a variety of applications ▪ Promote an awareness of the relevance of mathematics to other fields of study and to other practical applications	
Module character	**3 hours** of lectures per week **2 hours** tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Master **Hydrology Science and Engineering.**	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	

Work load	The work load is **150 hours**
Duration of the module	The course takes **one semester (1)**
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Hung Cheng, Advanced Analytic Methods in Applied Mathematics, Science, and Engineering , Luban Press, 2006 ▪ Sanjoy Mahajan, Street-Fighting Mathematics: The Art of Educated Guessing and Opportunistic Problem Solving , MIT Press, 2010

Module Number	**Module Name**	**Professor in Charge**
MHSE.02	**Biology-Ecology**	**Dr. ………**
Contents and qualification aims	**Contents**: General introduction, Populations: birth, death, migration, harvesting, the effects of size and life history, Predictability and favorability of habitat. Communities: interactions between species, Predation, succession, spatial heterogeneity, disturbance, diversity of communities. Shallow lake ecology and eutrophication: introduction, phosphorus loading and eutrophication, alternative measures to solve the problem of eutrophication in lakes.	
Module character	**2 hours** of lectures per week **2 hours** tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Master **Hydrology Science and Engineering.**	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (2)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ **Larkum,** Anthony W. D**., Orth,** Robert J**., Duarte**, Carlos 2006. Seagrasses: Biology, Ecology and Conservation. Springer. ▪ Lynn, Les. 2010. Environmental Biology and Ecology Lab. Man. - 5th edition. Kendall/Hunt Pub. Co.	

Module Number	**Module Name**	**Professor in Charge**
MHSE.03	**DAMS**	**Dr. ………**
Contents and qualification aims	**Contents:** Description: Plan formulation, ecological and environmental considerations, flood hydrology studies, regulators, modules and miscellaneous canal structures, Selection of type of dam, foundations and construction materials, earth fill dams, rock fill dams. Concrete gravity dams, arch and buttress dams, Spillways, Outlet works, dissipaters, Diversion during construction, Operation and maintenance, Dam safety, certain important Syrian barrages **Qualification aims:** • To understand the basic concepts of dams • To understand the aims of dams • To knows different types of dams • To able to make calculation of dams • To able to compose project reports of dam	
Module character	**3 hours** of lectures per week **2 hours** of tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Master **Hydrology Science and Engineering.**	
Prerequisite achieve credit points	Having passed the module exam in each semester. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **10 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is **300 hours**	
Duration of the module	The course takes **two semesters (1,2)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Design of Small Dams. 2006 **By:** Us Dept of the Interior**.** ▪ L. Barry, 2013. Small Dams: Planning, Construction and Maintenance**.** CRC PRESS**.**	

Module Number	**Module Name**	**Professor in Charge**
MHSE.04	**Reservoir (Regulating Flow in Rivers)**	**Dr. ………**
Contents and qualification aims	**Contents:** Introduction: purpose of reservoir operation. Reservoirs classification; storage, flood control, retarding, detention and distribution reservoirs. Hydrological data required for reservoir operation, reservoir operation rules, policies and procedures. Major reservoirs of Pakistan and their operational and management rules. Regulation of flood control, power generation, irrigation reservoirs. Single and multipurpose operation, reservoir operation using system analysis techniques and operational research. Determination of reservoir capacity required for specific yield or demand using mass curve. Demand pattern for various type of reservoirs. Flood routing by graphical inflow; outflow discharge curve method; Trial and error method. Sources of sediment; Factors affecting erosion, silt load estimate for reservoirs; Mechanism of sediment distribution in reservoirs; Prediction of sediment distribution; Estimation of life of a reservoir. Operation and Maintenance of small dams: Maintenance of spillways, outlet pipes, earth embankments and foundation, storage dams, diversion dams, flood detention reservoirs; emergency preparedness plan, periodic examination and evaluation, reservoirs problem, silting seepage control, toxic algae, reservoir safety, marine life. **Qualification aims:** • To acquaint the students with the understanding of reservoir operation and problems related to management of reservoirs	
Module character	**3 hours** of lecture per week **2 hours** of tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Master **Hydrology Science and Engineering.**	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in summer term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (1)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ L.P. Dake (1983) Fundamentals of Reservoir Engineering, Elsevier. ▪ Ahmed T. (2010). Reservoir Engineering Handbook, Elsevier.	

Module Number	**Module Name**	**Professor in Charge**
MHSE.05	**River Morphodynamics**	**Dr. ………**
Contents and qualification aims	**Contents:** Introduction. Fluid velocities and bed shear stresses. Fluid and sediment properties. Initiation of motion. Bed forms. Effective bed roughness. Bed material suspension and transport in steady uniform currents. Bed material suspension and transport in waves. Bed material suspension and transport in combined waves and currents. Bed material transport, erosion and deposition in non steady and non uniform flow. Transport of cohesive materials. Mathematical models of sediment transport. Measuring instruments for sediments transport, settling velocity and wet bulk density.	
Module character	**3 hours** of lectures per week **2 hours** of tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Master **Hydrology Science and Engineering.**	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (2)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Tucker, M. E. (2003). Sedimentary Rocks in the Field (3rd edition). John Wiley & Sons, New York ▪ Boggs, S. (2001). Principles of Sedimentology and Stratigraphy (3rd edition) Prentice Hall, New York ▪ Miall, A.D. (2000). Principles of Sedimentary Basin Analysis (3rd edition). Springer-Verlag, Berlin ▪ Leeder, M.R. (1999).Sedimentology and Sedimentary Basins: from turbulence to tectonics. Blackwell Science, London ▪ Allen, PA (1997). Earth Surface Processes. Blackwell Science, London	

Module Number	**Module Name**	**Professor in Charge**
MHSE.06	**Water Quality Monitoring and Management**	**Dr. ………**
Contents and qualification aims	**Contents:** Introduction: definition, physical properties of water, uses of water, hydrologic cycle, water quality concern, major agricultural pollutants. Chemical water quality issues: drinking water quality, environmental water quality, agricultural water quality. Microbiological water quality issues: public health microbiology; pathogens in drinking water, recreational waters, water for irrigation. Microbiological interactions with chemical pollutants; eutrophication, toxigenic microbes, microorganisms in water distribution systems. Biotic indicators of water quality. Water quality guidelines, standards and legislation. Sampling strategies and methods: surface and groundwater. Sediment measurement. Effects of land use on water quality. Quality assurance. Data handling and interpretation. **Qualification aims:** • To provide the students basic rationale of water quality and practical hand in the sampling of water and the measurement and interpretation of water quality parameters	
Module character	**3 hours** of lectures per week **1 hour** of seminar per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Master **Hydrology Science and Engineering.**	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (3)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** • C.A. Brebbia, Wessex (2006): Water Pollution VIII**,** Modelling, Monitoring and Management, WITPress. • Harmanciogammalu**, N.B. & al.** (1999): Water Quality Monitoring Network Design, Measuring and Prediction, Water Science and Technology Library**.**	

Module Number	**Module Name**	**Professor in Charge**
MHSE.07	**Flood Protection in Lowland Areas**	**Dr. ………**
Contents and qualification aims	**Contents:** Carry out a basic design of dikes, revetments and closure dams, understand concepts and advances of flood risk management with due consideration of societal aspects, including flooding issues in the floodplain and coastal zone, management of flood risk, planning aspects and a variety of non-structural measures, understand and apply concepts and advances in tools used for coastal flood modeling and flood forecasting, understand and apply the principles of flood frequency analysis and risk based approaches to design of hydraulic works, understand (the practical application of) probabilistic design theory.	
Module character	**2 hours** of lectures per week **2 hours** of tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Master **Hydrology Science and Engineering.**	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (2)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ BEN SHE.YI MING. (2000). Artificial lowland Dutch flood control and reclamation History [hardcover](Chinese Edition). Amazon.	

Module Number	**Module Name**	**Professor in Charge**
MHSE.08	**Automation and Control in irrigation Projects**	**Dr. ………**
Contents and qualification aims	**Contents:** Introduction to mechanizing irrigation: Mechanizing surface irrigation, Mechanizing sprinklers irrigation; control theory: Basics of inputs and outputs, Open and closed control systems, Determining control system parameters in irrigation field; relays and programmable systems: Introduction to control logic rules, Electrical control, Electronic control, Programmed control; Control sensors in irrigation field: Levels sensors, Movements sensors, Thermal sensors, Humidity sensors, Soil moisture sensors; controlling channels: Adjust flows, Adjust distribution and division; controlling grids: Adjust flows, Adjust pressure, Adjust distribution; controlling Dams and Lakes: Adjust levels and its changes, Safety equipments; controlling irrigation programs services: Programmed timers, Responding to needs; 9th chapter: local control and wide control.	
Module character	**2 hours** of lectures per week **2 hours** of tutorial per week	
Prerequisite of attendance	Mathematics	
Applicability	The module is compulsory for the Master **Hydrology Science and Engineering.**	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (1)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Bolton, W. (1998) Control Engineering. Amazon. ▪ Dawkins, N. (2014). Automation and Controls: a guide to automation, controls, PLC's PLC programming. Amazon.	

Module Number	**Module Name**	**Professor in Charge**
MHSE.09	**Groundwater Modeling**	**Dr. ………**
Contents and qualificati-on aims	**Contents:** Groundwater exploration: reconnaissance survey, surface investigation methods. Subsurface investigations including test drilling, drilling methods, resistivity logging, radiation logging, temperature logging, velocity measurement and other methods. Well design, construction and development. Deterioration of wells; its causes and remedial measures. Groundwater monitoring: observation network, water table fluctuation. Selection of sites for the observation network. Installation of observation wells and piezometers. Conjunctive use of surface and groundwater. **Qualification aims:** • To equip the students groundwater exploration techniques, well design, groundwater monitoring and conjunctive use of surface and groundwater	
Module character	**2 hours** of lectures per week **2 hours** of tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Master **Hydrology Science and Engineering.**	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (2)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Anderson, M.P. and W.W. Woessner , 1992, Applied Groundwater Modeling: Simulation of Flow and Advective Transport, Academic Press, 381 p ▪ Zheng, C., and G. D. Bennett, 2002, Applied Contaminant Transport Modeling Second Edition, Wiley, New York, 621 pp	

Module Number	**Module Name**	**Professor in Charge**
MHSE.10	**River Basin Development**	**Dr. ………**
Contents and qualification aims	**Contents:** Understand the concepts of River Basin Development; Familiarize participants with potential and uses of water resources, factors affecting these and problems involved; principles and advances in integrated planning, development and multi-sectoral management of water resources; and the concepts of RB planning and management, Describe likely environmental impacts on the water environment (from WRD projects); Explain the principles of environmental (social) impact assessment (EIA/ESIA); Distinguish and describe the different methodologies available to environmental assessment; Plan the different stages in environmental assessment; Apply a method to a given example and communicate that method to others, Understand the necessity for the integration of these topics/approaches in (international) projects, Use state of the art modeling tools to simulate the distribution of water to stakeholders within a river basin, and evaluate the impact of future scenarios and develop strategies to manage expected consequences.	
Module character	**2 hours** of lectures per week **2 hours** of tutorial per week	
Prerequisite of attendance	Reservoir (Regulating Flow in Rivers)	
Applicability	The module is compulsory for the Master **Hydrology Science and Engineering.**	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (3)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Kirby, C. and White, W. R. (1994). Integrated River Basin Development Paperback.	

Module Number	**Module Name**	**Professor in Charge**
MHSE.11	**Unsaturated Zone Hydrology**	**Dr. ………**
Contents and qualification aims	**Contents:** Introduction and brief history, Physical properties and characteristic of soils, Behavior of clay-water systems, Potential and thermodynamics of soil water, Chemical properties and principles of soil water, Principles of water flow in soil, Saturated water flow in soil, Unsaturated water flow in soil, Transport of heat and gas in soil and at the surface, Contaminant transport, Effects of infiltration and drainage on soil-water redistribution, Field water in soils, Applied soil physics: modeling water, solute, and vapor movement, Drainage in soil water and ground water, Soil remediation techniques, Spatial variability, scaling, and fractals	
Module character	**3 hours** of lectures per week **1 hour** of tutorial per week	
Prerequisite of attendance	Applied Hydrology and Hydrogeology and Groundwater Modeling	
Applicability	The module is compulsory for the Master **Hydrology Science and Engineering.**	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (1)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Tindall, J. A. and al., (1999) Unsaturated Zone Hydrology for Scientists and Engineering. Prentice Hall.	

Module Number	**Module Name**	**Professor in Charge**
MHSE.12	**Integrated Hydrological and River Modelling**	**Dr. ………**
Contents and qualification aims	**Contents:** Understand and describe the structure of physically-based hydrological models and the methods used by these models to simulate the behavior of distinct hydrological phenomena, Distinguish components of hydrological modeling software for hydrodynamic simulation, catchment process simulation and surface water quality simulation, Translate a given hydrological problem into a model definition using available data, Conduct a model calibration/validation procedure and to interpret the simulation results to assess model performance and to suggest improvement in the model set-up, Independently carry out a hydrological modeling study and to report the results.	
Module character	**2 hours** of lectures per week **2 hours** of seminar per week	
Prerequisite of attendance	None	
Applicability	The module is one of **6 optional modules** for the Master **Hydrology Science and Engineering.**	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (2)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Wheater , H. and al. (2007), Hydrological Modelling in Arid and Semi-Arid Areas	

Module Number	**Module Name**	**Professor in Charge**
MHSE.13	**Introduction to Coastal Science and Engineering**	**Dr. ………**
Contents and qualification aims	**Contents:** Understand the basics of coastal engineering, Analyze the behavior of waves in oceanic and coastal waters, Describe tides and tidal currents and be familiar with methods for tidal computations, Understand the principle of soil mechanics, basically understand processes in coastal hydrodynamics and morphology, assess processes related to salt intrusion and density currents, understand the basics for numerical aspects, be aware of the limitations and characteristics of hydrodynamic numerical models, know the principle of finite differences and finite element-based methods.	
Module character	**2 hours** of lectures per week **2 hours** of tutorial per week	
Prerequisite of attendance	Basic knowledge in hydrology, meteorology, ground water management, urban drainage and system analysis	
Applicability	The module is one of **6 optional modules** for the Master **Hydrology Science and Engineering.**	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (2)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** • Reeve, D., and al. (2001) Coastal Engineering: Processes, Theory and Design Practice Paperback**,** Amazon	

Module Number	**Module Name**	**Professor in Charge**
MHSE.14	**Service Oriented Management of Irrigation Systems**	**Dr. ………**
Contents and qualification aims	**Contents**: Formulate policy objectives for irrigation development and management, Gain insight to the laws, legislations, and traditions pertaining to the development and use of water resources for agriculture, Identify water delivery arrangements including suitable flow control amenable to objectives, Comprehend different levels of water delivery service and associated costs, Conceptualize legislative, organizational and financial attributes of irrigation service delivery, Draw up service agreements considering cost recovery and accountability; Design asset management programs and action plans for implementation; and Devise monitoring & evaluation and benchmarking systems for assessing system performance.	
Module character	**3 hours** of lectures per week **1 hour** of tutorial per week	
Prerequisite of attendance	Applied Mathematics and Applied Hydrology and Hydrogeology	
Applicability	The module is one of **6 optional modules** for the Master **Hydrology Science and Engineering.**	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (1)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Majumdar D. P., Irrigation Water management Principles and Practices, Prentice Hall of India, New Delhi, 2005 ▪ Dewasish Choudhary, Irrigation Theory and Practice, Anmol Pub., 2008 ▪ Michal A.M., Irrigation Theory and Practice, Vikas Publishing House, New Delhi, 1999 ▪ Van den Bosch B.E., Hoevenaars J. and Broumer C., Irrigation Water Management Training Manual No.1 to 7, FAO, Rome, 1999 ▪ Asawa G.L., Irrigation Engineering, New Age International Private Limited, New Delhi, 1996	

Module Number	**Module Name**	**Professor in Charge**
MHSE.15	**Pumping Stations**	**Dr. ………**
Contents and qualification aims	**Contents:** Introduction to pumps, Pump types, Pumping System, Pump Terminology, System curve, Operating point, Pumps in series and parallel, Laws of Similarity, Pumps Selection, Cavitation in pumps, Components of pumping stations, Kind of pumping stations, Intakes of pumping station and its design, Pumping station buildings, Basic principles of pumping station design, Fundamental of hydraulic transients, Control of hydraulic transients, System design for wastewater pumping, System design for water pumping. **Qualification aims:** ▪ Understand the role of pumps as energy-conversion devices and use, appropriately, the terms head, power and efficiency ▪ Be aware of the main types of pumps and the distinction between impulse and reaction turbines and between radial, axial and mixed-flow devices ▪ Match pump characteristics and system characteristics to determine the duty point ▪ Calculate characteristics for pumps in series and parallel and use the hydraulic scaling laws to calculate pump characteristics at different speeds ▪ Select the type of pump on the basis of specific speed ▪ Understand the mechanics of a centrifugal pump ▪ Recognize the problem of cavitation and how it can be avoided	
Module character	**2 hours** of lectures per week **1 hour** tutorial per week **1 hour** seminar per week (Excursion 8 hours total)	
Prerequisite of attendance	None	
Applicability	The module is one of **6 optional modules** for the Master **Hydrology Science and Engineering.**	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (3)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ P.N. Modi and S.M. Seth, Hydraulics and Fluid Mechanics, Standard Book House, 1998 ▪ J. Lal, Hydraulics Machines, Metropolitan Book Co., 1969 ▪ I. J. Karassik. J. P. Messina, P. Cooper, and C. C. Heald, Pump Handbook, McGraw-Hill, Third ed., 2001 ▪ T. Jiandong, Z. Naibo, W. Xianhuan, H. Jing, and D. Hu-ishen, Mini- Hydropower, John Wiley & Sons, 1997	

Module Number	**Module Name**	**Professor in Charge**
MHSE.16	**Water Resources Development**	**Dr. ………**
Contents and qualification aims	**Contents:** Global water crisis – Water, industry & development - Agriculture, water and development – Aridity and climate change – Enhancing supply through technology - Enhancing supply through conservation – Managing demand through pricing – Managing demand through conservation – Catchments, development and integrated management – Water governance and course review. **Qualification aims:** • To provide an introduction to the global water crisis • To explore key relationships between water resources and the process of development • To place contemporary problems of water availability in a historical perspective of changing management strategies • To understand the relationships between water supply, sanitation and health, the spatial dimensions of water supply and demand and the potential impacts of climate change on water resources • To gain critical understanding of water supply enhancement strategies and of water demand management strategies • To develop cognitive, analytical and communication skills	
Module character	**2 hours** of lecture per week **1 hour** of tutorial per week	
Prerequisite of attendance	Principles of Integrated Water Resources Management	
Applicability	The module is one of **6 optional modules** for the Master **Hydrology Science and Engineering.**	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in summer term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (1)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Allam, Gamal Ibrahim Y., Decision Support System for Integrated Watershed Management, Colorado State University, 1994 ▪ American Socy. of Civil Engr., Watershed Management, American Soc. of Civil Engineers, New York, 1975 ▪ Black Peter E., Watershed Hydrology, Prentice Hall, London, 1991 ▪ Michael A.M., Irrigation Engineering, Vikas Publishing House, 1992 ▪ Murty, J.V.S. “Watershed Management”, New Age Intl., New Delhi 1998 ▪ Murthy, J.V.S., Watershed Management in India, Wiley Eastern, New Delhi, 1994 ▪ Purandare, A.P., Jaiswal A.K., Waterhed Development in India, NIRD, Hyderabad, 1995	

Module Number	**Module Name**	**Professor in Charge**
MHSE.17	**Water Supply and Sanitation**	**Dr. ………**
Contents and qualification aims	**Contents:** Introduction: Overview of water supply and sanitation in Syria; Health aspects of water supply and sanitation; water quality criteria. Water supply: sources of water, choices of water sources (spring, wells etc.) and their protection; forecasting population; consumption for various purposes, factors effecting consumption; economics of community water supply. Water treatment and distribution: sedimentation tank; coagulation; flocculation, usual coagulants, mixing devices, filtration, filter sand, classification of filters, disinfections, and chlorination. Sanitation and wastewater treatment: purpose of sanitation, site for sewage treatment work; water borne diseases and their control; health and water chemistry; planning and design of low cost sanitation; composting and biogas, sanitation and irrigation; agriculture and aqua cultural reuse. **Qualification aims:** • To provide the students with basic knowledge of water supply and sanitation	
Module character	**2 hours** of lecture per week **2 hours** of tutorial per week	
Prerequisite of attendance	Drinking Water System / Modeling and Water System Management	
Applicability	The module is one of **6 optional modules** for the Master **Hydrology Science and Engineering.**	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in summer term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (3)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ WHO Guidelines for Drinking Water Quality, 3rd Edition.Ch.3:Health-based targets ▪ Loomis and Wing. 2001. Theories of Causation.Ch.3in Thomas& Weber, eds. Epidemiologic Methods for the Study of Infectious Diseases. Oxford University Press ▪ Fewtrell,L.,R.B.Kaufmann,D.Kay,W.Enanoria,L.Haller,andJ.M.Colford,J.r.2005.Water, sanitation, and hygiene interventions to reduce diarrhea in less developed countries: a systematic review and meta-analysis. Lancet Infectious Diseases 5:42-52	

Module Number	**Module Name**	**Professor in Charge**
MHSE.18	**Writing of proposals for water projects**	**Dr. ………**
Contents and qualification aims	**Contents: Introduction, Writing a Funding Proposal** (Useful Tips for Planning- Useful Tips for Planning-Some Useful Tips on Writing-Hints on the Appearance), **Components of a Typical Proposal** (Title Page or Cover Page- Project Overview or Summary - Contents Page), **Background Information or Statement of the Problem**, **Project Details** (Goals and Objectives- Rationale - Target Group-Methodology (Activities)- Project Management / Staff / Administration), **Available and Needed Resources** (Available Resources- Needed Resources- The Budget), **Evaluation of Project Outcomes, Appendices, Covering Letter, Annexes.** **Qualification aims:** • To acquaint the students with the understanding of writing of proposals for water projects	
Module character	**2 hours** of lecture per week **2 hours** of tutorial per week	
Prerequisite of attendance	All modules	
Applicability	The module is compulsory for the Master **Hydrology Science and Engineering.**	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns **5 credits** The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in summer term	
Work load	The work load is **150 hours**	
Duration of the module	The course takes **one semester (3)**	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University **Recommended:** Theory and practice will be presented mostly from the reference materials available at Faculty of Civil Engineering, Damascus University; however additional material will be used from various sources. Example problems will be solved in class. Practical applications will be presented. Students are responsible for all lecture and recitation material. There is no attendance policy, however, there will be a significant amount of information that will be covered in class that is not found in the reference materials available at Faculty of Civil Engineering, Damascus University.	

Module Number	**Module Name**	**Professor in Charge**
MHSE.19	**Practical Training/ Project Study**	**Dr. ………**
Contents and qualification aims	The Student must carry out practical training about one Problem belongs to subjects of the Master course of Hydrology Science and Engineering in one or more institution or incorporation, and he must present full study about this problem	
Module character	Practical Training/ Project Study: 20 hours tutorial per week	
Prerequisite of attendance	Basic Knowledge of Practical Training/ Project Study, the student must be in the 3rd Semester.	
Applicability	The module is suitable for the professional and research oriented studies in civil and environmental engineering	
Prerequisite achieve credit points	Having passed the module seminar and presentation before a commission.	
Credit points and grade	The module earns 10 Cr. The final Grade is generated with 100% as presentation in front of committee.	
Frequency of the module	The module is offered annually.	
Work load	The work load is 300 hours.	
Duration of the module	The module takes one term starting in Semester 3.	
Reference Materials	• Old Master, Bachelor thesis and Practical Training reports which are available in the Libraries of the University. • James E. Mauch and Namgi Park: Guide to the Successful Thesis and Dissertation, A Handbook for Students and Faculty. 2003. 5th ed. Copyright ©2003 by Marcel Dekker. ISBN: 0-8247-4288-5.	

Module Number	**Module Name**	**Professor in Charge**
MHSE.20	**Master Thesis plus Defense**	**Dr. ………**
Contents and qualification aims	The Student must work Master Thesis with Defense about one Problem belongs to the subjects of the Master course of Hydrology Science and Engineering in one or more institution or incorporation, and he must present full study about this problem.	
Module character	Master Thesis with Defense: 30 Hours tutorial per week.	
Prerequisite of attendance	Basic Knowledge of Master Thesis with Defense, the student must be in 4th Semester.	
Applicability	The module is suitable for the professional and research oriented studies in civil and environmental engineering	
Prerequisite achieve credit points	Having passed the module presentation before a commission.	
Credit points and grade	The module earns 30 Cr. The final Grade is generated with 100% as presentation in front of committee.	
Frequency of the module	The module is offered in 6 semester	
Work load	The work load is 900 hours.	
Duration of the module	The module takes one term starting in Semester 4.	
Reference Materials	1. James E. Mauch and Namgi Park: **Guide to the Successful Thesis and Dissertation, A Handbook for Students and Faculty**. 2003. 5th ed. Copyright ©2003 by Marcel Dekker. ISBN: 0-8247-4288-5. 2. Derek Swetnam: **Writing Your Dissertation, How to plan, prepare and present successful work**.2007, 3rd ed. ISBN: 978 1 84803 126 5. 3. Louis Cohen; Lawrence Manion and Keith Morrison: **Research Methods in Education**, 2005, 5th ed. ISBN 0-203-22434-5 Master e-book ISBN. 4. **Old Master and Bachelor thesis**, which are available in the Libraries of the University.	

14. Course Requirements

Assignments

Assignments will be due either one or two weeks after they are handed out depending on their length. Grades will be reduced 10% for each day late.

Exams

In-class midterm and a final examination.

Grading

Activity	Percentage
Assignments	20%
In-class Midterm Exam	10%
Final Exam	70%

Below is a table that lists University letter grades (last column) and the equivalent percentages The Instructor will use for grading. All numerical grades will be rounded up or down to the nearest integer. The Instructor reserves the right to adjust the scores of any exam or the cumulative average in the students' favor if necessary, i.e. The Instructor reserves the right to add a few percentage points to every student's grade. No work for extra credit shall be given. An "Incomplete" grade will not be given to students who have missed exams.

Grading Matrix

Numerical value		Equivalent University Letter grade
greater than or equal to (%)	**and less than (%)**	
90	100	A
87	90	A-
84	87	B+
80	84	B
77	80	B-
74	77	C+
70	74	C
67	70	C-
64	67	D+
60	64	D
---	60	F

Master Thesis plus Defense:

I. The Master thesis meets the basis requirements of Bologna System.

- ✓ The Master thesis covers 30 ECTS.
- ✓ Supervisors have to meet the requirements of the university at which the thesis is undertaken.
- ✓ A thesis proposal and a preliminary report of the thesis are presented in a seminar.
- ✓ The thesis is written in Arabic (or English).
- ✓ The written thesis is an independent work which has to cover the following aspects
    - Relevant, clearly formulated and testable problem definition
    - Theoretical framework and research methodology
    - Description of the research project
    - Analysis and interpretation of the results, conclusions
    - Responsible and transparent use of relevant references

II. An examiner independent of the supervisor examines the thesis.

III. The candidate must defend his/her thesis in a public defense. The evaluation of the thesis and of the thesis defense is carried out on the basis of the Thesis Evaluation Form and the Thesis Defense Evaluation Form.

IV. The student participating in a degree programme will be awarded a diploma by the university which had been attended by the student.

MODULE COMPENDIUM

Soil and Groundwater

Science and Engineering (SGW)

Bachelor Programme

Damascus University

Faculty of Civil Engineering

2015

EDUWAT: 511251-TEMPUS-1-2010-1-DE-TEMPUS-SMHES

Development of a Modern Higher Education System for Water Engineering in Syria

Preface

This course in one of three water courses designed in the framework of the EU-TEMPUS project: EDUWAT: *Development of a Modern Higher Education System for Water Engineering in Syria*, TEMPUS 1-2010-1DE TEMPUS SMHES No. 511251.

The three developed courses are designed for Bachelor and Master Degrees in three engineering fields according to Bologna process, they are:

- Water Engineering and Management
- Hydrology Science and Engineering
- **Soil and Groundwater Science and Engineering**

The study period is 3 years for a Bachelor degree and 2 years for a Master degree. As the entire study period will be limited to 5 years. The majority of students should complete the Master degree to be qualified as engineers in the study filed of their choice.

Three working groups were given the responsibility of developing the three courses, each of three staff members from the Department of Water Engineering at The Faculty of Civil Engineering, Damascus University. A similar plan is made by Al Bath, Tishreen and Aleppo Universities. The resulted courses are being discussed frequently with the Ministry of Higher Education to set a procedure for implementation.

The work group responsible for this course; Soil and Groundwater Science and Engineering consists of the following staff members of Damascus University:

7. **Dr. Wael SEIF**
   Faculty of Civil Engineering, Damascus University
   The Arab Centre for the Studies of Arid Zones & Dry Lands (ACSAD)

8. **Dr. Wissam AKHLED**
   Faculty of Civil Engineering, Damascus University

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein

Contents

Preface

1. Introduction to the Study Course
2. Course Outlines and Aims
3. Groundwater Hydrology Career
4. Admission Requirements
5. Program of Study

Curriculum for B.Sc. in Soil and Groundwater (BSGW)

6. General Structure
7. Curricula structure
8. Details of Courses (Core Courses – Elective Courses)
9. Practical Training
10. Principal learning outcomes

• Introduction

This course is under the EU-TEMPUS project **“Development of a Modern Higher Education System for Water Engineering in Syria - EDUWAT”**, No. 511251-TEMPUS-1-2010-1-DE-TEMPUS-SMHES, in the duration between 15 of October 2010 and 14 of Aprilr 2015.

As water is one of the priority sectors of the Syrian economic, new master and PhD study courses in water engineering for all universities will be established in Syria. They will be based on the existing study courses of the Faculty Civil Engineering and/or agriculture to overcome the fragmentation. The quality and competence of the Syrian graduates are enhanced by introducing the Bologna system, e.g. module and ECTS. By the inter-disciplinarity and trans-disciplinarity of natural sciences and engineering new education and research fields can be created e.g. eco-technology.

The **EDUWAT** project aims to:

- Increase higher education opportunities
- Develop high-quality curricula and educational programs
- Establish a quality assurance system
- Create an innovation environment for higher education and scientific research
- Increase the productivity of the Syrian scientific research and link it to development needs of the country
- Encourage partnerships among universities on national and international level
- Improve and modernize intermediate education

• Course outline and aims

This course has been designed to introduce groundwater hydrology to the graduate and undergraduate students of the Civil Engineering Faculty. Master students will gain a wide understanding of hydrological processes.

The course covers most aspects of groundwater hydrology, such as assessment, development and management, role of groundwater in water resources system and management, movement of groundwater through saturated and unsaturated porous media, well hydraulics, and groundwater transport process. While the course gives an introduction to soil- and groundwater hydrology, focusing on the understanding of the physical processes controlling the propagation of water through the hydrological cycle, groundwater modelling techniques and management will be further given in the Master course.
Undergraduate students gain an understanding of the basic scientific concepts relevant to groundwater, current pressing groundwater management issues and the new technologies employed to deal with them. They also receive basic training in a range of field, laboratory and computational methods, as well as learning communication skills and problem-based and critical thinking skills.

The Master course with a significant research/industry training project provides training in research methodology and preparation of a professional thesis or report – from project conception, design of methods, collection of results and their analysis, through to final conclusions and recommendations for future work.

Other associated topics teach students the critical interrelationships that groundwater has in the hydrologic cycle such as surface water hydrology and soil-plant hydrology, amongst others.
Example problems including its solution will be incorporated for easy understanding of the physical and mathematical concepts of groundwater hydrology. Some real case studies have also been incorporated to give an idea about the complexities and challenges encountered during the modelling and management of groundwater processes
Course name: Graduate/postgraduate Certificate in Science (Soil and Groundwater Hydrology)
Duration (full-time equivalent): 6 semesters for the Undergraduates (3 academic years) and 4 semesters for the Master degree (2 academic years)
Course name: Bachelor degree in Engineering Science (Soil and Groundwater Hydrology)
Duration (full-time equivalent): 3 years for Bachelor and 2 years for Master
Course type: Undergraduate and Postgraduate
Availability: Full-time

.1. Learning outcome

To provide a basic understanding of the physical processes involved in the soil- and groundwater part of the hydrological cycle and to understand the link to every part of the cycle. In addition to give the student experience in the use of hydrological observations and enable her/him to perform basic hydrological calculations. The master course will provide students with basic knowledge of groundwater modelling and enable them to use new mathematical and numerical techniques to sort out a number of groundwater challenges

- **Groundwater Hydrology Career**

Graduates from the Groundwater Hydrology programs at can find jobs in:

- Natural resource and environment agencies of the national government and regional and international organizations
- Water and environmental consultancies; and
- Industry sectors such as agriculture, mining, aquaculture, water resource planning and management.

Graduates of this degree can find job opportunities in land and water resource monitoring and management, and in water resources management planning and allied technical roles.
The Master course can also be a pathway to a PhD for those who want to pursue a research career or work in the university and water/agriculture research centers.

Soil and Groundwater Hydrology degrees

The Soil and Groundwater Hydrology is offered by the Department of Water Engineering within the Faculty of Civil Engineering.

The course is given in 6 semester for undergraduates and 2 semesters for postgraduates. Students who have completed the Graduate Certificate are awarded credit towards the Graduate Master degree.

- **Admission requirements**

Applicants must hold an approved Bachelor Degree in Engineering Science of Soil and Groundwater Hydrology from an approved institution. However, the Faculty Board may, under certain circumstances and subject to specific conditions, admit others who can show evidence of fitness for candidature.

Course aims

A groundwater hydrologist is a scientist who understands how groundwater hydrological systems operate, has an advanced interdisciplinary knowledge in this field, can apply the scientific method to explore problems of relevance to this discipline, is able to use a range of analytical methods, including computer software to analyse relevant data, and field techniques, and can contribute to an advance of knowledge in this discipline

Learning outcomes

Upon successful completion of this course, students are expected to:

- have gained knowledge of the topics specified in the course
- understand and be able to apply basic scientific methods
- be able to review and interpret scientific information
- be able to develop scientific hypotheses
- be able to communicate effectively
- be able to work both independently and as part of a multidisciplinary team
- value ethical behaviour.

- ## Program of study

To qualify for the Bachelor and master degrees in Soil and Groundwater Hydrology, a student must complete the modules specified in the table below with a grade of F or better in each topic, according to the following:

Assignments

Assignments will be due either one or two weeks after they are handed out depending on their length. Grades will be reduced 10% for each day late.

Exams

In-class midterm and a final examination.

Grading

Activity	Percentage
Assignments	20%
In-class Midterm Exam	10%
Final Exam	70%

Below is a table that lists University letter grades (last column) and the equivalent percentages The Instructor will use for grading. All numerical grades will be rounded up or down to the nearest integer. The Instructor reserves the right to adjust the scores of any exam or the cumulative average in the students' favour if necessary, i.e. The Instructor reserves the right to add a few percentage points to every student's grade. No work for extra credit shall be given. An "Incomplete" grade will not be given to students who have missed exams.

Grading Matrix

Numerical value		**Equivalent University Letter grade**
greater than or equal to (%)	**and less than (%)**	
90	100	A
87	90	A-
84	87	B+
80	84	B
77	80	B-
74	77	C+
70	74	C
67	70	C-
64	67	D+
60	64	D
---	60	F

- ## Curriculum for B.Sc. in Soil and Groundwater (BSGW)

- ### General Structure

	Credits	%
Modules with Basics in Mathematics and Natural Sciences	45	25
Modules with Basics in Engineering	15	8
Modules with Basics in Hydro Sciences	30	17
Modules with specialized Basics	30	17
Elective Modules	15	8
Modules for General Qualification	20	11
Practical Training /Project	10	6
Bachelor examination	15	8
Total	**180**	**100**

Module Semester	**1**	**2**	**3**	**4**	**5**	**6**	**Total/ ECTS**
Basics in Mathematics and Natural Sciences	25	10	10				**45**
Basic in Engineering		10	5				**15**
Basics in Hydro Sciences		5	10	10	5		**30**
Specialized Basics				15	10	5	**30**
Elective Modules					10	5	**15**
General Qualification	5	5	5			5	**20**
Practical Training/ Project Study				5	5		**10**
Bachelor Theses incl. De-fence						15	**15**
Total	**30**	**30**	**30**	**30**	**30**	**30**	**180**

Module Nr.	Course Semester	1	2	3	4	5	6	ECTS
	Basics in Mathematics and Natural Sciences	**25**	**10**	**10**	**0**	**0**	**0**	**45**
BSGW.01	Mathematics I	5						5
BSGW.02	Mathematics II		5					5
BSGW.03	Mathematics III			5				5
BSGW.04	Physics I	5						5
BSGW.05	Physics II		5					5
BSGW.06	Computer Sciences	5						5
BSGW.07	Chemistry	5						5
BSGW.08	Biology	5						5
BSGW.09	Geodesy and Cartography			5				5
	Basics in Engineering	**0**	**10**	**5**	**0**	**0**	**0**	**15**
BSGW.10	Engineering Graphics		5					5
BSGW.11	Engineering Geology			5				5
BSGW.12	Computer Sciences/Modelling		5					5
	Basics in Hydro Sciences	**0**	**5**	**10**	**10**	**5**	**0**	**30**
BSGW.13	Soil Physics				5			5
BSGW.14	Soil Chemistry				5			5
BSGW.15	Fluid Mechanics		5					5
BSGW.16	Hydraulics			5				5
BSGW.17	Meteorology and Hydrometeorology					5		5
BSGW.18	Soil Sciences			5				5
	Specialized Basics	**0**	**0**	**0**	**15**	**10**	**5**	**30**
BSGW.19	Water Management Legalisation						5	5
BSGW.20	Pumping Stations and Transport Pipe Lines					5		5
BSGW.21	Soil Conservation and Management				5			5
BSGW.22	Irrigation/Drainage Systems				5			5
BSGW.23	Hydrogeology and Groundwater Flow				5	5		10
	Elective Modules					**10**	**5**	**15**
BSGW.24	Surface and Ground Water Protection						5	
BSGW.25	Water and Solute Transport in Soils					5		
BSGW.26	Managing Soil Erosion					5		
BSGW.27	Climate Change					5		
BSGW.28	Water Resources Management						5	
BSGW.29	Groundwater Modelling						5	
	General Qualification	5	5	5	0	0	5	**20**
BSGW.30	Project Management			5				5
BSGW.31	Writing of Technical/Financial Proposals						5	5
BSGW.32	Foreign Language	5	5					10
BSGW.33	**Practical Training/ Project Study**				**5**	**5**		**10**
BSGW.34	**Bachelor Thesis incl. Defense**						**15**	**15**
	Total	**30**	**30**	**30**	**30**	**30**	**30**	**180**

- **Curricula structure - Bachelor Course Soil and Groundwater (BSGW)**

Semester 1	**Mathematics I**	**Physics I**	**Computer Scien-ces**	**Chemistry**	**Biology**	**Foreign Langua-ge**
Semester 2	**Mathematics II**	**Physics II**	**Engineering Gra-phics**	**Computer Scien-ces/Modelling**	**Fluid Mechanics**	**Foreign Language**
Semester 3	**Mathematics III**	**Geodesy and Car-tography**	**Engineering Geo-logy**	**Hydraulics**	**Soil Sciences**	**Project Manage-ment**
Semester 4	**Soil Physics**	**Soil Chemistry**	**Soil Conservation and Management**	**Irrigati-on/Drainage Sys-tems**	**Hydrogeology and Groundwater Flow**	**Practical Trai-ning/ Project Study**
Semester 5	**Meteorology and Hydrometeorology**	**Pumping Stations and Transport Pipe Lines**	**Hydrogeology and Groundwater Flow**	**Elective Modules**	**Elective Modules**	**Practical Trai-ning/ Project Study**
Semester 6	**Water Management Legalisation**	**Elective Modules**	**Writing of Tech-nical/Financial Proposals**	**Bachelor Thesis incl. Defense**		
Credits	5	5	5	5	5	5

Modules in Natural Sciences 25%

Modules inTechnical Sciences 25%

Modules in Economic & Social Sciences 25%

Modules in Variable Sciences 25%

- ## Module description

Module Number	Module Name	Professor in Charge
BSGW.01	**Mathematics I**	N.N.
Contents and qualification aims	**Contents:** Notation and concept of function, trigonometry, vector calculus in IR³, elementary functions, differential calculus, integral calculus, Taylor series. Notation and concept of function, trigonometry, vector calculus in IR³, elementary functions, differential calculus, integral calculus, Taylor series. **Qualification aims:** The objective of the subject is to cover basic mathematic skills. The students can understand and apply important mathematic terms and techniques. They are able to comprehend mathematic derivations in other subjects of their course.	
Module character	2 hours of lectures(one lecture) per week 2 hours tutorial(one lecture) per week	
Prerequisite of attendance	Non	
Applicability	The module is compulsory for the Bachelor Soil and Groundwater Engineering.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes).	
Credit points and grade	The module earns 5 credits. The grade for the examination equals the module grade.	
Frequency of the module	The module is offered annually in Autumn term.	
Work load	The workload is 150 hours.	
Duration of the module	The course takes one semester (first semester)	
Textbooks	**Essential:** Reference Materials available at Faculty of Civil Engineering. **Recommended:** ▪ H. Anton, I. Bivens, and S. Davis. Calculus, 8th Edition. John Wiley and Sons, 2005 ▪ H. Anton. Calculus, 7th Edition. John Wiley and Sons, 2002 ▪ James Stewart. Calculus Early Transcendentals, 5th edition. Thomson, 2003 ▪ R. Larson, R. Hostetler, and B. Edwards. Calculus, 7th edition. Houghton Mifflin Company, 2002 ▪ H. Anton. Calculus, 7th Edition. John Wiley and Sons, 2002	

Module Number	Module Name	Professor in Charge
BSGW.02	**Mathematics II**	N.N.
Contents and qualification aims	**Contents:** Ordinary differential equations, Matrix calculus, homogenous and inhomogeneous equation systems, determinants, eigenvalues and Eigenvectors, differentiation of functions with several variables, multiple integrals. **Qualification aims:** The objective of the subject is to cover basic mathematic skills. The students can understand and apply important mathematic terms and techniques. They are able to comprehend mathematic derivations in other subjects of their course.	
Module character	2 hours of lectures per week. 2 hour of tutorial per week.	
Prerequisite of attendance	Knowledge of the contents from the unit Math1	
Applicability	The module is compulsory for the Bachelor Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module’s exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 cr.	
Frequency of the module	The module is offered annually in spring term.	
Work load	The workload is 120 hours.	
Duration of the module	The module takes one term.	
Textbooks	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ H. Anton, I. Bivens, and S. Davis. Calculus, 8th Edition. John Wiley and Sons, 2005 ▪ H. Anton. Calculus, 7th Edition. John Wiley and Sons, 2002 ▪ James Stewart. Calculus Early Transcendentals, 5th edition. Thomson, 2003 ▪ R. Larson, R. Hostetler, and B. Edwards. Calculus, 7th edition. Houghton Mifflin Company, 2002 ▪ H. Anton. Calculus, 7th Edition. John Wiley and Sons, 2002 ▪ E. Swokowski, M. Olinic, and D. Pence Calculus, 6th Edition. PWS Publishing Company,1994	

Module Number	Module Name	Professor in Charge
BSGW.03	**Mathematics III**	N.N.
Contents and qualification aims	**Contents:** basic probability models; combinatorics; random variables; discrete and continuous probability distributions; statistical estimation and testing; confidence intervals; and an introduction to linear regression. **qualification aims:** This course provides an elementary introduction to probability and statistics with applications.	
Module character	2 hours of lectures per week. 2 hour of tutorial per week.	
Prerequisite of attendance	Knowledge of the contents from Math1 and Math2	
Applicability	The module is compulsory for the Bachelor Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module's exam. The module exam is a written examination (120 minutes).	
Credit points and grade	The module earns 5 cr.	
Frequency of the module	The module is offered annually in Autumn term.	
Work load	The workload is 150 hours.	
Duration of the module	The module takes one term .	
Textbooks	**Essential:** Reference Materials available at Faculty of Civil Engineering. **Recommended:** ▪ H. Anton, I. Bivens, and S. Davis. Calculus, 8th Edition. John Wiley and Sons, 2005 ▪ H. Anton. Calculus, 7th Edition. John Wiley and Sons, 2002 ▪ James Stewart. Calculus Early Transcendentals, 5th edition. Thomson, 2003 ▪ R. Larson, R. Hostetler, and B. Edwards. Calculus, 7th edition. Houghton Mifflin Company, 2002 ▪ H. Anton. Calculus, 7th Edition. John Wiley and Sons, 2002 ▪ E. Swokowski, M. Olinic, and D. Pence Calculus, 6th Edition. PWS Publishing Company,1994	

Module Number	**Module Name**	**Professor in Charge**
BSGW.04	**Physics I**	N.N.
Contents and qualification aims	**Contents:** Units and dimensional analysis, problem solving and estimation, Cartesian coordinates and vectors, translational kinematics, Force and Newton's laws of motion, circular motion, conservation of energy, momentum, two-dimensional rotational motion, angular momentum, rotation and translation, central force motion. **Qualification aims:** ▪ The course introduces Classical Mechanics. It covers the basic concepts of Newtonian mechanics, fluid mechanics, and kinetic gas theory. ▪ Develop and reinforce laboratory skills including: questioning, developing an experimental procedure, observing, data collection, and data analysis, including graphical analysis ▪ Develop an understanding of how we experience physics in our everyday lives and of how physics is applied in the real world	
Module character	2 hours of lectures(one lecture) per week 2 hours of Lab(one lecture) per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor Water Engineering and Management.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes).	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in Autumn term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (first semester)	
Textbooks	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University **Recommended:** ▪ F. Reif, Fundamentals of Statistical and Thermal Physics (McGraw-Hill, 1965, QC 175.R43) ▪ F. Mandl, Statistical Physics, Second Edition (Wiley, 1988, QC 174.8.M27) ▪ D.L. Goodstein, States of Matter (Prentice Hall, 1975; Dover, 1985, QC 173.3.G66) ▪ K. Huang, Statistical Mechanics, Second Edition (Wiley, 1987, QC 174.8.H83) ▪ C. Kittel and H. Kroemer, Thermal Physics, Second Edition (Freeman, 1980, QC 311.5.K52) ▪ L.D. Landau and E.M. Lifshitz, Statistical Physics, Third Edition, Part 1 (Pergamon,1980, QC 175.L32) ▪ P.K. Pathria, Statistical Mechanics (Pergamon, 1972, QC 175.P35)	

<table>
<tr><th>Module Number</th><th>Module Name</th><th>Professor in Charge</th></tr>
<tr><td>BSGW.05</td><td>Physics II</td><td>N.N.</td></tr>
<tr><td>Contents and qualification aims</td><td colspan="2">Contents:
Electric fields, electric potential, capacitors, circuits, magnetic fields and forces, creating magnetic fields, Faraday’s law, oscillating circuits, Maxwell’s equations, electromagnetic waves, nature of light.
The course focuses on electricity and magnetism, including electric fields, magnetic fields, electromagnetic forces, conductors and dielectrics, electromagnetic waves, and the nature of light.

qualification aims:
The overall goal is to use the scientific method to come to understand the enormous variety of electromagnetic phenomena in terms of a few relatively simple laws.</td></tr>
<tr><td>Module character</td><td colspan="2">2 hours of lectures per week.
2 hours of tutorial per week.</td></tr>
<tr><td>Prerequisite of attendance</td><td colspan="2">Physics 1, Math 1</td></tr>
<tr><td>Applicability</td><td colspan="2"></td></tr>
<tr><td>Prerequisite achieve credit points</td><td colspan="2">Having passed the module’s exam. The module exam is a written examination (120 minutes)</td></tr>
<tr><td>Credit points and grade</td><td colspan="2">The module earns 5 cr.</td></tr>
<tr><td>Frequency of the module</td><td colspan="2">The module is offered annually in spring term.</td></tr>
<tr><td>Work load</td><td colspan="2">The workload is 150 hours.</td></tr>
<tr><td>Duration of the module</td><td colspan="2">The module takes one term.</td></tr>
<tr><td>Textbooks</td><td colspan="2">Essential:
Reference Materials available at Faculty of Civil Engineering, Damascus University.

Recommended:
▪ Physics Volume 2 by Halliday, Resnick and Krane; John Wiley & Son.
▪ Applied Physics 2nd Edition by Dr. P. Appala Naidu & Dr. M. Chandra Shekar, V.G.S. Book links.
▪ Engineering Physics by R.K.Gaur & S.L. Gupta; Dhanpat Rai and Sons.</td></tr>
</table>

Module Number	**Module Name**	**Professor in Charge**
BSGW.06	**Computer Sciences**	N.N.
Contents and qualification aims	**Contents:** Introduction to computers, problem solving and algorithm development. Design, code, debug and document programs using techniques of good programming style and C++ programming language. Laboratory experiments and examples will be used to illustrate and reinforce concepts taught in the lectures. Continuation of CSI 1430. Introduction to basic aspects of arrays, pointers, classes, inheritance, polymorphism, virtual functions, linked lists, stacks, queues, and binary trees. **Qualification aims:** This subject has several related goals: - Provide an understanding of the role computation can play in solving problems. - Help students, including those, to feel justifiably confident of their ability to write small programs that allow them to accomplish useful goals.	
Module character	Lectures: 2 sessions / week, 1 hour / session Recitations: 1 session / week, 1 hour / session	
Prerequisite of attendance	This subject is aimed at students with little or no programming experience.	
Applicability	The module is compulsory for the Bachelor Soil and Groundwater.	
Prerequisite achieve credit points	Problem sets : 60% Quiz 1 : 10% Quiz 2 : 15% Quiz 3 : 15%	
Credit points and grade	The module earns 5 cr.	
Frequency of the module	The module is offered annually in Autumn term.	
Work load	The workload is 150 hours.	
Duration of the module	The module takes one term(first semester).	
Textbooks	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Yale N. Patt and Sanjay J. Patel, Introduction to Computing Systems: from bits and gates to C and beyond McGraw-Hill Publishers, SECOND Edition, 2004. ISBN: 0-07-246750-9---ISBN 0-07-121503-4 \\(ISE)	

<table>
<tr><th>Module Number</th><th>Module Name</th><th>Professor in Charge</th></tr>
<tr><td>BSGW.07</td><td>Chemistry</td><td>N.N.</td></tr>
<tr><td>Contents and qualification aims</td><td colspan="2">Contents:
The ability of soil to function as a medium for plant growth and/or waste disposal, a purifier of water, a determinant of contaminant fate and transport, etc. is inextricably tied to chemistry. Applying basic principles of chemistry to processes that occur commonly in soil/water systems is, thus, fundamental to understanding and optimizing soil functions. Successful approaches range from applied (empirical) to basic (theoretical) studies and conceptualizations. This course utilizes the full range of approaches, with emphasis on the soil solution and the various soil components and chemical processes influencing its chemistry.

Qualification aims:
▪ Strengthen the student’s understanding of basic chemical principles.
▪ Teach students how to apply the principles to soil/water chemical processes.
▪ Demonstrate how chemical knowledge helps explain soil functions.</td></tr>
<tr><td>Module character</td><td colspan="2">2 hours of lectures per week.
2 hour of lab per week.</td></tr>
<tr><td>Prerequisite of attendance</td><td colspan="2">Basic knowledge in geology, physics and chemistry.</td></tr>
<tr><td>Applicability</td><td colspan="2">The module is compulsory for the Bachelor Soil and Groundwater.</td></tr>
<tr><td>Prerequisite achieve credit points</td><td colspan="2">Having passed the module exam. The module exam is a written examination (120 minutes).</td></tr>
<tr><td>Credit points and grade</td><td colspan="2">The module earns 5 credits.
The grade for the examination equals the module grade.</td></tr>
<tr><td>Frequency of the module</td><td colspan="2">The module is offered annually in Autumn term.</td></tr>
<tr><td>Work load</td><td colspan="2">The workload is 150 hours.</td></tr>
<tr><td>Duration of the module</td><td colspan="2">The course takes one semester .</td></tr>
<tr><td>Textbooks</td><td colspan="2">Essential:
Reference Materials available at Faculty of Civil Engineering, Damascus University.
Recommended:
▪ Soil and Water Chemistry: An Integrative Approach, 2004, by Michael E. Essington, University of Tennessee, [CRC Press].
▪ Environmental Soil Chemistry, 2003 (2nd Edition), by Donald L. Sparks, University of Delaware, [Academic Press].
▪ Soil Chemistry, 2001 (3rd Edition), H.L. Bohn, B.L. McNeal, and G.A. O’Connor [John Wiley & Sons, Inc.] – available as an e-book.
▪ Chemical Equilibrium, 1966, by A.J. Bard [Harper & Row Publishers]</td></tr>
</table>

Module Number	**Module Name**	**Professor in Charge**
BSGW.08	**Biology**	N.N.
Contents and qualification aims	**Contents:** A study of the biosphere, environmental conditions and their effects on animals, plants and communities; responses of organisms to environmental conditions; interactions between plants and animals; environmental genetics and microbiology; management of biological resources; and an introduction to ecology and the impact of humans on the environment. **Qualification aims:** On completion of this unit students will be able to: ▪ Understand the nature and importance of biodiversity, evolutionary concepts and processes, aspects of the evolution of the Australian biota and the nature of biogeochemical cycles; ▪ Work in teams to discuss, design and implement a field experiment, including the gathering, analysis and presentation of data using appropriate software; ▪ Undertake field observations of a species and collate, input and analyse such data; ▪ Communicate scientific principles and information underlying biology-related topics in written or oral formats and using appropriate conventions for scientific attribution; ▪ Demonstrate and utilise skills in the use of library catalogues and databases to locate suitable information for essays and practical reports.	
Module character	2 hours of lectures per week 1 hours tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in Autumn term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester.	
Textbooks	**Recommended:** ▪ Roberts, M.M., Reiss and G.Monger. 2000. Advanced Biology, Nelson. ▪ Starr, C, and R, Taggart, 2001. Biology: The Unity and Diversity of Life Brooks and Cole. ▪ Campbell, N.A., J.B, Reece, L.G. Mitchell, M.R, Taylor. 2001. Biology: Concepts and Connections. Prentice-Hall.	

Module Number	Module Name	Professor in Charge
BSGW.09	**Geodesy and Cartography**	N.N.
Contents and qualification aims	**Contents:** Introduce to surveying fundamental, units of measurements and scale, chain surveying; leveling and its application in contouring, profiles and cross-sections. Areas, volumes, and earthwork calculations; Theodolite and its application in measurement of angles; traverse surveys, Traverse coordinate calculations; Theory of errors and adjustments; tachometry and electronic distance measurements (EDM, Total station). Using traditional surveying equipment like Chan and measuring tape, leveling, countering, cross and longitudinal sections, measuring vertical and horizontal angles using theodolite. **Qualification aims:** To provide the students a basic understanding of Geodesy and Surveying theory, the shape, motion and gravity field of the earth; to familiarize with surveying instruments and operations, to apply typical surveying computations	
Module character	2 hours of lectures per week 2 hours tutorial per week	
Prerequisite of attendance	Basic knowledge of mathematics, statistics, and physics	
Applicability	The module is compulsory for the Bachelor Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in Autumn term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (3rd semester)	
Textbooks	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Jack C. McCormac, Wayne Sarasua, William Davis, 2012. Surveying, 6th Edition, John Wiley & Sons, Toronto, ISBN 978-0-470-49661-9, 379pp ▪ Charles D. Ghilani and Paul R. Wolf, 2012. Elementary Surveying - An ▪ Introduction to Geomatics, 13/e, Prentice Hall, Toronto, ISBN-10: 0132554348, 984pp ▪ Barry F. Kavanagh, 2009. Surveying: Principles and Applications, 8/e. Prentice Hall, Upper Saddle River, NJ, ISBN-10: 013236512X, 816pp	

Module Number	**Module Name**	**Professor in Charge**
BSGW.10	**Engineering Graphics**	N.N.
Contents and qualification aims	**Contents:** Introduction to computer aided drawing, geometrical constructions, orthographic drawing and sketching, auxiliary views, sections, dimensioning, tolerances, working drawings, 3D drawing and solid modeling. **qualification aims:** On successful completion of this course, student will be able to: ▪ Draw 2D and 3D drawings. ▪ Use SolidWorks (a computer aided drawing software) ▪ Model solid parts ▪ Make stress-strain analysis using computer simulation ▪ Create molds form parts. ▪ Assemble discrete parts to form a working product ▪ Analyze for the interferences across parts in an assembly ▪ Make motion analysis in the assemblies	
Module character	Lectures, Practical Sessions, Presentation, Project, Assignments.	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor Soil and Groundwater.	
Prerequisite achieve credit points	Homework 15% Project 20% 2 Midterm Exams 40% Final Exam 25%	
Credit points and grade	The module earns 5 cr.	
Frequency of the module	The module is offered annually in Spring term.	
Work load	The work load is 150 hours.	
Duration of the module	The module takes one term .	
Textbooks	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Gary Robert, Eric N wiebe "Fundamentals of graphics" Communications", McGraw Hill, 2006 ▪ William Howard, Joe Musto " Introduction to solid Modeling " Using Solid Works, McGraw Hill , 2005	

Module Number	Module Name	Professor in Charge
BSGW.11	**Engineering Geology**	N.N.
Contents and qualification aims	**Contents:** Engineering Geology, Identification of Rock and minerals types, soil properties, weathering and soils Basic principles of physical and structural geology with emphasis related to civil engineering, active tectonics and earthquakes hazards, Ground water, slope stability and landslides **Qualification aims:** At the conclusion of this course: ▪ To outline the contribution of engineering geology to the civil and mining works ▪ To explain the classical approach to solve an engineering geological problem ▪ The extensive uses of engineering geology maps The role and effect of engineering geology in the improvement of earth materials	
Module character	2 hours of lectures per week 1 hours tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in Autumn term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (third semester)	
Textbooks	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Engineering Geology and Geotechnics by BELL, F. G., 1980 ▪ Engineering Geology: Rock Engineering in Construction by GOODMAN, R.E., 1993 ▪ Engineering Geology: An Environmental Approach by RAHN, P. H., 1986 ▪ Engineering Geology by ZARUBA, Q., and MENCL, V., 1976	

Module Number	**Module Name**	**Professor in Charge**
BSGW.12	**Computer Scien-ces/Modelling**	N.N.
Contents and qualification aims	**Contents:** Introduction to computers, problem solving and algorithm development. Design, code, debug and document programs using techniques of good programming style and C++ programming language. Laboratory experiments and examples will be used to illustrate and reinforce concepts taught in the lectures. Continuation of CSI 1430. Introduction to basic aspects of arrays, pointers, classes, inheritance, polymorphism, virtual functions, linked lists, stacks, queues, and binary trees. **Qualification aims:** The module prepares its graduates: ▪ to understand and be able to apply the underlying principles of Computer Science to a variety of problem domains; ▪ to develop good communication skills so that they can solve problems and communicate their solution; ▪ to develop strong analytical skills so that they can quickly assess how to solve problems; ▪ to be able to work in groups and appreciate the dynamic and collaborative nature of problem solving; ▪ to be equipped with a thorough understanding of the development process of software including design, implementation, documentation, and testing; ▪ to appreciate the role that computers play in society and to be able to direct the use of technology in a beneficial way and to solve new problems.	
Module character	2 hours of lectures per week 1 hours tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in pring.	
Work load	The work load is 150 hours	
Duration of the module	The course takes one term .	
Textbooks	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Yale N. Patt and Sanjay J. Patel, Introduction to Computing Systems: from bits and gates to C and beyond McGraw-Hill Publishers, SECOND Edition, 2004. ISBN: 0-07-246750-9---ISBN 0-07-121503-4 \\(ISE)	

Module Number	**Module Name**	**Professor in Charge**
BSGW.13	**Soil Physics**	N.N.
Contents and qualification aims	**Contents:** physical properties and processes in soil, state and transport of matter and energy affecting environment and agriculture (State: soil texture, structure, temperature, water; Transport: water flow, chemical transport, heat and gas flow), mass and energy balance in soil, effect of various environmental events on soil physical properties, management of physical properties and processes for various practical agricultural, hydrological and environmental applications including land reclamation.	
Module character	3 hours of lectures per week. 3 hours Lab per week.	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor Water Engineering and Management.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in spring term.	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester.	
Textbooks	**Recommended:** ▪ Jury, William A.; Horton, Robert (2004): Soil physics. 6th ed. Hoboken, NJ: J. Wiley. ▪ Lal, R.; Shukla, Manoj (2004): Principles of soil physics. New York: M. Dekker (Books in soils, plants, and the environment, v. 57).	

Module Number	**Module Name**	**Professor in Charge**
BSGW.14	**Soil Chemistry**	N.N.
Contents and qualification aims	**Contents:** In the module fundamentals of soil physics and soil hydrology are provided and the impact of soil properties and land use on the soil water budget and its components is presented involving budget simulations. In addition, the close relationship between soil properties, soil water budget and crop yield is highlighted. Measures to regulate the soil water budget are presented. The impacts of the soil on surface runoff, tendency for salinisation and water erosion as well as measures of their reduction are discussed. The presented topics are deepened within tutorials and practical training, where tasks like sampling, measurement of groundwater levels, and determination of hydraulic conductivities are carried out.	
Module character	2 hours of lectures per week 1 hours tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor Water Engineering and Management.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in Spring term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester .	
Textbooks	**Recommended:** ▪ Soil and Water Chemistry: An Integrative Approach, 2004, by Michael E. Essington, University of Tennessee, [CRC Press]. ▪ Environmental Soil Chemistry, 2003 (2nd Edition), by Donald L. Sparks, University of Delaware, [Academic Press]. ▪ Soil Chemistry, 2001 (3rd Edition), H.L. Bohn, B.L. McNeal, and G.A. O'Connor [John Wiley & Sons, Inc.] – available as an e-book. ▪ Chemical Equilibrium, 1966, by A.J. Bard [Harper & Row Publishers]	

Module Number	**Module Name**	**Professor in Charge**
BSGW.15	**Fluid Mechanics**	N.N.
Contents and qualification aims	**Contents**: Introduction, fluid properties, basic units, fluid statics, pressure and its measurements, forces on plane and curved submerged surfaces, buoyancy & floatation, fluids in motion, flow kinematics and visualization, basic control volume approach, differential and integral continuity equation, Euler's and Bernoulli's equations, applications of Bernoulli equation, hydraulic and energy grade lines, momentum principle and its applications, Navier-Stokes equations, dimensional analysis and similitude, surface resistance and introduction to boundary layer theory, flow in conduits, laminar and turbulent flows, frictional and minor losses, piping systems. **Qualification aims:** To provide an opportunity for students to: ▪ Learn about basic fluid properties ▪ Learn about fluid static principles ▪ Gain understanding of steady state flow-rate conservation of mass and conservation of energy equations ▪ Gain understanding of mass-rate impulse-momentum methods. ▪ Learn about friction losses in pipes ▪ See and measure fluid flow phenomena Enhance student problem solving skills	
Module character	2 hours of lectures per week 1 hours tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in Spring term	
Work load	The work load is 150 hours.	
Duration of the module	The course takes two semesters.	
Textbooks	**Essential:** Dr.Wael Mualla, Dr Amjad Zeno Fundamental of Engineering Hydraulics, Damascus University.2005-2006. **Recommended:** ▪ Kumar, K.L., "Engineering Fluid Mechanics", Eurasia Publishing House (P) Ltd., New Delhi, 1995. ▪ Garde, R.J. and Mirajgaoker, A.G., "Engineering Fluid Mechanics", Nem Chand Bros., Roorkee. ▪ Rajput, R.K., "A text book of Fluid Mechanics in SI Units" ▪ Fox, Robert, W. and Macdonald, Alan,T., "Introduction to Fluid Mechanics", John Wiley & Sons, 1995	

Module Number	**Module Name**	**Professor in Charge**
BSGW. 16	**Hydraulics**	N.N.
Contents and qualification aims	**Contents**: OPEN CHANNEL FLOW; Open channel flow – Types and regimes of flow – Velocity distribution in open channel – Wide open channel – Specific energy – Critical flow and its computation. UNIFORM FLOW; Uniform flow – Velocity measurement – Manning's and Chezy's formula – Determination of roughness coefficients – Determination of normal depth and velocity – Most economical sections – Non-erodible channels. VARIED FLOW; Dynamic equations of gradually varied flow – Assumptions – Characteristics of flow profiles – Draw down and back water curves – Profile determination – Graphical integration, direct step and standard step method – Flow through transitions - Hydraulic jump – Types – Energy dissipation – Surges – Surge channel transitions. **Qualification aims:** To provide an opportunity for students to: ▪ Learn about basic fluid properties ▪ Learn about fluid static principles ▪ Gain understanding of steady state flow-rate conservation of mass and conservation of energy equations ▪ Gain understanding of mass-rate impulse-momentum methods. ▪ Learn about friction losses in pipes ▪ See and measure fluid flow phenomena Enhance student problem solving skills	
Module character	2 hours of lectures per week 1 hours tutorial per week	
Prerequisite of attendance	Knowledge of the contents from Fluid Mechanics.	
Applicability	The module is compulsory for the Bachelor Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in Autumn term	
Work load	The work load is150 hours.	
Duration of the module	The course takes two semesters .	
Textbooks	**Essential:** Dr.Wael Mualla, Dr Amjad Zenor.Kutaiba Alsadi, Hydraulics (Open Channel Flow), Damascus University.2002-2003. **Recommended:** ▪ Subramanya K., "Flow in Open channels", Tata McGraw-Hill Publishing Company, 1994. ▪ Kumar K.L., "Engineering Fluid Mechanics", Eurasia Publishing House (P) Ltd., New Delhi, 1995. ▪ Jain A.K., "Fluid Mechanics (including Hydraulic Machines)", Khanna Publishers, 8th edition, 1995.	

Module Number	**Module Name**	**Professor in Charge**
BSGW.17	**Meteorology and Hydrometeo-rology**	N.N.
Contents and qualifica-tion aims	**Content:** Meteorological aspects of rainstorms and floods, Meteorological aspects of precipitation on macro scale,The atmospheric dangerous phenomenon which are connected with heavy precipitation,Type of floods and their forecasting possibility, special precipitation measurement,Meteorological measurement and observations,Water in atmosphere (big and small water cycles). Humidity and their characteristics,Air mass and their classification. Thermal and geographic classi-fication,Atmospheric pressure formation,Atmospheric fronts (AF) - formation and type of AF,Cloud origin and evoluti-on,The international clouds classification,The atmospherics precipitation (AP). Constitution and dividing of AP. Methods and precipitation forecasting possibility. **Qualification aims:** The main object is to acquire the fundaments of hydrometeo-rology in necessary purview to meteorological phenomenon and processes which affected the hydrological cycle of water in the nature from a meteorological viewpoint. We pay atten-tion to water in earth atmosphere, clouds and precipitation origin and evolution, precipitation measurement and evaluati-on. The students will be informed about dangerous meteoro-logical phenomenon related to heavy precipitation. They will be informed about methods of detection and prediction of precipitation and dangerous phenomenon.	
Module character	2 hours of lectures per week 1 hours tutorial per week	
Prerequisite of atten-dance	None	
Applicability	The module is compulsory for the Bachelor Soil and Ground-water.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a writ-ten examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in Autumn term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester .	
Textbooks	**Recommended:** ▪ Boiten, W. 2008. Hydrometery: A Comprehensive Introduction to Measurement of Flow in Open Channels. UNESCO-IHE Lecture Notes Series. Taylor & Francis, Ox-ford, London. ▪ Herschy, R. W. 1998. Hydrometry: Principles and Practi-ce. John Wiley & Sons, New York. ▪ Bos, M. G.1989. Discharge Measurement Structures. ILRI Publication No. 20, The Netherlands. ▪ Federal Water Management Cell, Islamabad.	

Module Number	**Module Name**	**Professor in Charge**
BSGW.18	**Soil Sciences**	N.N.
Contents and qualification aims	**Content :** The study of soil formation and evolution (pedology) will be addressed through four topics: (1) processes controlling soil formation at pedon scale, (2) effect of environmental conditions and anthropic factors on soil evolution, (3) classification, distribution and functionality of major soil groups of the World, (4) soil management principles based on their agronomical and sylvicultural efficiency **Qualification aims:** Integrate the fundamental disciplines to diagnose pedological processes and soil functioning and to assess the anthropic impact on soils, ▪ Discern and briefly and precisely summarize the laws governing soil development, based on the relation factors-processes-properties ▪ Describe and predict pedogenic processes controlling soil evolution according to environmental conditons by applying concepts and tools (analytical tables) taught ▪ Decipher soil-forming processes for the major soil groups of the World (in natural and anthropic environment), by integrating theoretical concepts thaught (part IV) and illustrated in tutorials and field trips, ▪ Classify soil types by applying in operational terms the soil typology principles taught in lecture and tutorials ▪ Describe properties and how soil operates for major soil types of the World in terms of agronomical and environmental functions, based on example taught in lectures and shown in field	
Module character	2 hours of lectures per week 1 hours tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in Autumn term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester .	
Textbooks	**Recommended:** ▪ Brady, N.C. "Nature and Properties of Soils", New YORK, Macmillan, 1990. ▪ Biswas TD. and Mukherjee, S.K. "text Book of Soil Science" 'New Delhi, Tata Mgraw,1987. ▪ Ghildyal B.P. and Tripathi, R.P. "Soil Physics", Wiley eastern Ltd, 1987. ▪ Hillel, D. "Introduction to Soil Physics" , San Diego, Academic press, 1982.	

Module Number	**Module Name**	**Professor in Charge**
BSGW.19	**Water Management Legalisation**	N.N.
Contents and qualification aims	**Contents:** International law and policy governing water, including trans-boundary water law, The evolution of Syrian statutory regimes for surface water and groundwater allocation and use, National water and resource management reforms towards National Water Initiative, Water quality: Rural and urban issues, such as salinity and pollution, Integrated catchment management and environmental water, including an outline of relevant water legislation and catchment management regimes, Urban water issues and alternative water uses. **Qualification aims:** By completing the programme, students will be able to demonstrate: ▪ an in depth knowledge and understanding of the structures, institutions and essential elements of international and national water law and the regulation of water services ▪ an ability to critically evaluate the role of law in water resource management and the provision of water services ▪ an ability to undertake independent research and to exercise autonomy and initiative ▪ an ability to communicate their knowledge, understanding and analysis clearly and coherently	
Module character	2 hours of lectures per week 1 hours tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in Spring term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester.	
Textbooks	**Recommended:** ▪ Caponera, Dante Augusto (1992): Principles of water law and administration. National and international. Rotterdam, Brookfield: A.A. Balkema. ▪ Sources of international water law (1998). Rome: Food and Agriculture Organization of the United Nations (FAO legislative study, 65). ▪ Dellapenna, Joseph W.; Gupta, Joyeeta (©2009): The evolution of the law and politics of water. Doredrecht: Springer.	

Module Number	**Module Name**	**Professor in Charge**
BSGW.20	**Pumping Stations and Transport Pipe Lines**	N.N.
Contents and qualification aims	**Contents:** Introduction to pumps, Pump types, Pumping System, Pump Terminology, System curve, Operating point, Pumps in series and parallel, Laws of Similarity, Pumps Selection, Cavitation in pumps, Components of pumping stations, Kind of pumping stations, Intakes of pumping station and its design, Pumping station buildings, Water transport through pipes, pressure losses, (pressure) network design and building, pump selection, pumping stations, power supply, quantitative reliability, operation and maintenance. **Qualification aims:** The student will acquire the ability to: design a pumping stations and transportation network, identify critical situations for water hammer design a pumping station in terms of capacity, lay out and operation of pumps analyse a lopped and branched pipe system, analyse a drinking water system with ALEID or EPANET and a sewer system with HYDROWORKS, identify critical areas for water quality deterioration, analyse the reliability of a drinking water system and identify critical elements as well as formulate solutions to these points	
Module character	2 hours of lectures per week 1 hours tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in Autumn term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (5th semester)	
Textbooks	**Essential:** Reference Materials available at Faculty of Civil Engineering In Damascus University **Recommended:** ▪ Lal, Jagdish "Hydraulic Machines". Metropolitan Book Company. 1961. ▪ Michael, A.M. and Khepar, S.D. "Well and Pump Engineering 1980". ▪ Stepanoff, AJ. "Flow Pumps Design and Application". John Wiley and Sons, 1998.	

Module Number	**Module Name**	**Professor in Charge**
BSGW.21	**Soil Conservation and Management**	N.N.
Contents and qualification aims	**Content :** Land capability for agriculture; storage, use of water and water use efficiency; saline and alkaline soils; soil acidity; soil erosion and conservation; tillage, cropping systems and rotations; fate of biosolids, pesticides. **Qualification aims:** At the completion of this course, the student should be able to: ▪ explain relationships among soil, water and air as they relate to environmental quality and agriculture in western Canada, ▪ interpret soil, climate and landscape data for the purpose of identifying potential environmental impacts of agricultural practices, as well as the most relevant beneficial management practices to minimize those impacts	
Module character	2 hours of lectures per week 1 hours tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in Spring term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (4^{th} semester)	
Textbooks	**Recommended:** ▪ Schwab, G.O., Frevert, R.K., Administer T.W. and Barnes, K.K. "Soil and Water Conservation Engineering". John Wiley and Sons Inc. New York.	

Module Number	**Module Name**	**Professor in Charge**
BSGW.22	**Irrigation/Drainage Systems**	N.N.
Contents and qualification aims	**Content :** Irrigation & drainage systems design including pump sizing & specification, water distribution systems, plant water requirement, drainage systems, & flood control. **Qualification aims:** ▪ Understand the hydrologic cycle, principles and processes necessary to effectively manage water resources through well designed drainage and irrigation systems. ▪ Apply appropriate techniques and analyses to the effective design of both irrigation and drainage systems. ▪ Design, test, and analyze agricultural irrigation and drainage systems and their components. ▪ Enhance communication skills, and impart a sense of professional, ethical and societal responsibility gained through knowledge and discussion of contemporary issues.	
Module character	2 hours of lectures per week 1 hours tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in Spring term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester .	
Textbooks	**Essential:** Reference Materials available at Faculty of Civil Engineering In Damascus University **Recommended:** ▪ Schwab, G.O., Frevert, R.K., Edminister, T.W. and Barnes, K.K. "Soil and Water Conservation Engineering". John Wiley and Sons Inc. New York. ▪ Michael, AM. "Irrigation Theory and Practice"; Vikas Publishing House, New Delhi. 1978 ▪ James, L.J. "Farm Irrigation System Design". John Wiley, 1988. ▪ Luthin, J. "Drainage Engineering". Wiley Eastem, 1970	

Module Number	Module Name	Professor in Charge
BSGW.23	**Hydrogeology and Groundwater Flow**	N.N.
Contents and qualification aims	**Content :** **Precipitation**: Types Forms, Measurement by rain gauge and other methods, Design of rain gauges station, Mean precipitation, Presentation of rainfall data, Estimation of messing rainfall data. Test for consistency of record, Analysis of rainfall data, Intensity-depth-area relationship, Duration-Frequency curves, Depth-Area-Duration curves, Frequency analysis of rainfall data. **Abstractions from Precipitation:** Evaporation, Factors affecting evaporation, Measurement by different methods, Evaporation measurement, infiltration, Factors affecting infiltration Measurement, Infiltration capacity curve, Infiltration indices. **Run Off:** Factors affecting run off, Estimation of run-off (various methods), Rainfall-runoff co-relations. **Hydrographs:** Components, Base flow separation, Derivation of unit hydrograph and its applications & limitations, Distribution graph, Synthetic and Instantaneous unit hydrograph. **Reservoir Planning:** Types of reservoir, Storage zones, Selection of reservoir site, Mass curve analysis for reservoir capacity, Reservoir yield and its determination for a given reservoir capacity, Reservoir sedimentation and its control, Reservoir evaporation and Methods for its reduction **Floods:** Estimation of peak flood, Methods of flood control, Flood control economics and Flood routing, **Ground Water:** Role of Ground Water in hydrological cycle, Distribution of Ground Water, Types of aquifers, Aquifers parameters. **Well Hydraulics**: Darcy's law, Types of aquifers, Steady flow towards fully penetrating well, Equation of motion and its applications to ground water flow problems, Determination of aquifer constant in various types of aquifers, Types of tube wells, Methods of construction, Well development. **Qualification aims** Understand flow and transport in groundwater aquifers: physics of groundwater flow, pumping test analysis, groundwater contamination, simple advective solute transport, introduction to groundwater modeling (GMS/Mod flow).	
Module character	2 hours of lectures per week 1 hours tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the	The module is offered annually in Spring term	

module	
Work load	The work load is 150 hours
Duration of the module	The course takes one semester (4th semester)
Textbooks	**Essential:** Reference Materials available at Faculty of Civil Engineering In Damascus University **Recommended:** ▪ Todd D.K., Ground Water Hydrology, John Wiley ▪ Garg S.P., Ground Water & Tube wells, Oxford & IBH ▪ Raghunath H.M., Ground Water Hydrology, Wiely ▪ Chow**, V. T., Applied Hydrology, Mc Graw Hill Company**

Module Number	Module Name	Professor in Charge
BSGW.24	**Surface and Ground Water Protection**	N.N.
Contents and qualification aims	**Contents:** ▪ Effects of irrigation development on the interaction of ground water and surface water ▪ Effects of nitrogen use on the quality of ground water and surface water ▪ Effects of pesticide application to agricultural lands on the quality of ground water and surface water ▪ Effects of surface-water reservoirs on the interaction of ground water and surface water ▪ Effects of the removal of flood-plain vegetation on the interaction of ground water and surface water ▪ Effects of atmospheric deposition on the quality of ground water and surface water	
Module character	2 hours of lectures per week 1 hours tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in Spring term.	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester .	
Textbooks	**Recommended:** ▪ Salvato, Joseph A.; Nemerow, Nelson Leonard; Agardy, Franklin J. (2003): Environmental engineering. 5th ed. Hoboken, N.J.: Wiley. ▪ Chanlett, Emil T. (1973): Environmental protection. New York: McGraw-Hill (McGraw-Hill series in water resources and environmental engineering). ▪ Salvato, Joseph A.; Nemerow, Nelson Leonard; Agardy, Franklin J. (2003): Environmental engineering. 5th ed. Hoboken, N.J.: Wiley. ▪ Chanlett, Emil T. (1973): Environmental protection. New York: McGraw-Hill (McGraw-Hill series in water resources and environmental engineering).	

Module Number	**Module Name**	**Professor in Charge**
BSGW.25	**Water and Solute Transport in Soils**	N.N.
Contents and qualification aims	**Contents:** This course is about transport of chemicals by flowing water which affects soil and groundwater quality. It contains lectures, a laboratory practical and a computer practical. During the lectures, the physical and mathematical backgrounds of the convection-dispersion equation CDE for solute transport in soils and groundwater are discussed in detail. Stochastic-convective (SCM) or stream tube solute transport modeling. The soil hydraulic properties (retention curve, conductivity function) are discussed in relation with flow and (solute) transport. Different preferential flow mechanisms are outlined, together with their effects on solute movement, field observations methods As a computationally efficient and elegant alternative to solving the CDE, random walk simulations are discussed in class and demonstrated during the computer practical. The basic theory underlying the CDE and the stochastic-convective transport models is illustrated for a number of broadly relevant application areas, such as salinity and sodicity hazards in natural ecosystems and agro-ecosystems, pesticide and heavy metal leaching. Relatively simple mathematical tools such as moment theory are provided to give hands-on experience with applying the different transport concepts. Illustrations of complicated transport phenomena in case of spatiotemporal variability and for multicomponent transport processes are explained, giving a clear link with the laboratory and computer practical's. The laboratory practical involves monitoring water flow and solute transport in a soil column by various sensors driven by a data logger, soil sampling in the field, various standard soil physical techniques (measurement of saturated hydraulic conductivity and the water retention curve), and several other methods and techniques. During the computer practical emphasis is put on numerical techniques to simulate solute transport in saturated part of groundwater. **Qualification aims:** After successful completion of this course students are expected to be able to: - give examples of various (differential) equations and conceptual approaches for modeling solute transport; - explain the processes involved in biochemically reactive solute transport and the concept of moment theory for interpreting transport behaviour; - appraise the strengths and limitations of the convection-dispersion equation CDE, and judge the value of CDE and alternatives such as SCM and apply them for simple cases;	

	- install, connect and operate various soil sensors at an introductory level; - critically evaluate the data the soil sensors generate to apply suitable (combinations of) instruments for observation/monitoring of solute transport in soils and groundwater; - distinguish several numerical techniques to handle time and space scales of the CDE; - derive numerical expressions for the CDE; - perform model simulations of solute transport and groundwater flow.
Module character	2 hours of lectures per week 1 hours tutorial per week
Prerequisite of attendance	None
Applicability	The module is compulsory for the Bachelor Soil and Groundwater.
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade
Frequency of the module	The module is offered annually in Autumn term.
Work load	The work load is 150 hours.
Duration of the module	The course takes one semester.
Textbooks	**Essential:** Reference Materials available at Faculty of Civil Engineering In Damascus University. **Recommended:** ▪ Russo, D.; Dagan, G. (1993): Water flow and solute transport in soils. Developments and applications :in memoriam Eshel Bresler (1930-1991). Berlin, New York: Springer-Verlag (Advanced series in agricultural sciences, 20). ▪ Jury, William A.; Roth, Kurt (1990): Transfer functions and solute movement through soil. Theory and applications. Basel, Boston: Birkhäuser Verlag.

Module Number	Module Name	Professor in Charge
BSGW.26	**Managing Soil Erosion**	N.N.
Contents and qualification aims	**Content:** Soil erosion (Idea, classification, causes, consequences, spreading) Water erosion, Wind erosion, Snow erosion Logging erosion , Project and realization of erosion control measures, Methods of erosion research, Modelling of soil erosion, Influence of climate change on soil erosion. **Qualification aims:** ▪ ability to compute water, wind and snow erosion intensity ▪ ability to project water and wind erosion control measu-res ▪ ability to solve problems in soil erosion control ▪ knowledge of problem of erosion on agricultural and non-agricultural land ▪ knowledge of software modelling of soil erosion	
Module character	2 hours of lectures per week 1 hours tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor Soil and Groundwater.	
Prerequisite achieve cre-dit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in Autumn term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (5th semester)	
Textbooks	**Recommended:** ▪ Schwab, G.O., Frevert, R.K., Administer, T.W. and Bar-nes, K.K. "Soil and Water Conservation Engineering", John Wiley and Sons, 1989. ▪ Murthy, V.V.N. "Land and Water Management Enginee-ring", Kaylan Publishers, 1985. ▪ Singh. G. "Manual of Soil and Water Conservation Prac-tice in India". Central Soil and Water Conservation Re-search and Training Institute, Dehradun, 1995. ▪ Suresh, R. "Soil and Water Conservation Engineering", Standard Publishers Distributors. 1997.	

Module Number	**Module Name**	**Professor in Charge**
BSGW.27	**Climate Change**	N.N.
Contents and qualification aims	**Content:** Introduction, Greenhouse Effect, greenhouse gases, CO_2 Emissions, The Earth's Carbon Reservoirs, Carbon Cycling, Climate and Weather, Global Wind Systems, Clouds, Storms and Climate -Cloud Formation, Global Ocean Circulation, El Niño and the Southern Oscillation, Outlook for the Future, Advances in Computer Modelling. **Qualification aims**: Students should be able to describe how the Earth's climate system works and summarize general atmosphere circulation patterns, ocean circulation patterns and climate oscillations such as the El-Niño Southern Oscillation. Students should be able to illustrate components of the Earth's carbon cycle and quantitatively describe how addition of CO_2 to the atmosphere through burning fossil fuels will influence the climate. Importantly, students will gain the scientific basis to analyse and critique policy issues related to global warming.	
Module character	2 hours of lectures per week 1 hours tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in Autumn term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (5th semester)	
Textbooks	▪ Recommended: ▪ Freeman, W. H. 2008. Earth's Climate: Past and Future. University of Virginia, USA. ▪ Taylor, F. W. 2005. Elementary Climate Physics. Oxford University Press. ▪ Aguado, E. Burt, J. 2006. Understanding Weather and Climate. Prentice Hall, London. ▪ Garbrecht, J. and T. Piechota. 2005. Climate Variations, Climate Change, and Water Resources Engineering. American Society of Civil Engineers, USA.	

Module Number	**Module Name**	**Professor in Charge**
BSGW.28	**Water Resources Management**	N.N.
Contents and qualification aims	**Content:** Problems in water management according to too little water, too much or too dirty. Different aspects of water augmentation (e.g. harvesting, desalination, translocation), water conservation (irrigation, pricing, household, ..), water management processes (e.g. IWRM, Virtual water, ..) **Qualification aim:** At the end of the module students are able to analyse and classify various problems in water resource management and to apply different management practices to solve water resource problems	
Module character	2 hours of lectures per week 1 hours tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in Spring term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester .	
Textbooks	**Recommended:** ▪ Loucks, D. P., E. van Beek, J. R. Stedinger, J. P. M. Dijkman, M. T. Villars, 2005. Water Resources Systems Planning and Management: An Introduction to Methods, Models and Applications. UNESCO, Paris. ▪ Sarkar, A. K., K. S. Raju and M. L.Das. 2004. Integrated Water Resources Planning and Management. Jain Brothers, India. ▪ Jain,S. and V. P.Singh. 2003. Water Resources System Planning and Management. Elsevier, Kidlington, UK ▪ Grigg, N. S. 1996. Water Management: Principles, Regulations and Cases, McGraw-Hill, New York, USA. ▪ Cech, T. V. Year. Principles of Water Resources: History, Development, Management, and Policy. John Wiley & Sons, Inc., USA.	

Module Number	**Module Name**	**Professor in Charge**
BSGW.29	**Groundwater Modelling**	N.N.
Contents and qualification aims	**Contents:** Groundwater flow processes, Numerical methods for groundwater modelling, Conceptual model development, Introduction to groundwater modelling software, Model calibration, Case Studies. **Qualification aims:** The Course will: ▪ develop groundwater modelling skills and an understanding of subsurface flow regimes, the way in which conceptual models of a groundwater system can be built, and how appropriate modelling software can be used to test and refine that understanding; ▪ provide a sound introduction to MODFLOW within industry-standard graphical user interfaces. ▪ On completion of the course, participants will understand: ▪ good practice in groundwater flow and transport modelling; ▪ the nature of conceptual, mathematical and numerical models of groundwater systems; ▪ the use of data in groundwater modelling; ▪ the processes of model calibration, validation and sensitivity analysis. ▪ Participants will be able to: ▪ develop a conceptual model of a groundwater flow system from typical data sets; ▪ translate a conceptual model into a numerical model; ▪ set up and run groundwater flow simulations using MODFLOW within industry-standard graphical user interfaces.	
Module character	2 hours of lectures per week 1 hours tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in Autumn term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester.	
Textbooks	**Recommended:** ▪ Anderson, Mary P.; Woessner, William W. (1992): Applied groundwater modeling. Simulation of flow and advective transport. San Diego: Academic Press. ▪ Wheater, Howard; Mathias, Simon A.; Li, Xin (2010): Groundwater modelling in arid and semi-arid areas. New York: Cambridge University Press (International hydrology series).	

Module Number	Module Name	Professor in Charge
BSGW.30	**Project Management**	N.N.
Contents and qualification aims	**Content:** ▪ Relationship between people and project management. ▪ Importance of project planning. ▪ Why projects fail. ▪ Project management life cycle. ▪ Risk management. ▪ Basic Public Relations knowhow for future managers: why to communicate with stakeholders and other groups; how to plan a communication strategy; how to control PR service providers; PR and environmental organizations. **Qualification aims:** At the end of the module, students should be able to plan a project in all its detail and to understand communication processes in Public Relations and apply current PR instruments to the requirements of their task.	
Module character	2 hours of lectures per week 1 hours tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in Autumn term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester .	
Textbooks	**Recommended:** ▪ Shroder. "Operations Management". McGraw Hill, 1994. ▪ Monk. "Operations Management". McGraw Hill, 1993. ▪ Buffa. "Operations Management". McGraw Hill, 1990.	

Module Number	**Module Name**	**Professor in Charge**
BSGW.31	**Writing of Technical/ Financial Reports and Proposals**	N.N.

Contents and qualification aims	**Content:** The value of good Report Writing, Construction of good Sentences and Paragraphs, Overview of the Technical Communication Process, The Structure of the Technical Report, Standardized finance reporting terminology Target of financial reports, Structure of financial reports Different phases of the Report-writing process, standard monthly reporting, and specific project/brief reports. **Qualification aims:** ▪ Identify and use accounting and technical terminology ▪ Analyze and interpret financial and technical reports ▪ Compare financial information and data ▪ Develop the principles of report writing that give it a logical base appealing to both the specialist and non-specialist reader. ▪ encourage writers to be efficient and logical in their use of words ▪ Focus on the real challenge – to express complex ideas simply.
Module character	2 hours of lectures per week 1 hour of seminar per week
Prerequisite of attendance	Have passant the Foreign Language course
Applicability	The module is compulsory for the Bachelor Soil and Groundwater.
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes).
Credit points and grade	The module earns 5 credits. The grade for the examination equals the module grade.
Frequency of the module	The module is offered annually in summer term.
Work load	The workload is 150 hours.
Duration of the module	The course takes one semester.
Textbooks	**Recommended:** ▪ Alfredson, K., K. Leo, P. Pacter, R. Picker, J. Radford, Applying International Accounting Standards, Wiley, ▪ Eddey, P., N. Arthur and J. Knapp, Accounting for Corporate Combinations and Associations, 5th ed., Prentice Hall, 2001. ▪ Henderson, S. and G. Peirson, Issues in Financial Accounting, 11th ed. Longman, 2004 ▪ Jubb, P., S. Haswell and 1. Langfield-Smith, Company Accounting, 4th ed., Nelson ITP, 2005 ▪ Northey, Margot; Jewinski, Judi (2007): Making sense. A student's guide to research and writing : engineering and the technical sciences. 2nd ed. Don Mills, Ont.: Oxford University Press.s.

<table>
<tr><th>Module Number</th><th>Module Name</th><th>Professor in Charge</th></tr>
<tr><td>BSGW.32</td><td>Foreign Language</td><td>N.N.</td></tr>
<tr><td>Contents and qualification aims</td><td colspan="2">Contents:
Basics of Grammar, Parts of speech and use of articles
Sentence structure, active and passive voice, Practice in unified sentence, Analysis of phrase, clause and sentence structure, Transitive and intransitive verbs ,Punctuation and spelling.
Answers to questions on a given text.
General topics and every-day conversation (topics for discussion to be at the discretion of the teacher keeping in view the level of students).
Topics to be chosen at the discretion of the teacher.

Qualification aims:
▪ Enhance language skills and develop critical thinking.
▪ Enable the students to meet their real life communication needs.
▪ Enhance language skills and develop critical thinking.</td></tr>
<tr><td>Module character</td><td colspan="2">2 hours of lectures per week</td></tr>
<tr><td>Prerequisite of attendance</td><td colspan="2">non</td></tr>
<tr><td>Applicability</td><td colspan="2">The module is compulsory for the Bachelor Soil and Groundwater.</td></tr>
<tr><td>Prerequisite achieve credit points</td><td colspan="2">Having passed the module exam. The module exam is a written examination (120 minutes).</td></tr>
<tr><td>Credit points and grade</td><td colspan="2">The module earns 5 credits.
The grade for the examination equals the module grade.</td></tr>
<tr><td>Frequency of the module</td><td colspan="2">The module is offered annually in Autumn term.</td></tr>
<tr><td>Workload</td><td colspan="2">The workload is 150 hours.</td></tr>
<tr><td>Duration of the module</td><td colspan="2">The course takes one semester</td></tr>
<tr><td>Textbooks</td><td colspan="2">Recommended:
▪ Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 1. Third edition. Oxford University Press. 1997. ISBN 0194313492
▪ Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press. 1997. ISBN 0194313506
▪ Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 0 19 435405 7 Pages 20-27 and 35-41.
▪ Reading. Upper Intermediate. Brain Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 453402 2..</td></tr>
</table>

Module Number	**Module Name**	**Professor in Charge**
BSGW.33	**Practical Training/Project Study**	N.N.
Contents and qualification aims	The Student must carry out practical training about one Problem belongs to subjects of Soil and Groundwater in one or more institution or incorporation, and he must present full study about this problem.	
Module character	Practical Training/ Project Study: 20 hours tutorial per week	
Prerequisite of attendance	Basic Knowledge of Practical Training/ Project Study, the student must be in the 4^{th} Semester.	
Applicability	The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite achieve credit points	Having passed the module seminar and presentation before commission.	
Credit points and grade	The module earns 10 Cr. The final Grade is generated with 100% as presentation in front of committee.	
Frequency of the module	The module is offered annually.	
Work load	The workload is 300 hours.	
Duration of the module	The module takes two terms starting in Semester 4.	
Reference Materials	• James E. Mauch and Namgi Park: **Guide to the Successful Thesis and Dissertation, A Handbook for Students and Faculty**.2003. 5^{th} ed., Copyright ©2003 by Marcel Dekker. ISBN: 0-8247-4288-5. • Louis Cohen; Lawrence Manion and Keith Morrison: Research Methods in Education, 2005, 5th ed., ISBN 0-203-22434-5 Master e-book ISBN.	

Module Number	**Module Name**	**Professor in Charge**
BSGW.34	**Bachelor Thesis incl. Defen-se**	N.N.
Contents and qualification aims	The Student must work Bachelor Thesis with Defense about one Problem belongs to the subjects of Soil and Ground-water in the semester, he must present full study about this problem.	
Module character	Bachelor Thesis with Defense: 30 hours tutorial per week.	
Prerequisite of attendance	Basic Knowledge of Bachelor Thesis with Defense, the stu-dent must be in 6 Semester.	
Applicability	the module is suitable for the professional and research oriented studies in civil and environmental engineering	
Prerequisite achieve cre-dit points	Having passed the module presentation before a commis-sion.	
Credit points and grade	The module earns 15 Cr. The final Grade is generated with 100% as presentation in front of committee.	
Frequency of the module	The module is offered in 6th Semester.	
Work load	The work load is 450 hours.	
Duration of the module	The module takes one term starting in Semester 6.	
Reference Materials	• James E. Mauch and Namgi Park: Guide to the Suc-cessful Thesis and Dissertation, A Handbook for Stu-dents and Faculty. 2003. 5th ed., Copyright ©2003 by Marcel Dekker. ISBN: 0-8247-4288-5. • Louis Cohen; Lawrence Manion and Keith Morrison: Research Methods in Education, 2005, 5th ed., ISBN 0-203-22434-5 Master e-book ISBN. • Derek Swetnam: Writing Your Dissertation, How to plan, prepare and present successful work. 2007, 3rd ed. ISBN: 978 1 84803 126 5. • 4. Old Master and Bachelor thesis, which are available in the Libraries of the University.	

- **References**

1. Bear J., Hydraulics of Groundwater, McGrow-Hill International, 1979.
2. Todd D.K., Ground Water Hydrology, John Wiley and Sons, 2000.
3. Driscoll, F., Groundwater and Wells, St. Paul, Minnesota, II Ed., 1986.
4. Raghunath H.M., Ground Water Hydrology, Wiley Eastern Ltd., Second reprint, 2000.
5. Willis, R. and W.W.G. Yeh, Groundwater Systems Planning and Management, Prentice-Hall, 1987.
6. Bear J., Dynamics of fluids in porous media, American Elsevier publishing co., inc, 1972.
7. C. Walton, Groundwater Resources Evaluation, McGraw Hill, 1970.
8. O.D.L. Strack, Groundwater Mechanics, Prentice Hall, 1989.
9. S.P. Garg, Groundwater and Tube Wells, Oxford & IBH Publishing Co., 1993.

MODULE COMPENDIUM

Soil and Groundwater Science and Engineering (SGW)

Master Programme

Damascus University

Faculty of Civil Engineering

2015

EDUWAT: 511251-TEMPUS-1-2010-1-DE-TEMPUS-SMHES
Development of a Modern Higher Education System for Water Engineering in Syria

Preface

This course in one of three water courses designed in the framework of the EU-TEMPUS project: EDUWAT: *Development of a Modern Higher Education System for Water Engineering in Syria*, TEMPUS 1-2010-1DE TEMPUS SMHES No. 511251.

The three developed courses are designed for Bachelor and Master Degrees in three engineering fields according to Bologna process, they are:

- Water Engineering and Management
- Hydrology Science and Engineering
- **Soil and Groundwater Science and Engineering**

The study period is 3 years for a Bachelor degree and 2 years for a Master degree. As the entire study period will be limited to 5 years. The majority of students should complete the Master degree to be qualified as engineers in the study filed of their choice.

Three working groups were given the responsibility of developing the three courses, each of three staff members from the Department of Water Engineering at The Faculty of Civil Engineering, Damascus University. A similar plan is made by Al Bath, Tishreen and Aleppo Universities. The resulted courses are being discussed frequently with the Ministry of Higher Education to set a procedure for implementation.

The work group responsible for this course; Soil and Groundwater Science and Engineering consists of the following staff members of Damascus University:

9. **Dr. Wael SEIF**
   Faculty of Civil Engineering, Damascus University
   The Arab Centre for the Studies of Arid Zones & Dry Lands (ACSAD)

10. **Dr. Wissam AKHLED**
   Faculty of Civil Engineering, Damascus University

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein

Contents

Preface

11. Introduction to the Study Course
12. Course Outlines and Aims
13. Groundwater Hydrology Career
14. Admission Requirements
15. Program of Study

Curriculum for M.Sc. in Soil and Groundwater (MSGW)

16. General Structure
17. Curricula structure
18. Details of Courses (Core Courses – Elective Courses)
19. Practical Training
20. Principal learning outcomes

• Introduction

This course is under the EU-TEMPUS project **"Development of a Modern Higher Education System for Water Engineering in Syria - EDUWAT"**, No. 511251-TEMPUS-1-2010-1-DE-TEMPUS-SMHES, in the duration between 15 of October 2010 and 14 of Aprilr 2015.

As water is one of the priority sectors of the Syrian economic, new master and PhD study courses in water engineering for all universities will be established in Syria. They will be based on the existing study courses of the Faculty Civil Engineering and/or agriculture to overcome the fragmentation. The quality and competence of the Syrian graduates are enhanced by introducing the Bologna system, e.g. module and ECTS. By the inter-disciplinarity and trans-disciplinarity of natural sciences and engineering new education and research fields can be created e.g. eco-technology.

The **EDUWAT** project aims to:

- Increase higher education opportunities
- Develop high-quality curricula and educational programs
- Establish a quality assurance system
- Create an innovation environment for higher education and scientific research
- Increase the productivity of the Syrian scientific research and link it to development needs of the country
- Encourage partnerships among universities on national and international level
- Improve and modernize intermediate education

• Course outline and Aims

This course has been designed to introduce groundwater hydrology to the graduate and undergraduate students of the Civil Engineering Faculty. Master students will gain a wide understanding of hydrological processes.

The course covers most aspects of groundwater hydrology, such as assessment, development and management, role of groundwater in water resources system and management, movement of groundwater through saturated and unsaturated porous media, well hydraulics, and groundwater transport process. While the course gives an introduction to soil- and groundwater hydrology, focusing on the understanding of the physical processes controlling the propagation of water through the hydrological cycle, groundwater modelling techniques and management will be further given in the Master course.
Undergraduate students gain an understanding of the basic scientific concepts relevant to groundwater, current pressing groundwater management issues and the new technologies employed to deal with them. They also receive basic training in a range of field, laboratory and computational methods, as well as learning communication skills and problem-based and critical thinking skills.

The Master course with a significant research/industry training project provides training in research methodology and preparation of a professional thesis or report – from project conception, design of methods, collection of results and their analysis, through to final conclusions and recommendations for future work.

Other associated topics teach students the critical interrelationships that groundwater has in the hydrologic cycle such as surface water hydrology and soil-plant hydrology, amongst others.
Example problems including its solution will be incorporated for easy understanding of the physical and mathematical concepts of groundwater hydrology. Some real case studies have also been incorporated to give an idea about the complexities and challenges encountered during the modelling and management of groundwater processes
Course name: Graduate/postgraduate Certificate in Science (Soil and Groundwater Hydrology)
Duration (full-time equivalent): 6 semesters for the Undergraduates (3 academic years) and 4 semesters for the Master degree (2 academic years)
Course name: Bachelor degree in Engineering Science (Soil and Groundwater Hydrology)
Duration (full-time equivalent): 3 years for Bachelor and 2 years for Master
Course type: Undergraduate and Postgraduate
Availability: Full-time

.1. Learning outcome

To provide a basic understanding of the physical processes involved in the soil- and groundwater part of the hydrological cycle and to understand the link to every part of the cycle. In addition to give the student experience in the use of hydrological observations and enable her/him to perform basic hydrological calculations. The master course will provide students with basic knowledge of groundwater modelling and enable them to use new mathematical and numerical techniques to sort out a number of groundwater challenges

- **Groundwater Hydrology Career**

Graduates from the Groundwater Hydrology programs at can find jobs in:

- Natural resource and environment agencies of the national government and regional and international organizations
- Water and environmental consultancies; and
- Industry sectors such as agriculture, mining, aquaculture, water resource planning and management.

Graduates of this degree can find job opportunities in land and water resource monitoring and management, and in water resources management planning and allied technical roles.
The Master course can also be a pathway to a PhD for those who want to pursue a research career or work in the university and water/agriculture research centers.

Soil and Groundwater Hydrology degrees

The Soil and Groundwater Hydrology is offered by the Department of Water Engineering within the Faculty of Civil Engineering.

The course is given in 6 semester for undergraduates and 2 semesters for postgraduates. Students who have completed the Graduate Certificate are awarded credit towards the Graduate Master degree.

- **Admission requirements**

Applicants must hold an approved Bachelor Degree in Engineering Science of Soil and Groundwater Hydrology from an approved institution. However, the Faculty Board may, under certain circumstances and subject to specific conditions, admit others who can show evidence of fitness for candidature.

Course aims
A groundwater hydrologist is a scientist who understands how groundwater hydrological systems operate, has an advanced interdisciplinary knowledge in this field, can apply the scientific method to explore problems of relevance to this discipline, is able to use a range of analytical methods, including computer software to analyse relevant data, and field techniques, and can contribute to an advance of knowledge in this discipline

Learning outcomes

Upon successful completion of this course, students are expected to:

- have gained knowledge of the topics specified in the course
- understand and be able to apply basic scientific methods
- be able to review and interpret scientific information
- be able to develop scientific hypotheses
- be able to communicate effectively
- be able to work both independently and as part of a multidisciplinary team
- value ethical behaviour.

- ## Program of study

To qualify for the Bacholer and master degrees in Soil and Groundwater Hydrology, a student must complete the modules specified in the table below with a grade of F or better in each topic, according to the following:

Assignments
Assignments will be due either one or two weeks after they are handed out depending on their length. Grades will be reduced 10% for each day late.

Exams
In-class midterm and a final examination.

Grading

Activity	Percentage
Assignments	20%
In-class Midterm Exam	10%
Final Exam	70%

Below is a table that lists University letter grades (last column) and the equivalent percentages The Instructor will use for grading. All numerical grades will be rounded up or down to the nearest integer. The Instructor reserves the right to adjust the scores of any exam or the cumulative average in the students' favour if necessary, i.e. The Instructor reserves the right to add a few percentage points to every student's grade. No work for extra credit shall be given. An "Incomplete" grade will not be given to students who have missed exams.
Grading Matrix

Numerical value		**Equivalent University Letter grade**
greater than or equal to (%)	**and less than (%)**	
90	100	A
87	90	A-
84	87	B+
80	84	B
77	80	B-
74	77	C+
70	74	C
67	70	C-
64	67	D+
60	64	D
---	60	F

Curriculum for Master Course Soil and Groundwater (MSGW)

- **General Structure**

	Credits	**%**
Modules in Mathematics and Natural Sciences	10	8%
Modules in Engineering	10	8%
Modules in Hydro Sciences	10	8%
Modules with Specialization	35	29%
Elective Modules	10	8%
Modules for General Qualification	5	4%
Practical Training /Project	10	8%
Master Thesis plus Defense	30	25%
Total	**120**	**100%**

Module Semester	1	2	3	4	Total/ ECTS
Mathematics and Natural Sciences	10				**10**
Engineering	5	5			**10**
Hydro Sciences		5	5		**10**
Specialization	10	20	5		**35**
Elective Modules			10		**10**
General Qualification	5				**5**
Practical Training/ Project Study			10		**10**
Master Thesis plus Defense				30	**30**
Total	**30**	**30**	**30**	**30**	**120**

Module Nr.	Course Semester	1	2	3	4	Total/ ECTS
	Mathematics and Natural Sciences	**10**	**0**	**0**	**0**	**10**
MSGW.01	Advanced Mathematics/Statistics	5				**5**
MSGW.02	Soil and Water Chemistry	5				**5**
	Engineering	**5**	**5**	**0**	**0**	**10**
MSGW.03	Computer Science Modelling	5				**5**
MSGW.04	Advanced Spatial-Data Analysis		5			**5**
	Hydro Sciences	**0**	**5**	**5**	**0**	**10**
MSGW.05	Soil/Plant Sciences Models			5		**5**
MSGW.06	Water Planning and Economics		5			**5**
	Specialization	**10**	**20**	**5**	**0**	**35**
MSGW.07	Advanced Hydrogeology	5				**5**
MSGW.08	Groundwater Modelling		5			**5**
MSGW.09	Soil and Water Management		5			**5**
MSGW.10	Water Planning and Economics	5				**5**
MSGW.11	Remediation of Soils and Groundwa-ter			5		**5**
MSGW.12	Groundwater Management and Exploitation		5			**5**
MSGW.13	Groundwater organic contaminant pollution and remediation		5			**5**
	Elective Modules			**10**		**10**
MSGW.14	Advanced GW Management			5		**5**
MSGW.15	Climate Change Impacts and Adapta-tion			5		**5**
MSGW.16	Drainage & land reclamation			5		**5**
	General Qualification	**5**	**0**	**0**	**0**	**5**
MSGW.17	Research Methodology & Scientific Writing	5				**5**
	Practical Training/Project study			**10**		**10**
MSGW.18	Project on Groundwater Management			5		**5**
MSGW.19	Project on Soil and Water Manage-ment			5		**5**
MSGW.20	**Master Thesis Plus Defense**				**30**	**30**
	Total	**30**	**30**	**30**	**30**	**120**

- **Curricula Structures - DAM - Master Course Soil and Groundwater (MSGW)**

Semester 1	**Advanced Ma-thematics**	**Soil and Water Chemistry**	**Computer Scien-ce Modelling**	**Advanced Hydro-geology**	**Water Planning and Economics**	**Research Me-thodology & Scientific Wri-ting**
Semester 2	**Advanced Spatial-Data Analysis**	**Water Planning and Economics**	**Groundwater Mo-delling**	**Soil and Water Management**	**Groundwater Ma-nagement and Exploitation**	**Groundwater or-ganic contaminant pollution and remediation**
Semester 3	**Soil/Plant Scien-ces Models**	**Remediation of Soils and Groundwater**	**Elective Modu-les**	**Elective Modu-les**	**Practical Trai-ning/Project study**	**Practical Trai-ning/Project study**
Semester 4	**Master Thesis**					
Credits	5	5	5	5	5	5

Modules in Natural Sciences 10% - 25%

Modules inTechnical Sciences 10 - 25%

Modules in Economic & Social Sciences 5% - 15%

Modules in Variable Sciences 55% - 70%

- **Module description**

Module Number	**Module Name**	**Professor in Charge**
MSGW.01	**Advanced Mathematics/ Statistics**	N.N.
Content and qualification aims	**Content:** Real function of two variables: Definition, domain of a function, Partial derivative, Local and global maxima and minima, Applications. Differential equations, Basic concept, Differential equations with separated equations, First and second order linear differential equation, Autonomous systems, Applications. Double integral: Definition, Fubini theorem, Transformation to polar, Theorem of Fubini coordinates. Graph theory: Introduction to graph theory, Minimal skeleton, CPM method. **Qualification aims:** Ability to analyze related rates problems. Ability to use calculus to solve basic optimization problems. Basic knowledge of integral calculus in more variables and its applications. Cultivation of abstract thinking on the study of mathematical structures. Focusing on the core of the problem by neglecting side factors. Master mathematical tools necessary for solving real world problems Solving differential equations and applications of differential equations	
Module character	(2 hours of lectures, 2 hours tutorial) per week.	
Prerequisite of attendance	Basic knowledge of mathematics for engineers (Math1, Math2, Math3), and computer skills and programming.	
Applicability	The module is compulsory for Master Course Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes).	
Credit points and grade	The module earns 5 credits. The grade for the examination equals the module grade.	
Frequency of the module	The module is offered annually in Autumn term.	
Work load	The workload is 150 hours.	
Duration of the module	The module takes one term.	
Textbooks	**Recommended:** ▪ Fischer-Cripps, Anthony C. (2005): The mathematics companion. Essential and advanced mathematics for scientists and engineers. Bristol: Institute of Physics. ▪ Krantz, Steven G.; Gavosto, Estela A.; Peloso, Marco M. (1992): Partial differential equations and complex analysis. Boca Raton, FL: CRC Press (Studies in advanced mathematics).	

<table>
<tr><th>Module Number</th><th>Module Name</th><th>Professor in Charge</th></tr>
<tr><td>MSGW.02</td><td>Soil and Water Chemistry</td><td>N.N.</td></tr>
<tr><td>Content and qualification aims</td><td colspan="2">Content:
▪ characterization of solid soil components
▪ processes in the water phase, and equilibrium with various mineral phases
▪ sorption of ions and organic compounds to soil and sediment material
▪ Redox processes and their importance for the solubility of different elements in the soil and water system
▪ acidifying and acid-neutralizing processes in soil and water systems
▪ geochemical modelling
▪ Applications of soil and water chemistry theory within agriculture, forestry and environmental research.

Qualification aims:
This course provides students with knowledge of how basic chemical theory can be applied in different types of soil and water systems. This equips them with tools to solve problems they may encounter in the future, e.g. environmental risk assessment, environmental monitoring or providing advice on plant nutrition issues.</td></tr>
<tr><td>Module character</td><td colspan="2">(2 hours of lectures, 1 hour tutorial,1 hour practical) per week.</td></tr>
<tr><td>Prerequisite of attendance</td><td colspan="2">Advance knowledge in SOILS.</td></tr>
<tr><td>Applicability</td><td colspan="2">The module is compulsory for Master Course Soil and Groundwater.</td></tr>
<tr><td>Prerequisite achieve credit points</td><td colspan="2">Having passed the module exam. The module exam is a written examination (120 minutes).</td></tr>
<tr><td>Credit points and grade</td><td colspan="2">The module earns 5 credits.
The grade is calculated from the grades achieved for the practical (40%) and the written examination (60%).</td></tr>
<tr><td>Frequency of the module</td><td colspan="2">The module is offered annually in Autumn term.</td></tr>
<tr><td>Work load</td><td colspan="2">The workload is 150 hours.</td></tr>
<tr><td>Duration of the module</td><td colspan="2">The module takes one term.</td></tr>
<tr><td>Textbooks</td><td colspan="2">▪ Essington, Michael E. (2004): Soil and water chemistry. An integrative approach. Boca Raton: CRC Press.
▪ Conklin, Alfred R. (2005): Introduction to soil chemistry. Analysis and instrumentation. Hoboken, N.J.: Wiley-Interscience (Chemical analysis, v. 167).</td></tr>
</table>

<table>
<tr><th>Module Number</th><th>Module Name</th><th>Professor in Charge</th></tr>
<tr><td>MSGW.03</td><td>Computer Science Modelling</td><td>N.N.</td></tr>
<tr><td>Contents and qualification aims</td><td colspan="2">Content:
This unit develops skills in modelling ecological, environmental, agricultural and economic systems, and the relationships between them. It builds on skills and experience developed at the undergraduate level through a series of modules that provide an overall understanding of the place of modelling in the natural sciences and a general overview of common modelling approaches and issues including the goals and purposes of modelling, types of models, the modelling process, systems analysis and conceptual modeling, and validation and testing. A range of practical laboratory exercises and a project allow a more detailed focus on techniques and issues specific to disciplines such as botany, zoology, theoretical ecology, agro-ecology, agricultural and resource economics, marine and aquatic ecosystems, and conservation ecology.

Qualification aims : Students can
▪ explain the possible purposes of modelling;
▪ discuss the relationship between modelling and experimental work;
▪ describe a range of different modelling approaches;
▪ explain how models can be evaluated and validated;
▪ Understand, explain, use, modify, construct and evaluate models of ecological, agricultural, environmental and economic systems.</td></tr>
<tr><td>Module character</td><td colspan="2">(2 hours of lectures, 2 hours tutorial) per week.</td></tr>
<tr><td>Prerequisite of attendance</td><td colspan="2">Basic knowledge of mathematics for engineers (Math1, Math2, Math3), and computer skills and programming.</td></tr>
<tr><td>Applicability</td><td colspan="2">The module is compulsory for Master Course Soil and Groundwater.</td></tr>
<tr><td>Prerequisite achieve credit points</td><td colspan="2">Having passed the module exam. The module exam is a written examination (120 minutes).</td></tr>
<tr><td>Credit points and grade</td><td colspan="2">The module earns 5 credits.
The grade for the examination equals the module grade.</td></tr>
<tr><td>Frequency of the module</td><td colspan="2">The module is offered annually in Autumn term.</td></tr>
<tr><td>Work load</td><td colspan="2">The workload is 150 hours.</td></tr>
<tr><td>Duration of the module</td><td colspan="2">The module takes one term.</td></tr>
<tr><td>Textbooks</td><td colspan="2">Recommended:
▪ Moller, Faron; Struth, Georg (2013): Modelling Computing Systems. Mathematics for Computer Science. In Modelling computing systems.
▪ Huth, Michael; Ryan, Mark (2004): Logic in computer science. Modelling and reasoning about systems. 2nd ed. Cambridge [U.K.], New York: Cambridge University Press.
▪ Jørgensen, Sven Erik; Bendoricchio, G. (2001): Fundamentals of ecological modelling. 3rd ed. Amsterdam, New York: Elsevier (Developments in environmental modelling, 21).
▪ Peng, Gongbing; Leslie, Lance M.; Shao, Yaping (2002): Environmental modelling and prediction. Berlin</td></tr>
</table>

<table>
<tr><th>Module Number</th><th>Module Name</th><th>Professor in Charge</th></tr>
<tr><td>MSGW.04</td><td>Advanced Spatial-Data Analysis</td><td>N.N.</td></tr>
<tr><td>Contents and qualification aims</td><td colspan="2">Content:
<u>Basic Module:</u>
▪ Introduction to GIS
▪ Representation of geo-information
▪ Geocoding
▪ GIS software
▪ Modelling of geodata
▪ Acquisition of geodata
▪ Geographic databases
▪ GIS analysis
<u>Soil Management</u>
▪ Soil variability: factors and causes; relationship with spatial scale
▪ Soil survey and soil maps: procedure and product; the Belgian soil map; advantages and limitations
▪ Quality of soil maps: procedure and indices
▪ Soil classification and fuzzy set
▪ Detailed soil inventory using soil sensors
<u>Water Management</u>
▪ Basic DTM analysis: simple calculation of flow directions, stream network and river basin extraction, calculation of topographic indices, more advanced methods for the determination of flow directions, evaluation of the different algorithms
▪ Advanced DTM analysis: Horton’s laws, fractal analysis, river routing, streamline-based methods

Qualification aims:
When finishing the course, the student should be able to:
▪ understand the function of the different components of GIS
▪ understand the links between GIS and cartographic properties such as scale, system of projection, coordinate system, ..
▪ know the properties and the applications of raster and vector data
▪ know the basic principles of relational databases and their relationship to GIS
▪ describe the algorithm of simple GIS applications and apply them.</td></tr>
<tr><td>Module character</td><td colspan="2">(2 hours of lectures, 2 hours tutorial) per week.</td></tr>
<tr><td>Prerequisite of attendance</td><td colspan="2">Basic knowledge of GIS, Soil and Water Management, and computer skills and programming.</td></tr>
<tr><td>Applicability</td><td colspan="2">The module is compulsory for Master Course Soil and Groundwater.</td></tr>
<tr><td>Prerequisite achieve credit points</td><td colspan="2">Having passed the module exam. The module exam is a written examination (120 minutes).</td></tr>
<tr><td>Credit points and grade</td><td colspan="2">The module earns 5 credits.
The grade for the examination equals the module grade.</td></tr>
</table>

Frequency of the module	The module is offered annually in Spring term.
Work load	The workload is 150 hours.
Duration of the module	The module takes one term.
Textbooks	**Recommended:** ▪ Haining, Robert (1997): Spatial data analysis in the social and environmental sciences. [Reprinted 1997]. Cambridge: Cambridge University Press. ▪ Bähr, Hans-Peter; Vögtle, Thomas (1999): GIS for environmental monitoring. Stuttgart: E. Schweizerbart'sche Verlagsbuchhandlung. ▪ Campagna, Michele (2006): GIS for sustainable development. Boca Raton: CRC Press.

Module Number	Module Name	Professor in Charge
MSGW.05	**Soil/Plant Sciences Models**	N.N.
Contents and qualification aims	**Content:** ▪ Basic theories of storage and transport of energy, water and solutes in the soil-plant-atmosphere system. ▪ Calculation of storage and flows of energy, water and solutes in the soil-plant-atmosphere system. ▪ Computer exercises involve construction of process-based models (e.g. using the programme POWERSIM). **Qualification aims:** On completion of the course students will be able to: ▪ describe the interactions between the physical processes and the key factors that control flows and stores of energy, water and solutes in the soil-plant-atmosphere system, ▪ use and develop numerical models to simulate flows of energy, water and solutes in different types of soil, linked to different vegetation and climate, ▪ Apply this knowledge to analyze and solve practical problems concerning water flow and solute transport in relation to land use and environmental protection.	
Module character	(2 hours of lectures, 2 hours tutorial) per week.	
Prerequisite of attendance	Basic knowledge of Water Recourses Management, Soil Physics and Chemistry, and computer skills and programming.	
Applicability	The module is compulsory for Master Course Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes).	
Credit points and grade	The module earns 5 credits. The grade for the examination equals the module grade.	
Frequency of the module	The module is offered annually in Autumn term.	
Work load	The workload is 150 hours.	
Duration of the module	The module takes one term.	
Textbooks	**Recommended:** ▪ Campbell, Gaylon S. (1985): Soil physics with BASIC. Transport models for soil-plant systems. Amsterdam, New York: Elsevier (Developments in soil science, 14). ▪ Schabenberger, Oliver; Pierce, F. J. (©2002): Contemporary statistical models for the plant and soil sciences. Boca Raton: CRC Press.	

Module Number	Module Name	Professor in Charge
MSGW.06	**Water Planning and Economics**	N.N.
Contents and qualification aims	Content : Economic value of water, Costs of water supply, Water economic efficiency ,Discounting ,Consumer and Producer Surplus measurement ,Valuation of water intangibles, Cost-Benefit Analysis, Water Marketing ,Water Pricing, Water Demand Analysis, Water Supply Analysis Virtual Water/ Water footprint. **qualification aims :** Students after the completion of the course are expected to ▪ Understand the economic concepts of water value ▪ Use economic water resource allocation tools ▪ Perform economic analysis of water ▪ resource policies and projects in the context of sustainability	
Module character	(2 hours of lectures, 2 hours tutorial) per week.	
Prerequisite of attendance	Basic knowledge of Statistics and computer skills and programming.	
Applicability	The module is compulsory for Master Course Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes).	
Credit points and grade	The module earns 5 credits. The grade for the examination equals the module grade.	
Frequency of the module	The module is offered annually in Autumn term.	
Work load	The workload is 150 hours.	
Duration of the module	The module takes one term.	
Textbooks	**Recommended:** ▪ Escobar, Isabel C.; Schäfer, Andrea Iris (2010): Sustainable water for the future. Water recycling versus desalination. 1st ed. Amsterdam, Boston: Elsevier Science (Sustainability science and engineering, v. 2). ▪ Green, Colin H. (2003): The handbook of water economics. Principles and practice. Hoboken, N.J: Wiley. ▪ Mays, Larry W. (2007): Water resources sustainability. 1st ed. New York, Alexandria, Va: McGraw-Hill; WEF Press. ▪ Merrett, Stephen (1997): Introduction to the economics of water resources. An international perspective. 1st American ed. Lanham [Md.]: Rowman & Littlefield.	

Module Number	**Module Name**	**Professor in Charge**
MSGW.07	**Advanced Hydrogeology**	N.N.
Contents and qualification aims	**content :** ▪ • principles and concepts of groundwater modeling ▪ • overview of groundwater modeling software ▪ • conceptual model development ▪ • data collection and preparation ▪ • model grid design ▪ • boundary conditions: concepts and application ▪ • implementing rivers, lakes, recharge, drainage, and other special situations ▪ • modeling multiple aquifer systems ▪ • sensitivity analysis, model calibration and verification ▪ • contaminant transport modeling ▪ • capture zone analysis **Qualification aims:** At the end of the course, participants should have: ▪ a well-founded knowledge of the principles in groundwater flow and transport modeling. ▪ familiarity with the major elements of groundwater modeling studies. ▪ hands-on experience in designing simple groundwater flow and transport studies with MODFLOW ▪ using popular groundwater modeling software. ▪ a fundamental understanding of the capabilities and limitations of groundwater modeling. ▪ an understanding of the appropriate role of groundwater models in groundwater assessment and management.	
Module character	(2 hours of lectures, 2 hours tutorial) per week.	
Prerequisite of attendance	Basic knowledge in soil sciences, Hydrogeology and groundwater flow, Groundwater modeling.	
Applicability	The module is compulsory for Master Course Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes).	
Credit points and grade	The module earns 5 credits. The grade for the examination equals the module grade.	
Frequency of the module	The module is offered annually in Autumn term.	
Work load	The workload is 150 hours.	
Duration of the module	The module takes one term.	
Textbooks	**Recommended:** ▪ Fetter, C. W. (2001): Applied hydrogeology. 4th ed. Upper Saddle River, N.J.: Prentice Hall. ▪ Hiscock, K. M. (2005): Hydrogeology. Principles and practice. Malden, MA: Blackwell Pub.	

Module Number	**Module Name**	**Professor in Charge**
MSGW.08	**Groundwater Modelling**	N.N.
Contents and qualification aims	Content: ▪ fundamental hydrogeology ▪ the basic principle of numerical groundwater modeling ▪ chemical transport, dispersion, sorption/retardation and degradation in the groundwater zone ▪ evaluating the uncertainty of the model results Qualification aims: ▪ • To collect, analyse and visualise the various data that forms the basis for the conceptual model. ▪ • To construct, calibrate and validate groundwater models. ▪ • To simulate water and contaminate transport ▪ • To evaluate and quantify modelling uncertainty ▪ Competences: ▪ • To evaluate and handling hydrological data that forms the basis for groundwater modelling. ▪ • To structure and produce technical documentation of complex problems, methods and results. ▪ • To communicate problems, findings and solutions graphical as well as oral to the relevant target audience	
Module character	(2 hours of lectures, 2 hours tutorial) per week.	
Prerequisite of attendance	Basic knowledge of hydrogeology, groundwater modeling, groundwater Flow and computer skills and programming.	
Applicability	The module is compulsory for Master Course Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes).	
Credit points and grade	The module earns 5 credits. The grade for the examination equals the module grade.	
Frequency of the module	The module is offered annually in Autumn term.	
Work load	The workload is 150 hours.	
Duration of the module	The module takes one term.	
Textbooks	**Recommended:** ▪ Kinzelbach, Wolfgang (1986): Groundwater modelling. An introduction with sample programs in BASIC. Amsterdam, New York, New York, N.Y., U.S.A: Elsevier; Distributors for the United States and Canada, Elsevier Science Pub. (Developments in water science, 25). ▪ Krešić, Neven (1997): Quantitative solutions in hydrogeology and groundwater modeling. Boca Raton: CRC Lewis. ▪ Wang, Herbert; Anderson, Mary P. (1995], c1982): Introduction to groundwater modeling. Finite difference and finite element methods. San Diego, London: Academic Press.	

Module Number	**Module Name**	**Professor in Charge**
MSGW.09	**Soil and Water Management**	N.N.
Contents and qualification aims	**Content:** Soil conservation methods, Reclamation of mine spoils, management of saline-sodic soils, Drainage methods, Reduction of soil pollution, Erosion hazards and methods of control,. Precipitation, evapotranspiration and infiltration, Rainfall run-off over agricultural land, Universal soil loss equation. **Qualification aims :** ▪ Intimate students with soil conservation methods ▪ Understand causes of soil degradation ▪ Understand basic principles of soil management ▪ Identify good sources of water ▪ Be able to determine water requirement by crops and ▪ control the water ▪ distribution of crops	
Module character	(2 hours of lectures, 2 hours tutorial) per week.	
Prerequisite of attendance	Basic knowledge of Soil Physics and Chemistry, Irrigation and Drainage Systems, Managing Soil Erosion, computer skills and programming.	
Applicability	The module is compulsory for Master Course Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes).	
Credit points and grade	The module earns 5 credits. The grade for the examination equals the module grade.	
Frequency of the module	The module is offered annually in Autumn term.	
Work load	The workload is 150 hours.	
Duration of the module	The module takes one term.	
Textbooks	**Recommended:** ▪ Blanco-Canqui, Humberto; Lal, R. (2008): Principles of soil conservation and management. Dordrecht, London: Springer. ▪ Schwab, Glenn Orville; Fangmeier, D. D.; Elliot, William J. (1996): Soil and water management systems. 4th ed. New York: Wiley.	

Module Number	Module Name	Professor in Charge
MSGW.06	**Problematic Soils and round Improvement Techniques**	N.N.

Contents and qualification aims	**Content:** Topics include classification of problematic soils, and the associated problems; design and construction methods including compaction, reinforcement, preloading, grouting, dynamic replacement, deep soil mixing, concrete columns, design and construction methods of slope stabilization methods; as well as design and installation of monitoring devices to observe behavior of the improved ground. **Qualification Aims:** Upon successful completion of this subject students should be able to: ▪ Analyse and evaluate modern methods to carry out laboratory and fieldwork associated with various soil types. ▪ Apply modern soil mechanics and advanced design of foundations under complex loadings for various ground conditions. ▪ Evaluate the performance of foundations of various structures. ▪ Apply quality control methods of foundation during and after construction. ▪ Analyse the behavior of soil considering various failure criteria and stress and strain paths in both small and large scales. ▪ Analyse and design combined shallow and deep footings for infrastructure projects.
Module character	(2 hours of lectures, 2 hours tutorial) per week.
Prerequisite of attendance	Basic knowledge of Soil Sciences, Soil Physics, programming.
Applicability	The module is compulsory for Master Course Soil and Groundwater.
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes).
Credit points and grade	The module earns 5 credits. The grade for the examination equals the module grade.
Frequency of the module	The module is offered annually in Autumn term.
Work load	The workload is 150 hours.
Duration of the module	The module takes one term.
Textbooks	**Recommended:** ▪ Balba, A. Monem (1995): Management of problem soils in arid ecosystems. Boca Raton, FL: CRC Lewis Publishers. ▪ Kirsch, Klaus; Bell, A. L. (2013): Ground improvement. 3rd ed. Boca Raton: CRC Press.

Module Number	Module Name	Professor in Charge
MSGW12	**Groundwater Management and Exploitation**	N.N.
Contents and qualification aims	**Content:** Flow through fractures and fracture networks; saline groundwater movement; heat transport; further development of recharge and surface water / groundwater interaction theories and their applications; groundwater aspects of clean carbon technologies. **Qualification Aims:** to extend the principles introduced in Groundwater Hydraulics to cover a range of more complex and challenging flow systems and methods of analysis in the context of the management of groundwater. The emphasis is on issues of current interest to groundwater professionals worldwide.	
Module character	(2 hours of lectures, 2 hours tutorial) per week.	
Prerequisite of attendance	Basic knowledge of Soil Physics and Chemistry, Surface and Groundwater movement and computer skills and programming.	
Applicability	The module is compulsory for Master Course Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes).	
Credit points and grade	The module earns 5 credits. The grade for the examination equals the module grade.	
Frequency of the module	The module is offered annually in Autumn term.	
Work load	The workload is 150 hours.	
Duration of the module	The module takes one term.	
Textbooks	**Recommended:** ▪ Findikakis, Angelos N.; Sato, K. (2011): Groundwater management practices. London, Boca Raton, Fla: CRC Press/Balkema (IAHR monograph). ▪ Llamas, Ramón (Ed.) (2003): Intensive use of groundwater. Challenges and opportunities; this book has been prepared after an ad-hoc expert meeting (Workshop on Intensively Exploited Aquifers, WINEX), Madrid, Spain, 13-15 December 2001. Lisse [u.a.]: Balkema.	

Module Number	Module Name	Professor in Charge
MSGW 13	**Groundwater organic contaminant pollution and remediation**	N.N.
Contents and qualification aims	**Content:** Contaminant source terms; toxicology, environmental standards, and legislation; organic contaminant phase partitioning to air, water, solids; conceptual models of contaminant migration; processes of sorption, chemical reaction, biodegradation; non-aqueous phase flow; contaminated land / groundwater legislative frameworks; groundwater risk assessment; site investigation and groundwater monitoring practice; and groundwater remediation. **Qualification Aim:** to provide the organic contaminant hydrogeological knowledge base that will underpin a student’s potential future professional activity in the field of groundwater contamination by synthetic organic chemicals.	
Module character	(2 hours of lectures, 2 hours tutorial) per week.	
Prerequisite of attendance	Basic knowledge of Groundwater movement, and Soil Sciences.	
Applicability	The module is compulsory for Master Course Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes).	
Credit points and grade	The module earns 5 credits. The grade for the examination equals the module grade.	
Frequency of the module	The module is offered annually in Autumn term.	
Work load	The workload is 150 hours.	
Duration of the module	The module takes one term.	
Textbooks	**Recommended:** ▪ Kaluarachchi, Jagath J. (2001): Groundwater contamination by organic pollutants. Analysis and remediation. Reston, Va: American Society of Civil Engineers (ASCE manuals and reports on engineering practice, no. 100). ▪ Simon, F.-G; Meggyes, T.; McDonald, Chris (2002): Advanced groundwater remediation. Active and passive technologies. London: Telford.	

Module Number	Module Name	Professor in Charge
MSGW.11	**Remediation of Soils and Groundwater**	N.N.
Contents and qualification aims	**Content:** ▪ linking soil, water and plant sciences in the environmental context of disturbed land. ▪ diffuse and point-source contamination ▪ land use changes in the context of urban development and mine site environments. ▪ Organic and inorganic contaminants ▪ chemical, physical and biological remediation techniques ▪ bioremediation using microbes ▪ phytoremediation using plants. ▪ Aspects of land rehabilitation as part of a holistic approach to remediation ▪ The concept of environmental risk assessment ▪ Field Trips **Qualification Aims:** Students are able to (1) understand the causes and effects of disturbed land in the context of diffuse and point-source contamination in different environments; (2) understand remediation and rehabilitation techniques in the scientific, social and economic context; (3) apply relevant legislation to identify and classify contaminated sites and suggest the most appropriate remediation approaches; (4) analyse chemical, physical and biological data and write a consultancy-type report about contamination/ remediation/ rehabilitation, recommending appropriate courses of action; and (5) understand and apply environmental risk assessment	
Module character	(2 hours of lectures, 2 hours tutorial) per week.	
Prerequisite of attendance	Basic knowledge of Biology, soil and water sciences, environmental assessment.	
Applicability	The module is compulsory for Master Course Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes).	
Credit points and grade	The module earns 5 credits. The grade for the examination equals the module grade.	
Frequency of the module	The module is offered annually in Autumn term.	
Work load	The workload is 150 hours.	
Duration of the module	The module takes one term.	
Textbooks	**Recommended:** ▪ Huang, P. M.; Iskandar, I. K. (2000): Soils and groundwater pollution and remediation. Asia, Africa, and Oceania. Boca Raton: Lewis Publishers. ▪ Hyman, Marve; Dupont, R. Ryan (2001): Groundwater and soil remediation. Process design and cost estimating of proven technologies. Reston, Va: ASCE Press.	

Module Number	Module Name	Professor in Charge
MSGW.14	**Advance Ground Water Development & Management**	N.N.

Contents and qualification aims	**Content:** ▪ Ground Water Occurrence: Ground water hydrologic cycle, origin of ground water, rock properties effecting ground water, vertical distribution of ground water, zone of aeration and zone of saturation, geologic formation as Aquifers, types of aquifers, porosity, Specific yield and Specific retention. ▪ Ground Water Movement: Permeability, Darcy's law, storage coefficient. Transmisivity, differential equation governing ground water flow in three dimensions derivation, ground water flow equation in polar coordinate system. Ground water, flow contours their applications. ▪ Analysis of Pumping Test Data – I: Steady flow groundwater flow towards a well in confined and unconfined aquifers – Dupuit and Theiss equations, Assumptions, Formation constants, yield of an open well interface and well tests. ▪ Analysis of Pumping Test Data – II: Unsteady flow towards a well – Non equilibrium equations – Thesis solution – Jocob and Chow's simplifications, Leak aquifers. ▪ Surface and Subsurface Investigation: Surface methods of exploration – Electrical resistivity and Seismic refraction methods. Subsurface methods – Geophysical logging and resistivity logging. Aerial Photogrammetry applications along with Case Studies in Subsurface Investigation. ▪ Artificial Recharge of Ground Water: Concept of artificial recharge – recharge methods, relative merits, Applications of GIS and Remote Sensing in Artificial Recharge of Ground water along with Case studies. **Qualification Aim:** To give an analysis of the occurrence, exploration and exploitation of groundwater resources for various purposes.
Module character	(3 hours of lectures, 1 hour practical training) per week.
Prerequisite of attendance	Basic knowledge in Hydraulic, Hydroloy, Meteorology, Surface and Groundwater flow and Irrigation/Drainage System.
Applicability	The module is compulsory for Master Course Soil and Groundwater.
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes), and a term paper(50hours).
Credit points and grade	The module earns 5 credits. The grade for the examination (60%) and the term paper (40%).
Frequency of the module	The module is offered annually in Autumn term.
Work load	The workload is 150 hours.
Duration of the module	The module takes one term.
Textbooks	**Essential:** ▪ Ground water Hydrology by David Keith Todd, John

	Wiley & Son, New York ▪ Groundwater by H.M.Raghunath, Wiley Eastern Ltd. **Recommended:** ▪ Groundwater by Bawvwr, John Wiley & sons. ▪ Groundwater Syatem Planning & Managemnet – R.Willes & W.W.G.Yeh, Printice Hall. ▪ Applied Hydrogeology by C.W.Fetta, CBS Publishers & Distributers.

Module Number	**Module Name**	**Professor in Charge**
MSGW.15	**Climate Change Impacts and Adaptation**	N.N.
Contents and qualification aims	**Contents:** ▪ Climate change and causation of impacts ▪ Assessing climate impacts: models and methodologies ▪ Case study: food security and climate change ▪ Using models to inform adaptation ▪ Approaches to climate change adaptation ▪ Policy and governance for adaptation ▪ Economics and delivery of adaptation ▪ How impacts and adaptation studies are related. **Qualification Aims:**Skills outcomes ▪ Disseminate and critique literature on impacts of and adaptation to climate change. ▪ Familiarity with impact assessment and vulnerability assessment methods. ▪ Ability to develop and judge climate change adaptation strategies. ▪ An ability to evaluate and assess arguments on impacts and adaptation using relevant scholarly sources and methods.	
Module character	(2 hours of lectures, 2 hours of seminar) per week	
Prerequisite of attendance	Basic knowledge in meteorology, hydrology, physics, chemistry, and mathematics.	
Applicability	The module is one of 6 optional modules for the Bachelor Water Engineering and Management	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade is calculated from the grades achieved for the presentation (40%) and the term paper (60%).	
Frequency of the module	The module is offered annually in Autumn term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one term.	
Textbooks	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Freeman, W. H. 2008. Earth's Climate: Past and Future. University of Virginia, USA. ▪ Aguado, E. Burt, J. 2006. Understanding Weather and Climate. Prentice Hall, London. ▪ Ahmad, Q. K. 2005. Climate Change and Water Resources in South Asia. CRC Press, Boca Raton, Florida, USA. ▪ Garbrecht, J. and T. Piechota. 2005. Climate Variations, Climate Change, and Water Resources Engineering. American Society of Civil Engineers, USA. ▪ Taylor, F. W. 2005. Elementary Climate Physics. Oxford University Press.	

Module Number	**Module Name**	**Professor in Charge**
MSGW.16	**Drainage & Land Reclamation**	N.N.
Contents and qualification aims	**Content:** Benefits of drainage. Drainage methods: surface subsurface systems. Design and layout of surface, drainage systems. Design and layout of subsurface, drainage systems, Drain spacing design theories based on steady and non-steady state conditions. Drainage survey and investigations, analysis of rainfall data; evapotranspiration; soil moisture. Drainage structures. Drainage materials: perforated pipes; tiles; filters; envelopes. Management of saline and alkali soils: nature of the salt problems; criteria and methods of diagnosis, salinity control - salt balance, leaching requirements, irrigation methods, drainage, soil management. **Qualification Aim:** To introduce the theory and design of surface and subsurface drainage of irrigated land including reclamation of salinized land.	
Module character	(2 hours of lectures, 2 hours tutorial) per week.	
Prerequisite of attendance	Basic knowledge of Irrigation/Drainage Systems, Soil Physics and Chemistry, GIS and computer skills and programming.	
Applicability	The module is compulsory for Master Course Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes).	
Credit points and grade	The module earns 5 credits. The grade for the examination equals the module grade.	
Frequency of the module	The module is offered annually in Autumn term.	
Work load	The workload is 150 hours.	
Duration of the module	The module takes one term.	
Textbooks	**Recommended:** ▪ Fox, Howard R.; Moore, Heather M.; McIntosh, Andrew D. (1998): Land reclamation. Achieving sustainable benefits : proceedings of the Fourth International Conference of the International Affiliation of Land Reclamationists, Nottingham, United Kingdom, 7-11 September 1998. Rotterdam, Netherlands, Brookfield, VT: A.A. Balkema. ▪ Smedema, Lambert K.; Vlotman, Willem F.; Rycroft, David W. (2004): Modern land drainage. Planning, design and management of agricultural drainage systems. Rev. 2nd ed. Leiden, London: A.A. Balkema.	

Module Number	Module Name	Professor in Charge
MSGW.17	**Research Methodology & Scientific Writing**	N.N.

Contents and qualification aims	**Content**: The course is divided into three parts where the parts are integrated in a final project. The three parts are: ▪ report writing ▪ research methodology ▪ Experimental assignment. **Qualification aims:** Following this course a student should be able to: ▪ Explain and apply techniques for scientific writing and research methodology to prepare the writing of a scientific report. ▪ perform investigation using methods, explain and take position on the results as well as summarize related work ▪ Apply the knowledge in scientific writing and research methodology and use the knowledge to write a scientific report.
Module character	(2 hours of lectures, 2 hours tutorial) per week.
Prerequisite of attendance	Non.
Applicability	The module is compulsory for Master Course Soil and Groundwater.
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes).
Credit points and grade	The module earns 5 credits. The grade for the examination equals the module grade.
Frequency of the module	The module is offered annually in Autumn term.
Work load	The workload is 150 hours.
Duration of the module	The module takes one term.
Textbooks	**Recommended:** ▪ Booth, Vernon (1993): Communicating in science. Writing a scientific paper and speaking at scientific meetings. Second ed. Cambridge: Cambridge University Press. ▪ Glasman-Deal, Hilary (2010): Science research writing for non-native speakers of English. London, Hackensack, NJ: Imperial College Press; Distributed by World Scientific Pub. ▪ Goddard, Wayne; Melville, Stuart (2001): Research methodology. An introduction. 2nd ed. Lansdowne: Juta. ▪ Lebrun, Jean-Luc (©2011): Scientific writing 2.0. A reader and writer's guide. New Jersey: World Scientific.

Module Number	Module Name	Professor in Charge
MSGW.18	**Project on Groundwater Management**	N.N.
Contents and qualification aims	Modeling hydraulic properties for sustainable Groundwater management in Syria A database containing hydrophysical properties, such as transmissibility and porosity, as well as basic geological information of Syrian undergrounds is introduced. The data set is used to develop geological maps for predicting hydrogeological properties of Syrian underground using various potential data mining techniques. Such functions are applied in scenario studies for sustainable **Groundwater** management.	
Module character	1 hour of lectures, 1 hour tutorial, 4hours practical training) per week.	
Prerequisite of attendance	Advance knowledge in mathematics, Hydro sciences, Computer sciences.	
Applicability	The module is compulsory for Master Course Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is cosist of 2 presentations and the project work (100 hours).	
Credit points and grade	The module earns 5 credits. The module is calculated from the grade achieved for presentations(25% each) and the project work (50%).	
Frequency of the module	The module is offered annually in Autumn term.	
Work load	The workload is 150 hours.	
Duration of the module	The module takes one term.	
Textbooks		

Module Number	Module Name	Professor in Charge
MSGW.19	**Project on Soil and Water Management**	N.N.
Contents and qualification aims	Modeling hydraulic properties for sustainable soil-water management in Syria A database containing hydrophysical properties, such as bulk density and the water retention curve, as well as basic soil information of Syrian soils covering various agroclimatic is introduced. The data set is used to develop pedotransfer function for predicting hydrophysical properties of Syrian soils using various potential data mining techniques. Such functions are applied in scenario studies for sustainable **soil and water** management.	
Module character	1 hour of lectures, 1 hour tutorial, 4hours practical training) per week.	
Prerequisite of attendance	Advance knowledge in mathematics, Hydro sciences, Computer sciences.	
Applicability	The module is compulsory for Master Course Soil and Groundwater.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is cosist of 2 presentations and the project work (100 hours).	
Credit points and grade	The module earns 5 credits. The module is calculated from the grade achieved for presentations(25% each) and the project work (50%).	
Frequency of the module	The module is offered annually in Autumn term.	
Work load	The workload is 150 hours.	
Duration of the module	The module takes one term.	
Textbooks	www.ugent.be/bw/soilmanagement/en/research /soilphysics/Projects	

Module Number	**Module Name**	**Professor in Charge**
MSGW.20	**Master Thesis plus Defense**	N.N.
Contents and qualification aims	The Student must work Master Thesis with defense about one Problem belongs to the subjects of the Master course of Soil and Groundwater in one or more institution or incorporation, and he must present full study about this problem.	
Module character	Master Thesis with defense: 30 Hours tutorial per week.	
Prerequisite of attendance	Basic Knowledge of Master Thesis with defense, the student must be in 6 Semester.	
Applicability	The module is suitable for the professional and research oriented studies in civil and environmental engineering	
Prerequisite achieve credit points	Having passed the module presentation before a commission.	
Credit points and grade	The module earns 30 Cr. The final Grade is generated with 100% as presentation in front of committee.	
Frequency of the module	The module is offered in 4th semester	
Work load	The work load is 900 hours.	
Duration of the module	The module takes one term starting in Semester 4.	
Textbooks	• James E. Mauch and Namgi Park: Guide to the Successful Thesis and Dissertation, A Handbook for Students and Faculty. 2003. 5th ed. Copyright ©2003 by Marcel Dekker. ISBN: 0-8247-4288-5. • Derek Swetnam: Writing Your Dissertation, How to plan, prepare and present successful work.2007, 3rd ed. ISBN: 978 1 84803 126 5. • Louis Cohen; Lawrence Manion and Keith Morrison: Research Methods in Education, 2005, 5th ed. ISBN 0-203-22434-5 Master e-book ISBN. • Old Master and Bachelor thesis, which are available in the Libraries of the University.	

.1.1. Master Thesis plus Defense:

V. The Master thesis meets the basis requirements of Bologna System.

- The Master thesis covers 30 ECTS.
- Supervisors have to meet the requirements of the university at which the thesis is undertaken.
- A thesis proposal and a preliminary report of the thesis are presented in a seminar.
- The thesis is written in Arabic (or English).
- The written thesis is an independent work which has to cover the following aspects
  - Relevant, clearly formulated and testable problem definition
  - Theoretical framework and research methodology
  - Description of the research project
  - Analysis and interpretation of the results, conclusions
  - Responsible and transparent use of relevant references

VI. An examiner independent of the supervisor examines the thesis.

VII. The candidate must defend his/her thesis in a public defense. The evaluation of the thesis and of the thesis defense is carried out on the basis of the Thesis Evaluation Form and the Thesis Defense Evaluation Form.

VIII. The student participating in a degree programme will be awarded a diploma by the university which had been attended by the student. .

MODULE COMPENDIUM

Water Engineering and Management

(WEM)

Bachelor Programme

Damascus University

Faculty of Civil Engineering

2015

EDUWAT: 511251-TEMPUS-1-2010-1-DE-TEMPUS-SMHES

Development of a Modern Higher Education System for Water Engineering in Syria

Preface

This course in one of three water courses designed in the framework of the EU-TEMPUS project: EDUWAT: *Development of a Modern Higher Education System for Water Engineering in Syria*, TEMPUS 1-2010-1DE TEMPUS SMHES No. 511251.

The three developed courses are designed for Bachelor and Master Degrees in three engineering fields according to Bologna process, they are:

- Water Engineering and Management
- Hydrology science and Engineering
- Soil and Groundwater Science and Engineering

The study period is 3 years for a Bachelor degree and 2 years for a Master degree. As the entire study period will be limited to 5 years. The majority of students should complete the Master degree to be qualified as engineers in the study filed of their choice.

Three working groups were given the responsibility of developing the three courses, each of three staff members from the Department of Water Engineering at The Faculty of Civil Engineering, Damascus University. A similar plan is made by Al Bath, Tishreen and Aleppo Universities. The resulted courses are being discussed frequently with the Ministry of Higher Education to set a procedure for implementation.

The work group responsible for this course; *Water Engineering and Management* consists of the following staff members of Damascus University coordinated by Dr. Wael Seif:

11. **Dr. Youssef Marai** (group coordinator)
    Faculty of Civil Engineering, Damascus University
    The Arab Centre for the Studies of Arid Zones & Dry Lands (ACSAD)

12. **Dr. Amjad Zeno**
    Faculty of Civil Engineering, Damascus University

13. **Dr. Bassam Farkouh**
    Faculty of Civil Engineering, Damascus University

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Contents

Preface

1. Introduction
2. Rationale
3. Learning Outcomes
4. Specific Outcome Objectives

Curriculum for B.Sc. in Water Engineering and Management (WEM)

5. General Structure
6. Details of Modules (Core Modules – Elective Modules)
7. Course Requirements

15. Introduction

This course is based on EU-TEMPUS project **“Development of a Modern Higher Education System for Water Engineering in Syria - EDUWAT”**,Nr. 511251-TEMPUS-1-2010-1-DE-TEMPUS-SMHES, in the duration between 15 of October 2010 and 14 of October 2014.

The **EDUWAT** project aims to:

- Increase higher education opportunities for all
- Develop high-quality curricula and educational programs
- Establish a quality assurance system
- Create an innovation environment for higher education and scientific research
- Increase the productivity of the Syrian scientific research and link it to development needs of the country
- Encourage partnerships among universities on national and international level
- Improve and modernize intermediate education

16. Rationale

Many regions of the world are increasingly facing challenges when it comes to managing water. Although all challenges are related to water, the nature of the challenge differs from one location to the next. It may relate to having too little water while water demands are growing explosively (water scarcity), too much water (flooding), and water of poor quality rendering them unfit to sustain the ecosystem or challenges related to providing water for people, industry and agriculture. What complicates matters further is that these challenges are all interdependent and influence each other. For example, water scarcity can impact water quality and the ability to provide water. Addressing these challenges requires that water engineers and managers apply an integrated and interdisciplinary approach, involving hydrological, biophysical, chemical, economic, institutional, legal, technical, policy-making and planning aspects.

Syria is considered as an arid to semi-arid country, about two third of its area is considered as very arid. The rainfall in Syria is characterized by high rate of variability. The annual average is less than 300 mm in more than 90% of the country.

Syria’s water resources are under growing pressure from rapidly population growth, urbanization, the impacts of climate change and an expanding agricultural sector. Available water per capita is constantly decreasing (**AWPC** was about 800m^3/ca in 2010 and it is likely to be reduced by about half up to 2050) and rainfall is becoming more irregular and scarce.

In this context, the Syrian government is starting to embrace the principle of integrated water resources management with a view to promoting ecological sustainability, social justice and greater economic efficiency. Integrated water resources management is an internationally recognized implementation tool for managing and developing water resources in a way that balances social and economic needs, and that ensures the protection of ecosystems for future generations.

National water strategies in Syria are articulated by the 5-year Development Plan. The recent Five-years Plans places special importance on water security as an essential ingredient of sustainable development. While water will be utilized as a mean for ensuring food security, concerted efforts will be made for its development, protection and rational use as a strategic wealth.

Facing water related challenges in Syria requires qualified professionals with expertise in the engineering and management for use, development and protection of the available water resources. Proposal BSc and MSc degrees in this study course according were designed to Bologna System to meet the career needs of people working in these fields.

17. Learning Outcomes

q. Provide breadth of knowledge of basic principles and concepts
r. Provide depth within specialized areas
s. Provide an understanding of experimental/research design and methodology
t. Develop approaches for integration of information
u. Encourage critical thinking and hypothesis building
v. Provide skills in writing and communication
w. Provide contemporary information
x. Encourage appreciation of scientific values

18. Specific Outcome Objectives

13. Provide a broad background on the occurrence, use, management, and conservation of water and water resources in the Syrian Arab Republic and around the world
14. Understand physical hydrology and the hydrologic basis of water resources
15. Explore water supply and demand, irrigation and agriculture, water allocation law and policy, and flood hazards and hydrology
16. Examine dams and reservoirs, drought, water geochemistry, water quality and pollutants, and the economic and political aspects of water resources
17. The scientific method will be presented and consistently applied for all topics discussed
18. The course will address four major milestones (simplified water budget, the geography of water supply and demand in the Syrian Arab Republic water resource development, and water quality and health), which requires integration of many related concepts and principles
19. Critically examine the role government policy plays in the environment, specifically with regard to water resource development, and formulation of water allocation law
20. Present and discuss relevant topics in real-time (e.g., weather phenomena, floods, pollution issues, natural disasters) using information available through the media
21. Present case studies of local interest as it relates to study course material
22. Apply the basic principles of mathematical and hydrologic sciences, physics, soil, agricultural engineering, chemistry and construction engineering to the understanding of water resources and socioeconomic development

Curriculum for B.Sc. in Water Engineering and Managemen

19. General Structure

	Credits	%
Modules with Basics Sciences	**30**	17
Modules with Basics in Engineering	**30**	17
Modules with Basics in Hydro Sciences	**25**	14
Modules with Specialized Basics	**40**	22
Elective Modules	**10**	6
Modules for General Qualification	**20**	11
Practical Training /Project Study	**10**	6
Bachelor Examination	**15**	9
Total	**180**	100

Module / **Semester**	**1**	**2**	**3**	**4**	**5**	**6**	**Total / ECTS**
Basics Sciences	15	5	5	5			**30**
Basics in Engineering	5	10	10	5			**30**
Basics in Hydro Sciences	5	10	5	5			**25**
Specialized Basics			10	10	10	10	**40**
Elective Modules					5	5	**10**
General Qualification	5	5			10		**20**
Practical Training/ Project Study				5	5		**10**
Bachelor Thesis incl. Defense						15	**15**
Total	**30**	**30**	**30**	**30**	**30**	**30**	**180**

	Course Semester	**1**	**2**	**3**	**4**	**5**	**6**	**Total / ECTS**
1	**Basics Sciences**	**15**	**5**	**5**	**5**			**30**
BWEM.01	Mathematics	5	5	5				15
BWEM.02	Computer Sciences	5						5
BWEM.03	Physics	5						10
BWEM.04	Soil and Water Chemistry				5			5
2	**Basics in Engineering**	**5**	**10**	**10**	**5**			**30**
BWEM.05	Statics & Strength of Materials	5	5					10
BWEM.06	Geotechnics				5			5
BWEM.07	Engineering Graphics		5					5
BWEM.08	Geodesy/Topography			5				5
BWEM.09	Engineering Geology			5				5
3	**Basics in Hydro Sciences**	**5**	**10**	**5**	**5**			**25**
BWEM.10	Fluid Mechanics	5	5					10
BWEM.11	Hydraulics			5				5
BWEM.12	Surface Water Hydrology		5					5
BWEM.13	Groundwater /Hydrogeology				5			5
4	**Specialized Basics**			**10**	**10**	**10**	**10**	**40**
BWEM.14	Hydro Structure Engineering			5		5		**10**
BWEM.15	Irrigation and Drainage				5			**5**
BWEM.16	Pumping Stations					5		**5**
BWEM.17	Water Supply Engineering			5	5			**10**
BWEM.18	Waste Water Treatment						5	**5**
BWEM.19	Water Demand Management						5	**5**
5	**Elective Modules**					**5**	**5**	**10**
	Group I						5	5
BWEM.20	Irrigation Management						5	
BWEM.21	GIS and Remote Sensing in Water Management						5	
BWEM.22	Environmental Impact Assess-ment						5	
	Group II					5		5
BWEM.23	Climate Change and Water Re-sources Management					5		
BWEM.24	Participatory Water Manage-ment					5		
BWEM.25	International Water Issues					5		
6	**General Qualification**	**5**	**5**			**10**		**20**
BWEM.26	Foreign Language	5	5					10
BWEM.27	Technical and Financial Reports					5		5
BWEM.28	Hydro informatics Tools					5		5
BWEM.29	**Practical Training/ Project Study**				5	5		**10**
BWEM.30	**Bachelor Thesis including Defense**						15	**15**
	Total	**30**	**30**	**30**	**30**	**30**	**30**	**180**

Curricula Structures Bachelor Programme Water Engineering and Management (BWEM)

Semester 1	Mathematics	Computer Sciences	Physics	Statics & Strength of Materials	Fluid Mechanics	Foreign Language
Semester 2	Mathematics	Statics & Strength of Materials	Engineering Graphics	Fluid Mechanics	Surface Water Hydrology	Foreign Language
Semester 3	Mathematics	Geodesy/Topography	Engineering Geology	Hydraulics	Hydro Structure Engineering	Water Supply Engineering
Semester 4	Soil and Water Chemistry	Geotechnics	Groundwater /Hydrogeology	Irrigation and Drainage	Water Supply Engineering	Practical Training/ Project Study
Semester 5	Hydro Structure Engineering	Pumping Stations	Elective Modules	Technical and Financial Reports	Hydro informatics Tools	Practical Training/ Project Study
Semester 6	Waste Water Treatment	Water Demand Management	Elective Modules	Bachelor Thesis incl. Defense		
Credits	5	5	5	5	5	5

(green)	Modules in Natural Sciences 25%
(light blue)	Modules inTechnical Sciences 25%
(orange)	Modules in Economic & Social Sciences 25%
(grey)	Modules in Variable Sciences 25%

20. Details of Modules (Core Modules – Elective Modules)

Module Number	**Module Name**	**Professor in Charge**
BWEM.01	**Mathematics**	**Dr. ………**
Contents and qualification aims	**Contents:** Limits, continuity, and their applications: chain rule, Implicit differentiation, related rates, increase decrease, concavity. Extreme. Newton's method, Roll's theorem, Mean-Value Theorem, definite and indefinite integrations, fundamental theorem of calculus, Area and volume, inverse functions, Exponential and logarithmic functions with their derivatives , conic sections. Inverse trigonometric and hyperbolic functions. Techniques of integration, by parts, trigonometric integrals, trigonometric substitutions, partial fractions, quadratic expressions, general substitutions. Improper integrals. Infinite series, convergence and divergence, convergence tests, Maclaurin and Taylor series. Polar coordinates: definition, arc length, area, conic sections. Systems of linear equations. Elimination methods (Gauss and Jordan). Matrices (operations and properties). Elementary matrices and the inverse of matrix. Matrix methods for solving linear systems. Determinants. Vector spaces and subspaces. Linear independence. Basis and Dimension. The four main fundamental subspaces of a matrix. Inner product spaces. Orthonormal bases. Eigenvalues and eigenvectors. Diagonalization. Jordan form. General linear transformation. Inverse of a linear transformation. Kernel and range. Applications. **Qualification aims:** Upon completion of the course, students will be able to: • Acquire the necessary mathematical concepts and skills for everyday life, and for continuous learning in mathematics and related disciplines • Develop the necessary process skills for the acquisition and application of mathematical concepts and skills • Develop the mathematical thinking and problem solving skills and apply these skills to formulate and solve problems • Recognize and use connections among mathematical ideas, and between mathematics and other disciplines • Develop positive attitudes towards mathematics • Make effective use of a variety of mathematical tools (including information and communication technology tools) in the learning and application of mathematics • Produce imaginative and creative work arising from mathematical ideas • Develop the abilities to reason logically, to communicate mathematically, and to learn cooperatively and independently	
Module character	2 hours of lectures per week 1 hour tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor Water Engineering and Management	

Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)
Credit points and grade	The module earns 15 credits The grade for the examination equals the module grade
Frequency of the module	The module is offered annually in winter term
Work load	The work load is 450 hours
Duration of the module	The course takes three semesters (1,2,3)
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering. **Recommended:** ▪ H. Anton, I. Bivens, and S. Davis. Calculus, 8th Edition. John Wiley and Sons, 2005 ▪ H. Anton. Calculus, 7th Edition. John Wiley and Sons, 2002 ▪ James Stewart. Calculus Early Transcendentals, 5th edition. Thomson, 2003 ▪ R. Larson, R. Hostetler, and B. Edwards. Calculus, 7th edition. Houghton Mifflin Company, 2002 ▪ H. Anton. Calculus, 7th Edition. John Wiley and Sons, 2002 ▪ E. Swokowski, M. Olinic, and D. Pence Calculus, 6th Edition. PWS Publishing Company,1994

Module Number	**Module Name**	**Professor in Charge**
BWEM.02	**Computer Sciences**	**Dr. ………**
Contents and qualification aims	**Contents:** Introduction to computers, problem solving and algorithm development. Design, code, debug and document programs using techniques of good programming style and C++ programming language. Laboratory experiments and examples will be used to illustrate and reinforce concepts taught in the lectures. Continuation of CSI 1430. Introduction to basic aspects of arrays, pointers, classes, inheritance, polymorphism, virtual functions, linked lists, stacks, queues, and binary trees. **Qualification aims:** Upon completion of the course, students will be able to: • Understand and be able to apply the underlying principles of Computer Science to a variety of problem domains • Develop good communication skills so that they can solve problems and communicate their solution • Develop strong analytical skills so that they can quickly assess how to solve problems • Work in groups and appreciate the dynamic and collaborative nature of problem solving • Be equipped with a thorough understanding of the development process of software including design, implementation, documentation, and testing • Appreciate the role that computers play in society and to be able to direct the use of technology in a beneficial way and to solve new problems	
Module character	2 hours of lectures per week 1 hour tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor Water Engineering and Management.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (1)	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Yale N. Patt and Sanjay J. Patel, Introduction to Computing Systems: from bits and gates to C and beyond McGraw-Hill Publishers, SECOND Edition, 2004. ISBN: 0-07-246750-9-ISBN 0-07-121503-4 \\(ISE)	

<table>
<tr><th>Module Number</th><th>Module Name</th><th>Professor in Charge</th></tr>
<tr><td>BWEM.03</td><td>Physics</td><td>Dr. ………</td></tr>
<tr><td>Contents and qualification aims</td><td colspan="2">Contents: Motion in One Dimension, Vectors, Motion in Two Dimensions, The Laws of Motion, Circular Motion and Other Applications of Newton’s Laws, Work and Kinetic Energy, Potential Energy and Conservation of Energy, Linear Momentum and Collisions, Rotation of a Rigid Object About a Fixed Axis, Rolling Motion and Angular Momentum. Charge and matter. Electric field. Gauss law. Electric potential. Capacitors and dielectrics. Electromotive force and electric circuits. Magnetic field. Ampere's law. Faraday's law of induction. Self-induction. Maxwell's equations.

Qualification aims:
Provide students with a college level physics experience
Develop and reinforce strong problem solving and critical thinking skills
Develop and reinforce a collaborative problem solving approach
Develop and reinforce laboratory skills including: questioning, developing an experimental procedure, observing, data collection, and data analysis, including graphical analysis
Develop and reinforce appropriate laboratory safety skills
Develop an understanding of how we experience physics in our everyday lives and of how physics is applied in the real world</td></tr>
<tr><td>Module character</td><td colspan="2">2 hours of lectures per week
1 hour tutorial per week</td></tr>
<tr><td>Prerequisite of attendance</td><td colspan="2">None</td></tr>
<tr><td>Applicability</td><td colspan="2">The module is compulsory for the Bachelor Water Engineering and Management.</td></tr>
<tr><td>Prerequisite achieve credit points</td><td colspan="2">Having passed the module exam. The module exam is a written examination (120 minutes)</td></tr>
<tr><td>Credit points and grade</td><td colspan="2">The module earns 5 credits
The grade for the examination equals the module grade</td></tr>
<tr><td>Frequency of the module</td><td colspan="2">The module is offered annually in winter term</td></tr>
<tr><td>Work load</td><td colspan="2">The work load is 150 hours</td></tr>
<tr><td>Duration of the module</td><td colspan="2">The course takes one semester (1)</td></tr>
<tr><td>Reference Materials</td><td colspan="2">Essential:
Reference Materials available at Faculty of Civil Engineering, Damascus University
Recommended:
Third Edition, Part 1 (Pergamon,1980, QC 175.L32)
P.K. Pathria, Statistical Mechanics (Pergamon, 1972, QC 175.P35)</td></tr>
</table>

<table>
<tr><td>Module Number</td><td>Module Name</td><td>Professor in Charge</td></tr>
<tr><td>BWEM.04</td><td>Soil and Water Chemistry</td><td>Dr. ………</td></tr>
<tr><td>Contents and qualification aims</td><td colspan="2">Contents: The ability of soil to function as a medium for plant growth and/or waste disposal, a purifier of water, a determinant of contaminant fate and transport, etc. is inextricably tied to chemistry. Applying basic principles of chemistry to processes that occur commonly in soil/water systems is, thus, fundamental to understanding and optimizing soil functions. Successful approaches range from applied (empirical) to basic (theoretical) studies and conceptualizations. This course utilizes the full range of approaches, with emphasis on the soil solution and the various soil components and chemical processes influencing its chemistry.

Qualification aims:
• Strengthen the student’s understanding of basic chemical principles.
• Teach students how to apply the principles to soil/water chemical processes
• Demonstrate how chemical knowledge helps explain soil functions</td></tr>
<tr><td>Module character</td><td colspan="2">2 hours of lectures per week
1 hour tutorial per week</td></tr>
<tr><td>Prerequisite of attendance</td><td colspan="2">Basic knowledge in geology, physics and chemistry</td></tr>
<tr><td>Applicability</td><td colspan="2">The module is compulsory for the Bachelor Water Engineering and Management</td></tr>
<tr><td>Prerequisite achieve credit points</td><td colspan="2">Having passed the module exam. The module exam is a written examination (120 minutes)</td></tr>
<tr><td>Credit points and grade</td><td colspan="2">The module earns 5 credits
The grade for the examination equals the module grade</td></tr>
<tr><td>Frequency of the module</td><td colspan="2">The module is offered annually in winter term</td></tr>
<tr><td>Work load</td><td colspan="2">The work load is 150 hours</td></tr>
<tr><td>Duration of the module</td><td colspan="2">The course takes one semester (4)</td></tr>
<tr><td>Reference Materials</td><td colspan="2">Essential:
Reference Materials available at Faculty of Civil Engineering, Damascus University.
Recommended:
▪ Soil and Water Chemistry: An Integrative Approach, 2004, by Michael E. Essington, University of Tennessee, [CRC Press].
▪ Environmental Soil Chemistry, 2003 (2nd Edition), by Donald L. Sparks, University of Delaware, [Academic Press].
▪ Soil Chemistry, 2001 (3rd Edition), H.L. Bohn, B.L. McNeal, and G.A. O’Connor [John Wiley & Sons, Inc.] – available as an e-book.
▪ Chemical Equilibrium, 1966, by A.J. Bard [Harper & Row Publishers]</td></tr>
</table>

<table>
<tr><th>Module Number</th><th>Module Name</th><th>Professor in Charge</th></tr>
<tr><td>BWEM.05</td><td>Statics & Strength of Materials</td><td>Dr. ………</td></tr>
<tr><td>Contents and qualification aims</td><td colspan="2">Contents: Support reactions, Normal force, shear force and bending moment, Hooke’s law, Axially loaded members. Trusses, Normal stresses in beams, Deflections of beams.

Qualification aims: Upon completion of the course, students will be able to:
Determine the magnitude and direction of resultant force
Calculate the center of mass for an asymmetric cross-section
Calculate support reactions for cantilever and simple beams
Calculate and draw load, shear and moment diagrams
Calculate normal stresses for axially loaded members
Perform calculations of deformation using Hooke’s law
Perform calculations of shear stresses for small cross-sections
Perform calculations of bending stresses in cantilever and simple beams
Calculate cumulative loads for cases with dead weight and one imposed load</td></tr>
<tr><td>Module character</td><td colspan="2">2 hours of lectures per week
1 hours tutorial per week</td></tr>
<tr><td>Prerequisite of attendance</td><td colspan="2">None</td></tr>
<tr><td>Applicability</td><td colspan="2">The module is compulsory for the Bachelor Water Engineering and Management</td></tr>
<tr><td>Prerequisite achieve credit points</td><td colspan="2">Having passed the module exam. The module exam is a written examination (120 minutes)</td></tr>
<tr><td>Credit points and grade</td><td colspan="2">The module earns 10 credits
The grade for the examination equals the module grade.</td></tr>
<tr><td>Frequency of the module</td><td colspan="2">The module is offered annually in winter term</td></tr>
<tr><td>Work load</td><td colspan="2">The work load is 300 hours</td></tr>
<tr><td>Duration of the module</td><td colspan="2">The course takes two semesters (1,2)</td></tr>
<tr><td>Reference Materials</td><td colspan="2">Essential:
Reference Materials available at Faculty of Civil Engineering, Damascus University.
Recommended:
Burns, Thomas, Applied Statics and Strength of Materials, 2nd ed., Delmar Centgage Published: 2010 ISBN 978-1-4354-1331-3
J. M. Gere, Mechanics of Materials, Sixth Edition, Thomson Press, Toronto, Canada, 2006
R. C. Hibbeler, Engineering Mechanics: Dynamics, 10th Edition, Prentice Hall.
R. C. Hibbeler, STATICS, Eleventh Edition, Pearson Prentice Hall, New Jersey USA, 2004</td></tr>
</table>

Module Number	**Module Name**	**Professor in Charge**
BWEM.06	**Geotechnics**	**Dr. ………**
Contents and qualification aims	**Contents:** Composition and structure of soils, Phase relations and index properties, soil classification, soil compaction, principle of effective stress, stresses due to self-weight, stresses due to applied loads, soil permeability, seepage: one and two dimensional, flow net, consolidation theory and consolidation settlement analysis, secondary compression, shear strength of soils (introductory). Specific gravity test, Dry screening using sieve analysis, wet analysis (Hydrometer test), water content, Atterberg Limits: Liquid limit, Plastic limit, and Shrinkage limit, standard and Modified Proctor compaction tests, in situ field test, Permeability test (constant and falling head tests), Triaxial shear test, unconfined compression test, direct shear test. Students present the report of one experiment using data show. types of shallow foundations, bearing capacity of foundations: equations and correlations, settlement, geometric design of isolated footings, special types of footings, rectangular combined and strap footings and mat foundations, lateral earth pressure and retaining walls, introduction to deep foundations. **Qualification aims:** Upon completion of the course, students will be able to**:** • Understand soil structure Soil classified • Estimate the soil bearing capacity • Estimate the soil settlement • Choose footing type and Design of footings • Understand seepage and drowning the flow net	
Module character	2 hours of lectures per week 1 hour tutorial per week 1 hour laboratory training	
Prerequisite of attendance	Engineering Geology	
Applicability	The module is compulsory for the Bachelor Water Engineering and Management	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (4)	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Das, B.M. (2006). Principles of Geotechnical Engineering. 6th Edition ▪ Geotechnical Engineering Principles & Practices: International Edition, 2nd Edition Donald Coduto, Manchu Ronald Yeung, William Kitch Jun 2010	

Module Number	**Module Name**	**Professor in Charge**
BWEM.07	**Engineering Graphics**	**Dr. ………**
Contents and qualification aims	**Contents:** Instruments of Drawing, Graphic geometry (Lines, Letters, Numbers, Tangency Construction). Intersections, Types of Projection, Dimensioning, Plane Sectioning. Steel Structure Drawing, Projection of Water Structure at Water-way Intersection. Pumping station Drawing. Dams Drawing AutoCAD program. **Qualification aims:** Upon completion of the course, students will be able to: • Understand theory and practice of surveying and leveling and to develop skills to use modern survey instruments	
Module character	2 hours of lectures per week 2 hours tutorial per week	
Prerequisite of attendance	Basic knowledge of mathematics	
Applicability	The module is compulsory for the Bachelor Water Engineering and Management	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (2)	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Gary Robert, Eric N wiebe "Fundamentals of graphics" Communications", McGraw Hill, 2006 ▪ William Howard, Joe Musto " Introduction to solid Modeling " Using Solid Works, McGraw Hill , 2005	

Module Number	**Module Name**	**Professor in Charge**
BWEM.08	**Geodesy/Topography**	**Dr. ………**
Contents and qualification aims	**Contents:** Concepts of geodesy and surveying, earth's gravity field and the geoid, and measurement techniques applied to geomatics are examined. Field studies include the use of the level, the total station, and GPS for doing distance and angle measurements, leveling, traversing and topographic surveying. **Qualification aims:** • To provide the students a basic understanding of Geodesy and Surveying theory, the shape, motion and gravity field of the earth; to familiarize with surveying instruments and operations, to apply typical surveying computations	
Module character	2 hours of lectures per week 2 hours tutorial per week	
Prerequisite of attendance	Basic knowledge of mathematics, statistics, and physics	
Applicability	The module is compulsory for the Bachelor Water Engineering and Management	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (3)	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Jack C. McCormac, Wayne Sarasua, William Davis, 2012. Surveying, 6th Edition, John Wiley & Sons, Toronto, ISBN 978-0-470-49661-9, 379pp ▪ Charles D. Ghilani and Paul R. Wolf, 2012. Elementary Surveying - An Introduction to Geomatics, 13/e, Prentice Hall, Toronto, ISBN-10: 0132554348, 984pp ▪ Barry F. Kavanagh, 2009. Surveying: Principles and Applications, 8/e. Prentice Hall, Upper Saddle River, NJ, ISBN-10: 013236512X, 816pp	

<table>
<tr><th>Module Number</th><th>Module Name</th><th>Professor in Charge</th></tr>
<tr><td>BWEM.09</td><td>Engineering Geology</td><td>Dr. ………</td></tr>
<tr><td>Contents and qualification aims</td><td colspan="2">Contents: Engineering geological consideration, description of soils and rock masses. Classification of rock masses for engineering purposes. Engineering geological maps and their applications. Requirement of conducting Engineering Geological studies and Writing Reports, Rock and soil improvement such as grouting, drains and reinforcement of ground (2days Field Trips)

Qualification aims: At the conclusion of this course:
• To outline the contribution of engineering geology to the civil and mining works
• To explain the classical approach to solve an engineering geological problem
• The extensive uses of engineering geology maps
• The role and effect of engineering geology in the improvement of earth materials</td></tr>
<tr><td>Module character</td><td colspan="2">2 hours of lectures per week
1 hour tutorial per week</td></tr>
<tr><td>Prerequisite of attendance</td><td colspan="2">None</td></tr>
<tr><td>Applicability</td><td colspan="2">The module is compulsory for the Bachelor Water Engineering and Management</td></tr>
<tr><td>Prerequisite achieve credit points</td><td colspan="2">Having passed the module exam. The module exam is a written examination (120 minutes)</td></tr>
<tr><td>Credit points and grade</td><td colspan="2">The module earns 5 credits
The grade for the examination equals the module grade</td></tr>
<tr><td>Frequency of the module</td><td colspan="2">The module is offered annually in winter term</td></tr>
<tr><td>Work load</td><td colspan="2">The work load is 150 hours</td></tr>
<tr><td>Duration of the module</td><td colspan="2">The course takes one semester (3)</td></tr>
<tr><td>Reference Materials</td><td colspan="2">Essential:
Reference Materials available at Faculty of Civil Engineering, Damascus University.
Recommended:
▪ Engineering Geology and Geotechnics by BELL, F. G., 1980
▪ Engineering Geology: Rock Engineering in Construction by GOODMAN, R.E., 1993
▪ Engineering Geology: An Environmental Approach by RAHN, P. H., 1986
▪ Engineering Geology by ZARUBA, Q., and MENCL, V., 1976</td></tr>
</table>

Module Number	**Module Name**	**Professor in Charge**
BWEM.10	**Fluid Mechanics**	**Dr. ………**
Contents and qualification aims	**Contents:** Introduction, fluid properties, basic units, fluid statics, pressure and its measurements, forces on plane and curved submerged surfaces, buoyancy & floatation, fluids in motion, flow kinematics and visualization, basic control volume approach, differential and integral continuity equation, Euler's and Bernoulli's equations, applications of Bernoulli equation, hydraulic and energy grade lines, momentum principle and its applications, Navier-Stokes equations, dimensional analysis and similitude, surface resistance and introduction to boundary layer theory, flow in conduits, laminar and turbulent flows, frictional and minor losses, piping systems. **Qualification aims:** To provide an opportunity for students to: • Learn about basic fluid properties • Learn about fluid static principles • Gain understanding of steady state flow-rate conservation of mass and conservation of energy equations • Gain understanding of mass-rate impulse-momentum methods. • Learn about friction losses in pipes • See and measure fluid flow phenomena • Enhance student problem solving skills	
Module character	2 hours of lectures per week 1 hour tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor Water Engineering and Management	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 10 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is 300 hours	
Duration of the module	The course takes two semesters (1,2)	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Cebeci, T., J. Shao, et al. Computational Fluid Dynamics for Engineers: From Panel to Navier–Stokes Methods with Computer Programs. Springer, 2005. ISBN: 9783540244516 ▪ Chapra, S., and R. Canale. Numerical Methods for Engineers. 6th ed. McGraw–Hill Higher Education, 2009. ISBN: 9780073401065	

Module Number	**Module Name**	**Professor in Charge**
BWEM.11	**Hydraulics**	**Dr. ………**
Contents and qualification aims	**Contents:** Open channels flow, channel geometry, steady uniform flow in open channels, energy principles in open channel (total energy and specific energy, specific energy diagram, critical flow and depth, critical slope, applications of energy principle, gradually varied flow in open channels, derivation of gradually varied flow equation, water surface profiles, computation of water surface profiles (direct step method, finite difference method), weirs and spillways, momentum principles in open channels, Hydraulic jump, fluid measurements, Sediment Transport, Wave Theory, River Engineering, Coastal Engineering, Principle of non-steady flow in open channel. **Qualification aims:** • Provide and understating of hydraulics principles and how they apply to irrigation systems • Exposes the student to an expansive suite of topics and methods within the field of hydraulics, hydrologic and hydraulic concepts	
Module character	2 hours of lectures per week 1 hour tutorial per week	
Prerequisite of attendance	Fluid Mechanics	
Applicability	The module is compulsory for the Bachelor Water Engineering and Management.	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (3)	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ B.F. White, Fluid Mechanics, McGraw Hill, 1994 ▪ B.C. Punmia, Irrigation and Water Power Engineering, Standard Publishers, 1992 ▪ Chow, Open Channel Flow, McGraw Hill, 1975 ▪ Frabzini, Fluid Mechanics with Engineering Applications, McGraw Hill, 1997 ▪ Garg, Irrigation Engineering and Hydraulic Structures, Khanna Publishers, 1992 ▪ H.M. Chaudhry, Open Channel Flow, Prentice Hall of India, 1998 ▪ Roberson, John A., John J. Cassidy and M. Hanif Chaudhry. Hydraulic Engineering. 2nd ed. Wiley, 1998 ▪ Subramanya, Flow in Open Channels, Tata McGraw Hill, 1998	

<table>
<tr><td>Module Number</td><td>Module Name</td><td>Professor in Charge</td></tr>
<tr><td>BWEM.12</td><td>Surface Water Hydrology</td><td>Dr. ………</td></tr>
<tr><td>Contents and qualification aims</td><td colspan="2">Contents: Introduction: hydrologic cycle and its components, climatic factors and their measurements, Precipitation; types and forms of precipitation and their measurement. Rainfall and runoff estimation, runoff and its components, rainfall-runoff relations, factors affecting runoff, stream flow, interpretation of stream flow data, evaporation and transpiration, evapotranspiration and its estimation using different methods. Hydrologic analysis: Hydrograph and its characteristics, hydrographs for various durations, hydrograph separation, unit hydrograph development and application, unit hydrographs from complex storms, rainfall frequency and duration analysis, flood frequency and duration analysis. Hydrologic Models: definition, classification of models, development, calibration, verification and application of models.

Qualification aims:
• Acquaint the students with principles and processes governing the movement of water through the hydrologic cycle, including atmospheric moisture flow, surface runoff, infiltration, and groundwater flow; and hydrologic statistics, and frequency analysis techniques applied to problems of water management</td></tr>
<tr><td>Module character</td><td colspan="2">2 hours of lectures per week
1 hour tutorial per week
Excursion 8 hours total</td></tr>
<tr><td>Prerequisite of attendance</td><td colspan="2">Mathematics, Soil and Water Chemistry, and Hydraulic</td></tr>
<tr><td>Applicability</td><td colspan="2">The module is compulsory for the Bachelor Water Engineering and Management</td></tr>
<tr><td>Prerequisite achieve credit points</td><td colspan="2">Having passed the module exam. The module exam is a written examination (120 minutes)</td></tr>
<tr><td>Credit points and grade</td><td colspan="2">The module earns 5 credits
The grade for the examination equals the module grade</td></tr>
<tr><td>Frequency of the module</td><td colspan="2">The module is offered annually in winter term</td></tr>
<tr><td>Work load</td><td colspan="2">The work load is 150 hours</td></tr>
<tr><td>Duration of the module</td><td colspan="2">The course takes one semester (2)</td></tr>
<tr><td>Reference Materials</td><td colspan="2">Essential:
Reference Materials available at Faculty of Civil Engineering, Damascus University
Recommended:
▪ D.R. Maidment, Handbook of Hydrology (1992), published by McGraw-Hill, Inc.
▪ L. W. Mays Water Resources Engineering (2001), published by John Wiley & Sons Inc.
▪ Chow, Maidment and Mays, Applied Hydrology (1988), published by McGraw-Hill Inc.</td></tr>
</table>

<table>
<tr><th>Module Number</th><th>Module Name</th><th>Professor in Charge</th></tr>
<tr><td>BWEM.13</td><td>Groundwater/Hydrogeology</td><td>Dr. ………</td></tr>
<tr><td>Contents and qualification aims</td><td colspan="2">Contents:
Background
• Hydrologic Cycle
• Water Budgets
Groundwater
• Darcy's Law and Hydraulic Potential
• The Steady-state Groundwater Flow Equation
• Streamlines and Flow Nets
• Regional Flow and Geologic Controls on Flow
• Transient Flow, Aquifer Storage and Compressibility
• Unconfined Flow
• Groundwater Interaction with Streams and Lakes
• Numerical Methods
• Flow in Fractured Rock
Well Hydraulics
• Thiem and Theis Equations
• Pump Tests and Slug Tests
Contaminant Transport
• Advection and Dispersion
• Sorption and Diffusive Mass Transfer
• Aquifer Remediation
Vadose Zone Hydrology
• Unsaturated Flow, Retention Curves and Richard's Equation
• Infiltration and Evapotranspiration
Couples Flow and Transport
• Density Driven Flow, Freshwater/Saltwater Interaction
• Heat Transport and Groundwater Flow
• The Role of Groundwater in Large-scale Water and Chemical Budgets

Qualification aims:
• Acquaint the students with principles and processes governing the movement of water through the hydrologic cycle, including atmospheric moisture flow, surface runoff, infiltration, and groundwater flow; and hydrologic statistics, and frequency analysis techniques applied to problems of water management</td></tr>
<tr><td>Module character</td><td colspan="2">2 hours of lectures per week
1 hour tutorial per week
1 hour seminar per week</td></tr>
<tr><td>Prerequisite of attendance</td><td colspan="2">Mathematics, Soil and Water Chemistry, Hydraulic and Surface Water Hydrology</td></tr>
<tr><td>Applicability</td><td colspan="2">The module is compulsory for the Bachelor Water Engineering and Management</td></tr>
<tr><td>Prerequisite achieve credit points</td><td colspan="2">Having passed the module exam. The module exam is a written examination (120 minutes)</td></tr>
<tr><td>Credit points and grade</td><td colspan="2">The module earns 5 credits
The grade for the examination equals the module grade</td></tr>
<tr><td>Frequency of the module</td><td colspan="2">The module is offered annually in winter term</td></tr>
<tr><td>Work load</td><td colspan="2">The work load is 150 hours</td></tr>
</table>

Duration of the module	The course takes one semester (4)
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University **Recommended:** • Bear J., Hydraulics of Groundwater, McGrow-Hill International, 1979 • Todd D.K., Ground Water Hydrology, John Wiley and Sons, 2000 • Driscoll, F., Groundwater and Wells, St. Paul, Minnesota, II Ed., 1986 • Raghunath H.M., Ground Water Hydrology, Wiley Eastern Ltd., Second reprint, 2000 • Willis, R. and W.W.G. Yeh, Groundwater Systems Planning and Management, Prentice-Hall, 1987 • Bear J., Dynamics of fluids in porous media, American Elsevier publishing co., inc, 1972 • C. Walton, Groundwater Resources Evaluation, McGraw Hill, 1970 • O.D.L. Strack, Groundwater Mechanics, Prentice Hall, 1989 • S.P. Garg, Groundwater and Tube Wells, Oxford & IBH Publishing Co., 1993

Module Number	**Module Name**	**Professor in Charge**
BWEM.14	**Hydro Structure Engineering**	**Dr. ………**
Contents and qualification aims	**Contents:** Introduction, Importance of Hydraulic Structures; Classification of Hydraulic Structures according to use; Design of inlet and outlet structures for irrigation canals; Cross structures, culverts, inverted siphons and aqueducts; Energy dissipation below hydraulic structures; Spillways; Design of dams. **Qualification aims:** Upon completion of the course, students will be able to: • Use the knowledge and skills studied previously, especially, on fluid mechanics, hydraulics and hydrology into this course • Recognize the different types of hydraulic structures, to understand its purpose and function and to select the most appropriate structure and location for a specific problem • Design, to analyze and to proof that the hydraulic structure is save and economical • Broaden skills in team work, communication and planning through small projects	
Module character	2 hours of lectures per week 1 hour tutorial per week 1 hour seminar per week (Excursion 8 hours total)	
Prerequisite of attendance	Static and Strength of Materials, Hydraulic and Surface Water Hydrology	
Applicability	The module is compulsory for the Bachelor Water Engineering and Management	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 10 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is 300 hours	
Duration of the module	The course takes two semesters (3,5)	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering. **Recommended:** ▪ Novak, P., Moffat, A. Nalluri, C. and Narayanan, R., Hydraulic Structures, 4th Ed., 2007 ▪ Varshney, R., Gupta, S. and Gupta, R., Theory and Design of Irrigation Structures, 1982 ▪ Ray, K., et al, Water Resources Engineering, McGraw-Hill, 1992 ▪ U.S. Bureau of Reclamation, Design of Small Dams, U.S. Government Office, 1987. CE 423 Hydraulic Structures –KSU-Coo- A. Alhamid 1432/1433H	

Module Number	**Module Name**	**Professor in Charge**
BWEM.15	**Irrigation and Drainage**	**Dr. ………**
Contents and qualification aims	**Contents:** Soil Physical Properties; Soil Water Content; Soil Plant Water Relationship; Irrigation and Water Management; Surface Irrigation Systems; Sprinkler irrigation system; Drip irrigation system; micro irrigation system; Irrigation Scheduling; Irrigation System Selection Issues. Importance of drainage to agricultural system; The types of drainage, i.e. surface drainage and subsurface drainage. The basic design parameters of the surface and subsurface drainage. **Qualification aims:** • Provide knowledge and skills in conveyance and distribution of water, design criteria of irrigation system, water distribution structures • Equip the students with detailed knowledge of waterlogging and salinity problems, drainage investigation and design of surface, sub-surface and vertical drainage systems	
Module character	2 hours of lectures per week 1 hour tutorial per week 1 hour seminar per week	
Prerequisite of attendance	Soil and Water Chemistry and Hydro Structure Engineering	
Applicability	The module is compulsory for the Bachelor Water Engineering and Management	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (4)	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering. **Recommended:** ▪ Frederick Haynes Newell (2010).Principles of Irrigation Engineering. McGraw-Hill Publication ▪ Etcheverry (2010). Irrigation Practice and Irrigation Engineering. McGraw-Hill Publisher ▪ Larry G. James (2004) Principles of Farming Irrigation System Design. Washington State University (Wiley) ▪ Schwab, Fangmeier, Elliot and Frevert (1992). Soil and Water conservation Engineering Wiley	

<table>
<tr><th>Module Number</th><th>Module Name</th><th>Professor in Charge</th></tr>
<tr><td>BWEM.16</td><td>Pumping Stations</td><td>Dr. ………</td></tr>
<tr><td>Contents and qualification aims</td><td colspan="2">Contents: Introduction to pumps, Pump types, Pumping System, Pump Terminology, System curve, Operating point, Pumps in series and parallel, Laws of Similarity, Pumps Selection, Cavitation in pumps, Components of pumping stations, Kind of pumping stations, Intakes of pumping station and its design, Pumping station buildings, Basic principles of pumping station design, Fundamental of hydraulic transients, Control of hydraulic transients, System design for wastewater pumping, System design for water pumping.
Qualification aims:
▪ Understand the role of pumps as energy-conversion devices and use, appropriately, the terms head, power and efficiency
▪ Be aware of the main types of pumps and the distinction between impulse and reaction turbines and between radial, axial and mixed-flow devices
▪ Match pump characteristics and system characteristics to determine the duty point
▪ Calculate characteristics for pumps in series and parallel and use the hydraulic scaling laws to calculate pump characteristics at different speeds
▪ Select the type of pump on the basis of specific speed
▪ Understand the mechanics of a centrifugal pump
▪ Recognize the problem of cavitation and how it can be avoided</td></tr>
<tr><td>Module character</td><td colspan="2">2 hours of lectures per week
1 hour tutorial per week
1 hour seminar per week
(Excursion 8 hours total)</td></tr>
<tr><td>Prerequisite of attendance</td><td colspan="2">Hydraulic</td></tr>
<tr><td>Applicability</td><td colspan="2">The module is compulsory for the Bachelor Water Engineering and Management</td></tr>
<tr><td>Prerequisite achieve credit points</td><td colspan="2">Having passed the module exam. The module exam is a written examination (120 minutes)</td></tr>
<tr><td>Credit points and grade</td><td colspan="2">The module earns 5 credits
The grade for the examination equals the module grade</td></tr>
<tr><td>Frequency of the module</td><td colspan="2">The module is offered annually in winter term</td></tr>
<tr><td>Work load</td><td colspan="2">The work load is 150 hours</td></tr>
<tr><td>Duration of the module</td><td colspan="2">The course takes one semester (5)</td></tr>
<tr><td>Reference Materials</td><td colspan="2">Essential:
Reference Materials available at Faculty of Civil Engineering, Damascus University.
Recommended:
▪ P.N. Modi and S.M. Seth, Hydraulics and Fluid Mechanics, Standard Book House, 1998
▪ J. Lal, Hydraulics Machines, Metropolitan Book Co.,
▪ I. J. Karassik. J. P. Messina, P. Cooper, and C. C. Heald, Pump Handbook, McGraw-Hill, Third ed., 2001
▪ T. Jiandong, Z. Naibo, W. Xianhuan, H. Jing, and D. Huishen, Mini- Hydropower, John Wiley & Sons, 1997</td></tr>
</table>

Module Number	**Module Name**	**Professor in Charge**
BWEM.17	**Water Supply Engineering**	**Dr. ………**
Contents and qualification aims	**Contents:** Water transport & Distribution (supply) system, Transmission, Storage, Pumping, Types of Distribution System, Water demand, Demand categories, Water demand patterns, Water demand calculation, Hydraulic design of pipes and networks, Nodal demands, Storage design, Valves, Kind of pipes used in pipeline, Pipes and networks installation, Pipeline profile, Anchor blocks, Quality of water supplies, Clarification of water, Filtration of water. **Qualification aims:** • Introduce the students the fundamental principles of water supply and environmental sanitations, to emphasize collecting and transmission of the sewage on environmental sanitations	
Module character	2 hours of lectures per week 1 hour tutorial per week 1 hour seminar per week	
Prerequisite of attendance	Hydraulic	
Applicability	The module is compulsory for the Bachelor Water Engineering and Management	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 10 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is 300 hours	
Duration of the module	The course takes two semester (3,4)	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Twort, Ratnayaka, and Brandt, “Water Supply”, 5th edition, IWA Publishing, 2000 ▪ Walksi, “Analysis of Water Distribution Systems”, Van Nostrand Reinhold, 1984 ▪ Reynolds and Richards, “Unit Operations and Processes in Environmental Engineering”. PWS Publishing Co., 1996 ▪ Qasim, Motley and Zhu, “Water Works Engineering: Planning, Design and Operation”. Prentice Hall PTR, 2000	

<table>
<tr><th>Module Number</th><th>Module Name</th><th>Professor in Charge</th></tr>
<tr><td>BWEM.18</td><td>Waste Water Treatment</td><td>Dr. ………</td></tr>
<tr><td>Contents and qualification aims</td><td colspan="2">Contents:
• Problems and fundamental principles of wastewater and rainwater drainage
• Types and characteristics of wastewaters
• Types of drainage and sewerage systems
• Recipient’s characteristics and conservation of water resources. Schemes of drainage/ sewage systems
• Calculations of relevant wastewater and rainwater quantities
• Designing drainage/sewage systems. Limitations in designing
• Dimensioning drainage/sewage networks
• Structures of drainage/sewage systems: relieving structures, pumping stations, retentions etc. Construction of sewage systems. Testing water tightness of sewers
• Wastewater disposal structures: types, dimensioning, calculation and construction
• Drainage/sewage systems maintenance and management
• Wastewater treatment plants. Treatment processes (mechanical, biological and physical-chemical processes)
• Sludge treatment.

Qualification aims: On successful completion of this course, students will be able to:
▪ Properly identify the critical issues and challenges in planning, design and operation of modern wastewater treatment facilities to meet not only current but also anticipated regulatory requirements
▪ Develop reasonable working knowledge and hands -on experiences that can be used to devise and design the efficient, cost-effective treatment and water reuse systems, and
▪ Gain the independent learning skills and enhance your ability to work effectively in teams through PBL format</td></tr>
<tr><td>Module character</td><td colspan="2">2 hours of lectures per week
1 hour tutorial per week
(Excursion and report 8 hours total : visit a Waste water treatment station)</td></tr>
<tr><td>Prerequisite of attendance</td><td colspan="2">Pumping Station and Surface Water Horology</td></tr>
<tr><td>Applicability</td><td colspan="2">The module is compulsory for the Bachelor Water Engineering and Management</td></tr>
<tr><td>Prerequisite achieve credit points</td><td colspan="2">Having passed the module exam. The module exam is a written examination (120 minutes)</td></tr>
<tr><td>Credit points and grade</td><td colspan="2">The module earns 5 credits
The grade for the examination equals the module grade</td></tr>
<tr><td>Frequency of the module</td><td colspan="2">The module is offered annually in winter term</td></tr>
<tr><td>Work load</td><td colspan="2">The work load is 150 hours</td></tr>
<tr><td>Duration of the module</td><td colspan="2">The course takes one semester (6)</td></tr>
</table>

Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Wastewater Treatment: Advanced Processes and Technologies Author / Editor: D. G. Rao; R. Senthilkumar; J. Anthony Byrne; S. Feroz , Published: July 09, 2012 - ISBN: 9781439860441 ▪ Steel, E. W., Mc Ghee T. J.: Water Supply and Sewerage, Mc Graw Hill Book Company, London, 1988. - ISBN: 978-87-7681-843-2

Module Number	**Module Name**	**Professor in Charge**
BWEM.19	**Water Demand Management**	**Dr. ………**
Contents and qualification aims	**Contents:** • Understand the history and theories of project management • Understand the project management cycle and use it in specific project activities • Apply the essential tools of project management relating to project planning and resourcing • Develop a project logical framework and critically analyses the logical framework approach • Recognize the need and plan for social, environmental, and gender impact assessments in project design and rollout • Understand and apply monitoring and evaluation and risk management in the project cycle • Show how relevant theories, integration tools and decision support systems can inform the research and analysis of case studies and help to identify practical, integrated solutions to water planning and management problems • Grasp the concepts underpinning water governance initiatives at different scales • Acquire an interdisciplinary perspective to governance, policies and practices related to Integrated Water Management in developing and developed country contexts • Be familiar with water planning as a key governance mechanism in developed and developing country contexts. understanding of processes used to reconcile interests of governments, the private sector and civil society through examples from Australia, South Africa and other countries • Be able to discuss, critique and evaluate transboundary governance arrangements, particularly how they implement international norms for sharing water and their methods of resolving conflict • Communicate an understanding of basic governance policies and challenges as identified above in a systematic and contextually appropriate way, either orally or in written form or through multimedia, with attention to the diverse needs of governments, the private sector and civil society • Undertake individual research on governance issues, critically evaluate materials accessed from a variety of standpoints and communicate essential points of such materials in an accurate, engaging and contextually appropriate way • Demonstrate the use of personal reflection to improve their own ability, and their ability as part of a team, to analyze, explore and evaluate governance initiatives to practical water planning and management problems exemplified in case studies presented in this course **Qualification aims:**	

	• Provide students with an overview of the issues relating to water demand management • Provide students to understand the principles of water project management and learn the skills necessary to professionally design and manage water projects in development contexts • Focus on the significance of developing sustainable water practices, particularly in developing countries and in countries in transition • Introduce students be to governance frameworks at the global /international, national, regional/basin, transboundary and local levels • Introduce students to some of the key perspectives on water and sustainable development in developing countries
Module character	2 hours of lectures per week 1 hour tutorial per week 1 hour seminar per week
Prerequisite of attendance	Surface Hydrology – Groundwater Hydrogeology
Applicability	The module is compulsory for the Bachelor Water Engineering and Management
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade
Frequency of the module	The module is offered annually in winter term
Work load	The work load is 150 hours
Duration of the module	The course takes one semester (6)
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Allan, Tony: 2003, IWRM/IWRAM: a new sanctioned discourse? Occasional papers 50 SOAS Water Issues Study Group, School of Oriental and African Studies / Kings College London. University of London, April 2003 ▪ Biswas, A.K. 2005. Integrated Water Resources Management: a reassessment.In A.K. Biswas, O. Varis, & C. Tortajada (Eds.) Integrated Water Resources Management in South and Southeast Asia . pp. 325-341. New Delhi : Oxford University Press ▪ Cech, T.V. 2004, Principles of Water Resources: History, Development, Management, and Policy. John Wiley and Sons: New York ▪ GWP, 2000, Integrated Water Resources Management, TAC background paper No.4, GWP Stockholm ▪ GWP-INBO, 2009 A Handbook for Integrated Water Resources Management in Basins ▪ Heathcote IW. 2009. Integrated Watershed Management: Principles and Practice. Wiley. Second edition ▪ UNESCO 2006; 2009: World Water Development Reports 2 and 3 (selected chapters)

Module Number	**Module Name**	**Professor in Charge**
BWEM.20	**Irrigation Management**	**Dr. ………**
Contents and qualification aims	**Contents:** Introduction: definition, importance of irrigation management, management cycle, activities in irrigation management. Objective of irrigation management: main interest groups, arranging objective by means and ends. Water delivery polices: acquisition water, water rights, cropping arrangement, water delivery arrangement. Flow control systems: characteristics of flow control, hydraulic of flow control, flow control concept, management objective and inputs. Organization: purpose and function, organizational structure, resource mobilization, farmer's participation, development of water users association. Monitoring and evaluation of irrigation system performance: need, framework, purpose, requirements for monitoring, indicators and performance parameters, evaluation. **Qualification aims:** Upon completion of the course, students will be able to: • Gain detailed knowledge of water delivery process, flow control systems, role of organization and monitoring and evaluation of irrigation systems performance	
Module character	2 hours of lectures per week 2 hours tutorial per week	
Prerequisite of attendance	Irrigation and Drainage and Water Demand Management.	
Applicability	The module is one of 6 optional modules for the Bachelor Water Engineering and Management	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in summer term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (6)	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Burton, M. A.2010. Irrigation Management: Principles and Practices. Cabi Publications ▪ Lorenzini, G. C.A. Brebbia. 2006. Sustainable Irrigation Management: Technologies and Polices. WIT Transactions on Ecology and Environment ▪ Joshi, L. K. and R. Hooja. 2000. Participatory Irrigation Management. Rawat Publications, India. ▪ Hoffman, G. J., T. A. Howell and K. H. Soloman. 1990. Managing Farm Irrigation Systems. American Society of Agriculture Engineers, USA	

Module Number	**Module Name**	**Professor in Charge**
BWEM.21	**GIS and Remote Sensing in Water Management**	**Dr. ………**
Contents and qualification aims	**Contents:** **Introduction** ▪ Role of RS and GIS as tools for IWRM: data generation, limitations and outlook **Geospatial data required for water management** • Introduction: remote sensing components • Platforms and sources of RS-GIS data • GIS components: spatial data, coordinates and projection • Building a GIS Database: maps and spatial data **Spatial and non-spatial data processing** • Image pre-processing techniques: Geometric correction, enhancement, noise removal and filtering • Information extraction: Digital and visual interpretation principles of digital classification • Basic spatial analysis: operations and output, spatial selection operations, Dissolve, Proximity functions and buffering - Overlay: Raster overlay, Vector overlay, clip, intersect and union **Data analysis and presentation** • Remote sensing applications in IWRM, monitoring and mapping of natural resources • Spatial estimation, interpolation, prediction and core area delineation. Sampling and sampling patterns • Interpolation Methods: Nearest Neighbor, Fixed Radius and Inverse Distance Weighted **Analysis, design and implementation of Information Systems** • Applications of RS data for monitoring vegetation, water and land se/cover mapping • Terrain Analysis and hydrologic models in GIS: slope and aspect, Hydrologic functions, watershed and view sheds **Qualification aims:** Upon completion of the course, students will be able to: • Access the main sources of geospatial data required for water management • Obtain and process spatial and non-spatial information related to water and land resources management • Use different instruments for analyzing and presenting spatial data • Understand the main steps of data modeling: analysis, design and implementation of Information Systems	
Module character	2 hours of lectures per week 2 hours tutorial per week	
Prerequisite of attendance	All compulsory modules	
Applicability	The module is one of 6 optional modules for the Bachelor Water Engineering and Management	
Prerequisite achieve cre-	Having passed the module exam. The module exam is a	

dit points	written examination (120 minutes)
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade
Frequency of the module	The module is offered annually in summer term
Work load	The work load is 150 hours
Duration of the module	The course takes one semester (6)
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Liu, J. G., and P. Mason. 2009. Essential Image Processing and GIS for Remote Sensing. John Wiley & Sons Inc., New York, USA. ▪ Weng, Q. 2009. Remote Sensing and GIS Integration: Theories, Methods, and Applications: Theory, Methods, and Applications. McGraw-Hill Professional, Dubuque, IA, USA. ▪ Chang, Kang-Tsung. 2006. Introduction to Geographic Information Systems. McGraw-Hill Higher Education, Columbus, Ohio, USA ▪ Shamsi, U.M.. 2005. GIS Applications for Water, Wastewater, and Stormwater Systems CRC, Boca Raton, FL, USA ▪ Jensen. J. R. 2004. Introductory Digital Image Processing. Prentice Hall, Inc., New Jersey, USA. ▪ Bernhardsen, T., A. Viak and A. Norway. 2002. Geographic Information System: An Introduction. John Wiley & Sons Inc., New York, USA ▪ Maidment, D. R. 2002. Arc Hydro: GIS for Water Resources. ESRI, Inc., USA ▪ Dijk, A. van, M. G. Bos. 2001. GIS and Remote Sensing Techniques in Land and Water Management. Springer, USA ▪ ICIMOD. 2001. Application of GIS and RS in Planning for Mountain Agriculture and Land Use Management. International Centre for Integrated Mountain Development (ICIMOD), Nepal ▪ Lyon, J. G. 2001. Wetland Landscape Characterization: GIS, Remote Sensing and Image Analysis. CRC, Boca Raton, FL, USA. ▪ Rees, W. G. 2001. Physical Principles of Remote Sensing (Topics in Remote Sensing) Cambridge University Press, UK ▪ Jensen, J. R. 2000. Remote Sensing of the Environment. Prentice Hall, New Jersey, USA

<table>
<tr><th>Module Number</th><th>Module Name</th><th>Professor in Charge</th></tr>
<tr><td>BWEM.22</td><td>Environmental Impact Assessment</td><td>Dr. ………</td></tr>
<tr><td>Contents and qualification aims</td><td colspan="2">Contents: Overview of environmental impact assessment. Selection of scientific and socio-economic factors in environmental impact assessment. Environmental impact indicators. Baseline study; air, water, soil, sediment. Identification of quantitative and qualitative environmental evaluation criteria; application of traditional and modern techniques. Approaches for identifying, measuring, predicting, and mitigating environmental impacts. Environmental management plan. Environmental standards and the environmental impact assessment process; methodologies for incorporating environmental impact assessment into management decision-making. Public hearing steps and procedures. Environmental evaluation of policies.

Qualification aims: Upon completion of the course, students will be able to:
• Learn and understand principles, process, and necessary techniques for assessment, mitigation and monitoring</td></tr>
<tr><td>Module character</td><td colspan="2">2 hours of lectures per week
2 hours of seminar per week</td></tr>
<tr><td>Prerequisite of attendance</td><td colspan="2">None</td></tr>
<tr><td>Applicability</td><td colspan="2">The module is one of 6 optional modules for the Bachelor Water Engineering and Management</td></tr>
<tr><td>Prerequisite achieve credit points</td><td colspan="2">Having passed the module exam. The module exam is a written examination (120 minutes)</td></tr>
<tr><td>Credit points and grade</td><td colspan="2">The module earns 5 credits
The grade for the examination equals the module grade</td></tr>
<tr><td>Frequency of the module</td><td colspan="2">The module is offered annually in summer term</td></tr>
<tr><td>Work load</td><td colspan="2">The work load is 150 hours</td></tr>
<tr><td>Duration of the module</td><td colspan="2">The course takes one semester (6)</td></tr>
<tr><td>Reference Materials</td><td colspan="2">Essential:
Reference Materials available at Faculty of Civil Engineering, Damascus University.
Recommended:
▪ Morris, P. and R. Therivel. 2009. Methods of Environmental Impact Assessment. Routledge, Oxon, UK.
▪ Therivel R, J. Glasson and A. Chadwick. 2009 Introduction to Environmental Impact Assessment. Routledge, Taylor & Francis Group, Kentucky, USA.
▪ Lawrence, D. P. 2005. Environmental Impact Assessment. John Wiley & Sons, Inc., Hoboken, New Jersey.
▪ Lee, N. and C. George. 2000. Environmental Assessment in Developing and Transitional Countries. John Wiley & Sons Ltd, England.
▪ Awan, N. M. and M. Latif. 1999. Environmental Assessment of Irrigation and Drainage Projects. Volume 1 & 2.
▪ Modak, P. and A. K. Biswas. 1999. Conducting Environmental Impact Assessment for Developing Count-</td></tr>
</table>

	ries. United Nations University Press, New York. ▪ Canter, L. W. 1996. Environmental Impact Assessment. McGraw Hill, Inc., New York. ▪ Dougherty, T. C. and A. W. Hall. 1995. Environmental Impact Assessment of Irrigation and Drainage Projects. FAO Irrigation and Drainage Paper 53. FAO, Rome. ▪ Glasson, J., R. Therivel, R. Therivel, A. Chadwick, J. Glasson, and A. Chadwick. 2005. Introduction to Environmental Impact Assessment. Routledge, Taylor & Francis Group, Kentucky, USA.

<table>
<tr><th>Module Number</th><th>Module Name</th><th>Professor in Charge</th></tr>
<tr><td>BWEM.23</td><td>Climate Change and Water Resources Management</td><td>Dr. ………</td></tr>
<tr><td>Contents and qualification aims</td><td colspan="2">Contents: Atmospheric structure, overview of earth system processes, earth‘s energy balance, meso, micro, macro climate, atmospheric circulation and climate, clouds and climate, carbon cycle, anthropogenic and natural forcing, radiative forcing and global warming, greenhouse gases and greenhouse effect history of past climate, recent climate change, carbon dioxide and energy use, surface temperature record, connections with our world, trend analysis of meteorological and oceanographic parameters, future predictions and impact, comparison of computer simulations of past climate with temperature records, computer projections of future climate change, the role of the hydrological cycle in the climate system, decade long precipitation variations and water resources, water availability and demand in south Asia, climate change and water resources, climate change and future water challenges, hydrologic models, global warming and the acceleration of the hydrological cycle, assessing of hydrology on regional and smaller scales, advantages and limitations of hydrologic models in climate, application of hydrologic models for climate change impact, application of models in Syria.

Qualification aims:
Provide introduction to climate change, its causes and effects, knowledge about the greenhouse process responsible for climate change
Help in understanding the impact of climate change on water resources</td></tr>
<tr><td>Module character</td><td colspan="2">2 hours of lectures per week
2 hours of seminar per week</td></tr>
<tr><td>Prerequisite of attendance</td><td colspan="2">Basic knowledge in meteorology, hydrology, physics, chemistry, and mathematics</td></tr>
<tr><td>Applicability</td><td colspan="2">The module is one of 6 optional modules for the Bachelor Water Engineering and Management</td></tr>
<tr><td>Prerequisite achieve credit points</td><td colspan="2">Having passed the module exam. The module exam is a written examination (120 minutes)</td></tr>
<tr><td>Credit points and grade</td><td colspan="2">The module earns 5 credits
The grade for the examination equals the module grade</td></tr>
<tr><td>Frequency of the module</td><td colspan="2">The module is offered annually in summer term</td></tr>
<tr><td>Work load</td><td colspan="2">The work load is 150 hours</td></tr>
<tr><td>Duration of the module</td><td colspan="2">The course takes one semester (5)</td></tr>
<tr><td>Reference Materials</td><td colspan="2">Essential:
Reference Materials available at Faculty of Civil Engineering, Damascus University.
Recommended:
Freeman, W. H. 2008. Earth's Climate: Past and Future. University of Virginia, USA.
Aguado, E. Burt, J. 2006. Understanding Weather and Climate. Prentice Hall, London.
Ahmad, Q. K. 2005. Climate Change and Water Resources in South Asia. CRC Press, Boca Raton, Florida, USA.</td></tr>
</table>

	▪ Garbrecht, J. and T. Piechota. 2005. Climate Variations, Climate Change, and Water Resources Engineering. American Society of Civil Engineers, USA. ▪ Taylor, F. W. 2005. Elementary Climate Physics. Oxford University Press. ▪ Kininmonth, W. 2004. Climate Change: A Natural Hazard, Multi-Science Publishing Co. Ltd. ▪ Peixoto, J. P., Oort, A. H. 1992. Physics of Climate. Springer ▪ Oke, T. R. 1988. Boundary Layer Climates. Routledge.

Module Number	**Module Name**	**Professor in Charge**
BWEM.24	**Participatory Water Management**	**Dr. ………**
Contents and qualification aims	**Contents:** Introduction: Users‘ participation in development and management of irrigation: strategies for approaching farmers; integrated rural development, target group development; target groups in irrigation; practical methods to communicate with farmers; farmers socio-economic context and irrigation development: the farming system; farmers‘ organizations; external relations of farmers for arranging inputs and outputs; the link of these aspects with irrigation design; construction and operation. Water Users‘ Associations; Water Users' Association Act. Water agreements/accords: local; regional and global; legislation about water and water vision. Mass awareness; key water issues; electronic and print media; consultations; holding events; demonstrations of improved techniques and practices. **Qualification aims:** • Provide students with basic knowledge about the rates of water users in irrigation management	
Module character	2 hours of lectures per week 2 hours of seminar per week	
Prerequisite of attendance	Basic knowledge in meteorology, hydrology, physics, chemistry, and mathematics	
Applicability	The module is one of 6 optional modules for the Bachelor Water Engineering and Management	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in summer term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (5)	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Ahmad, Nisar. 2008. Participatory Irrigation Management. Higher Education Commission, Islamabad. ▪ Kahlown, M. A. and A. Majeed. 2004. Pakistan Water Resources: Development and Management. PCRWR, Government of Pakistan. ▪ Khan, M. I., B. A. Tahir, S. Amir and N. Akhtar. 2004. Towards Participatory Management, Allama Iqbal Open University. ▪ Shepherd, A. 1998. Sustainable Rural Development, St. Martin Press, Inc. ▪ Burkey, S. 1993. People First: A Guide to Self-reliant Participatory Rural Development. Zed Books, London.	

Module Number	**Module Name**	**Professor in Charge**
BWEM.25	**International Water Issues**	**Dr. ………**
Contents and qualification aims	**Contents:** The module improves the information and the knowledge exchange among the students. Professionals and scientists from academic institutions and consulting agencies present recent developments in water related issues. The students prepare term papers about water specific problems and present the contents orally. The topics may concern the general aspects of the situation of water supply, i.e. the hydrologic regime, the type of climate including climate change, state of water supply, condition of waste water management, management of floods and water related natural damages (e.g. landslides, tsunamis). The students have the possibility to introduce projects and organizations where they participated or to which they contribute now. **Qualification aims:** • After the completion of this module, the students get to know the situation of different countries and may reflect about their own experiences. Piece by piece they may develop a global view and learn to manage their knowledge and make decisions	
Module character	2 hours of lectures per week 2 hours of seminar per week	
Prerequisite of attendance	Basic knowledge in hydro sciences, regional water management and hydrology	
Applicability	The module is one of 6 optional modules for the Bachelor Water Engineering and Management	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in summer term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (5)	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Ahmad, Nisar. 2008. Participatory Irrigation Management. Higher Education Commission, Islamabad. ▪ Kahlown, M. A. and A. Majeed. 2004. Pakistan Water Resources: Development and Management. PCRWR, Government of Pakistan. ▪ Khan, M. I., B. A. Tahir, S. Amir and N. Akhtar. 2004. Towards Participatory Management, Allama Iqbal Open University. ▪ Shepherd, A. 1998. Sustainable Rural Development, St. Martin Press, Inc. ▪ Burkey, S. 1993. People First: A Guide to Self-reliant Participatory Rural Development. Zed Books, London.	

Module Number	**Module Name**	**Professor in Charge**
BWEM.26	**Foreign Language**	**Dr. ………**
Contents and qualification aims	**Contents:** Basics of Grammar; Parts of speech and use of articles; Sentence structure, active and passive voice; Practice in unified sentence; Analysis of phrase, clause and sentence structure; Transitive and intransitive verbs; Punctuation and spelling; Paragraph writing (Practice in writing a good, unified and coherent paragraph); Essay writing (Introduction); CV and job application (Translation skills , Arabic to English); Presentation skills; Essay writing (Descriptive, narrative, discursive, argumentative; Academic writing (How to write a proposal for research paper/term paper, How to write a research paper/term paper (emphasis on style, content, language, form, clarity, consistency); Technical Report writing; Progress report writing. **Qualification aims:** • Enhance language skills and develop critical thinking • Enable the students to meet their real life communication needs • Enhance language skills and develop critical thinking	
Module character	2 hours of lectures per week 2 hours of seminar per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Bachelor Water Engineering and Management	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 10 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in summer term	
Work load	The work load is 300 hours	
Duration of the module	The course takes two semester (1,2)	
Reference Materials	Reference Materials available at Faculty of Civil Engineering, Damascus University. ▪ Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 1. Third edition. Oxford University Press. 1997. ▪ Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press. 1997. ISBN 0194313506. ▪ Writing. Intermediate by Marie-Christine Boutin, Suzanne Brin and and Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ▪ Reading. Upper Intermediate. Brain Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 453402 2. ▪ Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press 1986. ISBN 0 19 431350 6.	

<table>
<tr><th>Module Number</th><th>Module Name</th><th>Professor in Charge</th></tr>
<tr><td>BWEM.27</td><td>Technical and Financial Reports</td><td>Dr. ………</td></tr>
<tr><td>Contents and qualification aims</td><td colspan="2">Contents
• Report Writing
• Developing Business Cases
• Developing Feasibility Studies
• Business Planning
• Peer Reviewing
• Effective Communication Skills
• Oral Reporting & Presentations
• Budgeting
• Financial Statement Analysis

Qualification aims:
• The course will provide tools and techniques that help students work step-by-step through workplace problems and scenarios. Along with operators, this course will be of value to any water sector workers and front line supervisors</td></tr>
<tr><td>Module character</td><td colspan="2">2 hours of lectures per week
1 hour of seminar per week</td></tr>
<tr><td>Prerequisite of attendance</td><td colspan="2">Have passant the Foreign Language course</td></tr>
<tr><td>Applicability</td><td colspan="2">The module is compulsory for the Bachelor Water Engineering and Management</td></tr>
<tr><td>Prerequisite achieve credit points</td><td colspan="2">Having passed the module exam. The module exam is a written examination (120 minutes)</td></tr>
<tr><td>Credit points and grade</td><td colspan="2">The module earns 5 credits
The grade for the examination equals the module grade</td></tr>
<tr><td>Frequency of the module</td><td colspan="2">The module is offered annually in summer term</td></tr>
<tr><td>Work load</td><td colspan="2">The work load is 150 hours</td></tr>
<tr><td>Duration of the module</td><td colspan="2">The course takes one semester (5)</td></tr>
<tr><td>Reference Materials</td><td colspan="2">Essential:
Reference Materials available at Faculty of Civil Engineering, Damascus University.
Recommended:
▪ Alfredson, K., K. Leo, P. Pacter, R. Picker, J. Radford, Applying International Accounting Standards, Wiley, 2005
▪ Eddey, P., N. Arthur and J. Knapp, Accounting for Corporate Combinations and Associations, 5th ed., Prentice Hall, 2001
▪ Godfrey, J., A. Hodgson, S. Holmes and A. Tarca, Accounting Theory, 6th ed., Wiley, 2006
▪ Henderson, S. and G. Peirson, Issues in Financial Accounting, 11th ed. Longman, 2004
▪ Henderson, S., G. Peirson and K. Harris, Financial Accounting Theory, Pearson, 2004
▪ Jubb, P., S. Haswell and 1. Langfield-Smith, Company Accounting, 4th ed., Nelson ITP, 2005
▪ Leo, K. and J. Hoggett, Company Accounting, 6th ed., Wiley, 2005</td></tr>
</table>

Module Number	**Module Name**	**Professor in Charge**
BWEM.28	**Hydro informatics Tools**	**Dr. ………**
Contents and qualification aims	**Contents:** Introduction to basic concepts (data vs information), Data types (notional, rational, spatial, temporal, remote, raster, vector, etc.), Data management data modeling (databases, data warehouses, etc.), The role of data in hydrology and water resources management. Methods and tools to convert data into information (models, modeling). Advances and limitations in computing systems driving information generation (High speed computers, large memory, large storage capacity, parallel computing, cloud computing). Advances in Information dissemination (mapping, graphing, 3D graphics, videos, etc.). The integration of computing methods such as Geographical information Systems and Mike SHE, Remote sensing, and computer mapping in hydrology. **Qualification aims:** • Give a broad overview of the integration of current and future based computer methods and tools in hydrology and water resources management	
Module character	2 hours of lectures per week 2 hours tutorial per week	
Prerequisite of attendance	GIS and Remote Sensing in Water Management	
Applicability	The module is compulsory for the Bachelor Water Engineering and Management	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in summer term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (5)	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Kumar, P., (2005), Hydro informatics: Data Integrative Approaches in Computation, Analysis, and Modeling, CRC Press, 552 p. ▪ Grayson, R. and G. Blöschl, ed. (2000), Spatial Patterns in Catchment Hydrology: Observations and Modeling, Cambridge University Press, Cambridge, 432 p, full PDF text available at http://www.catchment.crc.org.au/special_publications1.html	

Module Number	**Module Name**	**Professor in Charge**
BWEM.29	**Practical Training/ Project Study**	**Dr. ………**
Contents and qualification aims	The Student must carry out practical training about one Problem belongs to subjects of Water Engineering and Management in one or more institution or incorporation, and he must present full study about this problem.	
Module character	Practical Training/ Project Study: 20 Hours tutorial per week	
Prerequisite of attendance	Basic Knowledge of Practical Training/ Project Study, the student must be in the 4th Semester.	
Applicability	The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite achieve credit points	Having passed the module seminar and presentation before commission.	
Credit points and grade	The module earns 10 Cr. The final Grade is generated with 100% as presentation in front of committee.	
Frequency of the module	The module is offered annually.	
Work load	The workload is 300 hours.	
Duration of the module	The module takes two terms starting in Semester 4.	
Reference Materials	• James E. Mauch and Namgi Park: **Guide to the Successful Thesis and Dissertation, A Handbook for Students and Faculty**.2003. 5th ed., Copyright ©2003 by Marcel Dekker. ISBN: 0-8247-4288-5. • Louis Cohen; Lawrence Manion and Keith Morrison: Research Methods in Education, 2005, 5th ed., ISBN 0-203-22434-5 Master e-book ISBN.	

Module Number	**Module Name**	**Professor in Charge**
BWEM.30	**Bachelor Thesis including Defense**	**Dr. ………**
Contents and qualification aims	The Student must work Bachelor Thesis with Defense about one Problem belongs to the subjects of Water Engineering and Management in the semester; he must present full study about this problem.	
Module character	Bachelor Thesis with Defense: 30 hours tutorial per week.	
Prerequisite of attendance	Basic Knowledge of Bachelor Thesis with defense, the student must be in 6 Semester.	
Applicability	the module is suitable for the professional and research oriented studies in civil and environmental engineering	
Prerequisite achieve credit points	Having passed the module presentation before a commission.	
Credit points and grade	The module earns 15 Cr. The final Grade is generated with 100% as presentation in front of committee.	
Frequency of the module	The module is offered in 6 th Semester.	
Work load	The work load is 450 hours.	
Duration of the module	The module takes one term starting in Semester 6.	
Reference Materials	• James E. Mauch and Namgi Park: Guide to the Successful Thesis and Dissertation, A Handbook for Students and Faculty. 2003. 5th ed., Copyright ©2003 by Marcel Dekker. ISBN: 0-8247-4288-5. • Louis Cohen; Lawrence Manion and Keith Morrison: Research Methods in Education, 2005, 5th ed., ISBN 0-203-22434-5 Master e-book ISBN. • Derek Swetnam: Writing Your Dissertation, How to plan, prepare and present successful work. 2007, 3rd ed. ISBN: 978 1 84803 126 5. • 4. Old Master and Bachelor thesis, which are available in the Libraries of the University.	

21.. Course Requirements

Assignments

Assignments will be due either one or two weeks after they are handed out depending on their length. Grades will be reduced 10% for each day late.

Exams

In-class midterm and a final examination.

Grading

Activity	Percentage
Assignments	20%
In-class Midterm Exam	10%
Final Exam	70%

Below is a table that lists University letter grades (last column) and the equivalent percentages The Instructor will use for grading. All numerical grades will be rounded up or down to the nearest integer. The Instructor reserves the right to adjust the scores of any exam or the cumulative average in the students' favor if necessary, i.e. The Instructor reserves the right to add a few percentage points to every student's grade. No work for extra credit shall be given. An "Incomplete" grade will not be given to students who have missed exams.

Grading Matrix

Numerical value		Equivalent University Letter grade
greater than or equal to (%)	and less than (%)	
90	100	A
87	90	A-
84	87	B+
80	84	B
77	80	B-
74	77	C+
70	74	C
67	70	C-
64	67	D+
60	64	D
---	60	F

MODULE COMPENDIUM

Water Engineering and Management Course (WEM)

Master Programme

Damascus University

Faculty of Civil Engineering

2015

EDUWAT: 511251-TEMPUS-1-2010-1-DE-TEMPUS-SMHES

Development of a Modern Higher Education System for Water Engineering in Syria

Preface

This course in one of three water courses designed in the framework of the EU-TEMPUS project: EDUWAT: *Development of a Modern Higher Education System for Water Engineering in Syria*, TEMPUS 1-2010-1DE TEMPUS SMHES No. 511251.

The three developed courses are designed for Bachelor and Master Degrees in three engineering fields according to Bologna process, they are:

- Water Engineering and Management
- Hydrology science and Engineering
- Soil and Groundwater Science and Engineering

The study period is 3 years for a Bachelor degree and 2 years for a Master degree. As the entire study period will be limited to 5 years. The majority of students should complete the Master degree to be qualified as engineers in the study filed of their choice.

Three working groups were given the responsibility of developing the three courses, each of three staff members from the Department of Water Engineering at The Faculty of Civil Engineering, Damascus University. A similar plan is made by Al Bath, Tishreen and Aleppo Universities. The resulted courses are being discussed frequently with the Ministry of Higher Education to set a procedure for implementation.

The work group responsible for this course; *Water Engineering and Management* consists of the following staff members of Damascus University coordinated by Dr. Wael Seif:

14. **Dr. Youssef Marai** (group coordinator)
    Faculty of Civil Engineering, Damascus University
    The Arab Centre for the Studies of Arid Zones & Dry Lands (ACSAD)

15. **Dr. Amjad Zeno**
    Faculty of Civil Engineering, Damascus University

16. **Dr. Bassam Farkouh**
    Faculty of Civil Engineering, Damascus University

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein

Contents

Preface

15. Introduction

16. Rationale

17. Learning Outcomes

18. Specific Outcome Objectives

Curriculum for M.Sc. in Water Engineering and Management (WEM)

19. General Structure

20. Details of Modules (Core Modules – Elective Modules)

21. Curricula Structures

22. Course Requirements

22. Introduction

This course is based on EU-TEMPUS project **“Development of a Modern Higher Education System for Water Engineering in Syria - EDUWAT”**,Nr. 511251-TEMPUS-1-2010-1-DE-TEMPUS-SMHES, in the duration between 15 of October 2010 and 14 of October 2014.

The **EDUWAT** project aims to:

- Increase higher education opportunities for all
- Develop high-quality curricula and educational programs
- Establish a quality assurance system
- Create an innovation environment for higher education and scientific research
- Increase the productivity of the Syrian scientific research and link it to development needs of the country
- Encourage partnerships among universities on national and international level
- Improve and modernize intermediate education

23. Rationale

Many regions of the world are increasingly facing challenges when it comes to managing water. Although all challenges are related to water, the nature of the challenge differs from one location to the next. It may relate to having too little water while water demands are growing explosively (water scarcity), too much water (flooding), and water of poor quality rendering them unfit to sustain the ecosystem or challenges related to providing water for people, industry and agriculture. What complicates matters further is that these challenges are all interdependent and influence each other. For example, water scarcity can impact water quality and the ability to provide water. Addressing these challenges requires that water engineers and managers apply an integrated and interdisciplinary approach, involving hydrological, biophysical, chemical, economic, institutional, legal, technical, policy-making and planning aspects.

Syria is considered as an arid to semi-arid country, about two third of its area is considered as very arid. The rainfall in Syria is characterized by high rate of variability. The annual average is less than 300 mm in more than 90% of the country.

Syria’s water resources are under growing pressure from rapidly population growth, urbanization, the impacts of climate change and an expanding agricultural sector. Available water per capita is constantly decreasing (**AWPC** was about 800m^3/ca in 2010 and it is likely to be reduced by about half up to 2050) and rainfall is becoming more irregular and scarce.

In this context, the Syrian government is starting to embrace the principle of integrated water resources management with a view to promoting ecological sustainability, social justice and greater economic efficiency. Integrated water resources management is an internationally recognized implementation tool for managing and developing water resources in a way that balances social and economic needs, and that ensures the protection of ecosystems for future generations.

National water strategies in Syria are articulated by the 5-year Development Plan. The recent Five-years Plans places special importance on water security as an essential ingredient of sustainable development. While water will be utilized as a mean for ensuring food security, concerted efforts will be made for its development, protection and rational use as a strategic wealth.

Facing water related challenges in Syria requires qualified professionals with expertise in the engineering and management for use, development and protection of the available water resources. Proposal BSc and MSc degrees in this study course according were designed to Bologna System to meet the career needs of people working in these fields.

24. Learning Outcomes

y. Provide breadth of knowledge of basic principles and concepts
z. Provide depth within specialized areas
aa. Provide an understanding of experimental/research design and methodology
bb. Develop approaches for integration of information
cc. Encourage critical thinking and hypothesis building
dd. Provide skills in writing and communication
ee. Provide contemporary information
ff. Encourage appreciation of scientific values

25. Specific Outcome Objectives

23. Provide a broad background on the occurrence, use, management, and conservation of water and water resources in the Syrian Arab Republic and around the world
24. Understand physical hydrology and the hydrologic basis of water resources
25. Explore water supply and demand, irrigation and agriculture, water allocation law and policy, and flood hazards and hydrology
26. Examine dams and reservoirs, drought, water geochemistry, water quality and pollutants, and the economic and political aspects of water resources
27. The scientific method will be presented and consistently applied for all topics discussed
28. The course will address four major milestones (simplified water budget, the geography of water supply and demand in the Syrian Arab Republic water resource development, and water quality and health), which requires integration of many related concepts and principles
29. Critically examine the role government policy plays in the environment, specifically with regard to water resource development, and formulation of water allocation law
30. Present and discuss relevant topics in real-time (e.g., weather phenomena, floods, pollution issues, natural disasters) using information available through the media
31. Present case studies of local interest as it relates to study course material
32. Apply the basic principles of mathematical and hydrologic sciences, physics, soil, agricultural engineering, chemistry and construction engineering to the understanding of water resources and socioeconomic development

Curriculum for M.Sc. in Water Engineering and Management
26. General Structure:

		Credits	%
1	Modules in Mathematics and Natural Sciences	**20**	17
2	Modules in Engineering	**10**	8
3	Modules in Hydro Sciences	**15**	12.5
4	Modules with Specialization	**30**	25
5	Elective Modules	**10**	8
6	Modules for general Qualification	**5**	4.5
7	Practical Training /Project	**10**	8
8	Master Thesis plus Defense	**20**	17
	Total	**120**	**100**

	Module Semester	**1**	**2**	**3**	**4**	**Total / ECTS**
1	Mathematics and Natural Sciences	10	5	5		**20**
2	Engineering	5	5			**10**
3	Hydro Sciences	5	5	5		**15**
4	Specialization	10	10		10	**30**
5	Elective Modules		5	5		**10**
6	General Qualification			5		**5**
7	Practical Training/ Project Study			10		**10**
8	Master Thesis plus Defense				20	**20**
	Total	**30**	**30**	**30**	**30**	**120**

	Course **Semester**	**1**	**2**	**3**	**4**	**Total/ ECTS**
1	**Mathematics and Natural Sciences**	**10**	**5**	**5**	**0**	**20**
MWEM.01	Applied Mathematics	5				**5**
MWEM.02	Applied Statistics		5			**5**
MWEM.03	Water Quality Monitoring and Management			5		**5**
MWEM.04	Geoinformatics/GIS	5				**5**
2	**Engineering**	**5**	**5**	**0**	**0**	**10**
MWEM.05	Advanced Geotechnics	5				**5**
MWEM.06	Soil Erosion and Sediment Transport		5			**5**
3	**Hydro Sciences**	**5**	**5**	**5**	**0**	**15**
MWEM.07	Drinking Water System / Modeling		5			**5**
MWEM.08	Applied Hydrology and Hydrogeology	5				**5**
MWEM.09	Groundwater Modeling			5		**5**
4	**Specialization**	**10**	**10**	**0**	**10**	**30**
MWEM.10	Hydraulic Structures	5				**5**
MWEM.11	Decision Support Systems				5	**5**
MWEM.12	Water System Management		5			**5**
MWEM.13	Principles of Integrated Water Resources Management				5	**5**
MWEM.14	Water Resources Planning	5				**5**
MWEM.15	Public Health and Sanitation		5			**5**
5	**Elective Modules***	**0**	**5**	**5**	**0**	**10**
	Group I			**5**		**5**
MWEM.16	Water Resources Development					
MWEM.17	Water Supply and Sanitation					
MWEM.18	Public Education and Participation					
	Group II		**5**			**5**
MWEM.19	Optimal Use of Irrigation Water					
MWEM.20	Reservoirs Operations and Management					
MWEM.21	Water Rights and Conflict Resolution					
6	**General Qualification**			**5**		**5**
MWEM.22	Writing of proposals for water projects			5		**5**
MWEM.23	**Practical Training/Project study**			**10**		**10**
MWEM.24	**Master Thesis plus Defense**				**30**	**20**
	Total	**30**	**30**	**30**	**30**	**120**

*Elective Modules - select one course from each group

Curricula Structures - Master Course Water Engineering and Management – MWEM

Semester 1	Applied Mathematics	Geoinformatics/GIS	Advanced Geotechnics	Applied Hydrology and Hydrogeology	Hydraulic Structures	Water Resources Planning
Semester 2	Applied Statistics	Soil Erosion and Sediment Transport	Drinking Water System / Modeling	Water System Management	Public Health and Sanitation	**Elective Modules**
Semester 3	Water Quality Monitoring and Management	Groundwater Modeling	**Elective Modules**	Writing of proposals for water projects	**Practical Training/Project study**	
Semester 4	**Master Thesis**					
Credits	5	5	5	5	5	5

Modules in Natural Sciences
10% - 25%

Modules inTechnical Sciences
10 - 25%

Modules in Economic & Social Sciences
5% - 15%

Modules in Variable Sciences
55% - 70%

27. Details of Modules (Core Modules – Elective Modules)

Module Number	**Module Name**	**Professor in Charge**
MWEM.01	**Applied Mathematics**	**Dr. ………**
Contents and qualification aims	**Contents:** Review of matrix algebra; solution of systems of linear equations: direct and indirect methods. Observation Equations; Condition Equations and Mixed models. Treatment of large geodetic networks and special network. Addition of observations and parameters; Weight and Functional Constraints in Least Squares. Application in Photogrammetry and Surveying. **Qualification aims:** A course should: ▪ Provide a relevant, stimulating and motivating course of advanced study in mathematics including the provision of a suitable foundation for further study in science and engineering ▪ Develop a variety of skills in modeling, logical reasoning and problem solving ▪ Encourage student interest and satisfaction through the development and use of mathematics in a variety of applications ▪ Promote an awareness of the relevance of mathematics to other fields of study and to other practical applications	
Module character	2 hours of lectures per week 2 hours tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Master Water Engineering and Management	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (1)	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Hung Cheng, Advanced Analytic Methods in Applied Mathematics, Science, and Engineering , Luban Press, 2006 ▪ Sanjoy Mahajan, Street-Fighting Mathematics: The Art of Educated Guessing and Opportunistic Problem Solving , MIT Press, 2010	

Module Number	**Module Name**	**Professor in Charge**
MWEM.02	**Applied Statistics**	**Dr. ………**
Contents and qualification aims	**Contents:** Descriptive statistics, discrete and continuous probability distributions, parameter estimation, statistical modeling, confidence intervals, hypothesis testing, parametric and nonparametric resampling tests, and introduction to variance analysis, correlation and regression analysis. **Qualification aims:** • The development of skills and abilities for problem oriented work using statistical methods and operations including selected software	
Module character	2 hours of lectures per week 2 hours tutorial per week	
Prerequisite of attendance	Basic knowledge of mathematics for engineers, in particular solving of equation systems, differential and integration calculus and probability methods, computer aided skills in spreadsheet calculation and basic knowledge of a programming environment	
Applicability	The module is compulsory for the Master Water Engineering and Management	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (2)	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Probability and Statistics in Engineering , By William W. Hines, Douglas C. Montgomery, David M. Goldsman, and Connie M. Borror, The fourth edition, 2003, John Wiley and Sons ▪ Introduction to Probabilities and Statistics for Engineers and Scientists , By Shel-dom M. Ross, Third Edition, 2004, Academic Press	

Module Number	**Module Name**	**Professor in Charge**
MWEM.03	**Water Quality Monitoring and Management**	**Dr. ………**
Contents and qualification aims	**Contents:** Introduction: definition, physical properties of water, uses of water, hydrologic cycle, water quality concern, major agricultural pollutants. Chemical water quality issues: drinking water quality, environmental water quality, agricultural water quality. Microbiological water quality issues: public health microbiology; pathogens in drinking water, recreational waters, water for irrigation. Microbiological interactions with chemical pollutants; eutrophication, toxigenic microbes, microorganisms in water distribution systems. Biotic indicators of water quality. Water quality guidelines, standards and legislation. Sampling strategies and methods: surface and groundwater. Sediment measurement. Effects of land use on water quality. Quality assurance. Data handling and interpretation. **Qualification aims:** • To provide the students basic rationale of water quality and practical hand in the sampling of water and the measurement and interpretation of water quality parameters	
Module character	2 hours of lectures per week 1 hour of seminar per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Master Water Engineering and Management	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (3)	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ R.S. K. Barnes and K.H. Mann (Edited) (1991): Fundamentals of Aquatic Ecology, Blackwell Science, ISBN 0-632-02983-8 ▪ Wetzel, R. G. (1983): Limnology, Second Edition, Saunders College Publishing, ISBN 0-03-057913-9 ▪ R.S.K. Barnes & R.N. Huges (1999): An Introduction to Marine Ecology, Blackwell Science, ISBN0-86542-834-4 ▪ Dobson, M. and Frid, C. (1998). Ecology of aquatic systems. Longman. ISBN 058229804	

<table>
<tr><th>Module Number</th><th>Module Name</th><th>Professor in Charge</th></tr>
<tr><td>MWEM.04</td><td>Geo informatics/GIS</td><td>Dr. ………</td></tr>
<tr><td>Contents and qualification aims</td><td colspan="2">Contents:
• Basic concepts of informatics and information systems, the nature and the specific features of geo informatics
• Representation of the real world in computer (vector and raster graphics),
• vector and raster graphics in GIS
• Editing spatial and attribute data in GIS environment (creation of new objects, editing existing objects)
• Queries - concept and implementation
• Main principles and techniques to perform spatial queries, querying by attribute data
• Connecting different data tables and derivation new data
• Creation buffer zones and the use in spatial analysis, thematic mapping and other techniques of data visualization, Layout and preparing output for printing
• Data transformations and data exchange between different systems, the creation of information systems and connected to this problems
• Data administration in GIS and meta data, data quality and its importance, legal issues of geo informatics
• Security issues of geo informatics
• Review of main GIS producers and products

Qualification aims:
• To understand the basic concepts of GIS and is able to explain them
• To understand the basic principles of representation the real world in GIS, knows appropriate technical means and is able to implement them
• To understand the role of geo informatics in present day world and is able to use the GIS to solve the professional tasks
• To knows basic methods of manipulation with spatial and attribute data in GIS environment and is able to use them
• To able to run the queries in GIS environment by spatial and attribute data
• To able to implement the elementary methods of spatial analysis
• To able to compose thematic maps
• To able to compose reports</td></tr>
<tr><td>Module character</td><td colspan="2">2 hours of lectures per week
2 hours of tutorial per week</td></tr>
<tr><td>Prerequisite of attendance</td><td colspan="2">None</td></tr>
<tr><td>Applicability</td><td colspan="2">The module is compulsory for the Master Water Engineering and Management</td></tr>
<tr><td>Prerequisite achieve credit points</td><td colspan="2">Having passed the module exam. The module exam is a written examination (120 minutes)</td></tr>
<tr><td>Credit points and grade</td><td colspan="2">The module earns 5 credits</td></tr>
</table>

	The grade for the examination equals the module grade
Frequency of the module	The module is offered annually in winter term
Work load	The work load is 150 hours
Duration of the module	The course takes one semester (1)
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Bedient P.B., W.C. Hube r, B.E. Vieux, 2008, Hydrology and Floodplain Analysis, Pearson, ISBN 0-13-174589-1 ▪ David R. Maidment, 2002. Arc Hydro: GIS for Water Resources, ESRI Press, ISBN 1-58948-034-1

Module Number	**Module Name**	**Professor in Charge**
MWEM.05	**Advanced Geotechnics**	**Dr. ………**
Contents and qualification aims	**Contents:** Subsurface stresses, Settlement Analysis, Site Investigation and InSitu Methods, Shallow and Deep Foundations, Slope Stability, and Lateral Earth Pressures/Retaining Wall Design. **Qualification aims:** Assure students are able to determine the stress increase due to a surface load; to apply stress increase and in situ measurements to analyze foundation settlements; to design shallow foundations (footings) and deep foundations (piles); to analyze the stability of slopes; to determine the stresses against retaining walls; to design retaining walls for various subsurface conditions.	
Module character	2 hours of lectures per week 2 hours of tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Master Water Engineering and Management	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (1)	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Das, B.M. (2008). Advanced Soil Mechanics. Taylor and Fracis Group, London, Second edition ▪ Helwany, S. (2007). Applied Soil Mechanics with ABAQUS Applications, John Wiley & Sons, INC, New Jersey, USA ▪ Wood, D.W. (2004). Geotechnial Modelling. Spon Press, Taylor and Francis Group, London, First edition ▪ Powrie, W. (2002). Soil Mechanics concepts and applications. Spon Press, Taylor and Fracis Group, London, Second edition ▪ Terzaghi, K., Peck, R.B. and Mesri, G. (1996). Soil Mechanics in Engineering Practice	

Module Number	**Module Name**	**Professor in Charge**
MWEM.06	**Soil Erosion and Sediment Transport**	**Dr. ………**
Contents and qualification aims	**Contents:** Problems of soil erosion and sediment Water erosion; causes and control practices, stream channel, revised universal soil loss equation (RUSLE). Contouring, strip cropping, contour bunding, graded bunding, broad based terraces, land leveling and grassed water ways conservation structures, gully control structures, sediment retention structures, retaining walls, field spillway, check dams, flood control structures. Wind erosion; wind erosiveness, types of soil movement, controlling surface wind velocity, assessment of wind erosion losses, conserving soil moisture. Sedimentation; sediment measurements; dynamics of suspended and bed sediment transport in erodible channels; erosion, transportation, and deposition of sediment by flowing water; depth-discharge relations for rivers; bed load and suspended load movement. Comparison of different sediment transport equations, bed load transport, suspended load, total load transport equations. Degradation and conservation of land and water; Land sustainability indicators, limiting factors in plant production affected by erosion, landslides, torrent and stream band erosion and protection. Sedimentation control measures. **Qualification aims:** • Increasing insights into the relation between soil erosion processes and sediment transport on the one hand and the possible strategies and techniques that can be applied in order to decrease the intensities of soil erosion and to better conserve soil and water, on the other	
Module character	2 hours of lectures per week 2 hours of tutorial per week	
Prerequisite of attendance	None	
Applicability	The module is compulsory for the Master Water Engineering and Management	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (2)	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Tucker, M. E. (2003). Sedimentary Rocks in the Field (3rd edition). John Wiley & Sons, New York ▪ Boggs, S. (2001). Principles of Sedimentology and Stratigraphy (3rd edition) Prentice Hall, New York	

	▪ Miall, A.D. (2000). Principles of Sedimentary Basin Analysis (3rd edition). Springer-Verlag, Berlin ▪ Leeder, M.R. (1999).Sedimentology and Sedimentary Basins: from turbulence to tectonics. Blackwell Science, London ▪ Allen, PA (1997). Earth Surface Processes. Blackwell Science, London ▪ Walker, R.G. and James, N.P. (1992). Facies models: response to sea level change. Geological Association of Canada, SI. John's

Module Number	**Module Name**	**Professor in Charge**
MWEM.07	**Drinking Water System / Modeling**	**Dr. ………**
Contents and qualification aims	**Contents:** An introductory course focusing on the fundamental mechanics of soil materials (gravel, sand, silt and clay) applied to geotechnical engineering problems. Topics studied include: phase relationships; index properties of coarse and fine grained soils; one-dimensional steady state seepage; effective stress; one-dimensional compression and consolidation; drained and undrained shear strength; and lateral earth pressure. Theoretical material is applied to examine real engineering issues with a particular focus on developing design skills and engineering judgment. Students will conduct physical experiments to explore soil behavior. The important role of geology on the mechanics of geotechnical materials is emphasized through classroom discussions and problem sets. A course focusing on design issues and methods of analysis for practical geotechnical engineering problems. Topics studied include: site investigation; capacity and settlement of shallow and deep foundations; two-dimensional steady state seepage; landslides and slope stability. Commercial software will be introduced to perform stability, deformation and seepage analyses. Students will conduct physical experiments to explore how design methods compare with real soil behavior. **Qualification aims:** This course will provide the student an introduction to the planning, design, and operation of drinking water using mathematical optimization methods and models. The student will learn to apply basic economic analysis and operations research techniques, and will apply them to various surface and ground water resource allocation problems	
Module character	2 hours of lectures per week 2 hours of tutorial per week	
Prerequisite of attendance	Water Quality Monitoring and Management and Geo informatics/GIS	
Applicability	The module is compulsory for the Master Water Engineering and Management	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (2)	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** 8. Krenkel P.A., Arnhoff K., Imhoff K. Karl Imhoff's Handbook of Urban Drainage and Wastewater Disposal 9. Sharma A.K., Swamee P.K. Design of Water Supply	

	Pipe Networks 10. Viessman W Jr., Hammer M.J. Water Supply and Pollution Control 11. Wang L.K., Okun D., A., Shammas N.K. Water Supply and Wastewater Removal

Module Number	**Module Name**	**Professor in Charge**
MWEM.08	**Applied Hydrology and Hydrogeology**	**Dr. ………**
Contents and qualification aims	**Contents:** **Groundwater concepts.** • Aquifers, aquitards and aquicludes • Confined and unconfined aquifers • Aquifer properties **Aquifer properties** • General flow equations • Methods of solution: flow nets, analytical solutions, numerical methods • Analytical solutions for regional flow in confined and unconfined aquifers • Radial flow to wells under steady state and transient conditions • Multiple wells: principle of superposition • Hydraulic boundary effects • Introduction to the use of distributed groundwater models **Groundwater exploration and development.** • Hydrogeological surveys • Geophysical techniques: resistivity, EM, seismic refraction • Exploratory drilling methods • Formation sampling and geophysical logging • Introduction to well design **Properties of rock and rock mass** • Engineering geology terminology • Standard laboratory tests • Logging and discontinuity analysis • Stereographic projection • Behavior of rock samples: strength and deformation • Behavior of rock mass • Slope failures in rock • Analysis of slope stability • Karst landforms and their implications for engineering structures **Qualification aims:** • To solve mathematical problems concerned with groundwater flow, geophysical surveys, rock discontinuities and slope stability • To question the assumptions underlying common methods of groundwater analysis, particularly in the context of the heterogeneous nature of the bedrock aquifers found in Ireland • To develop a conceptual model of an aquifer system and plan a groundwater investigation programme, including identification of suitable drilling, geophysical and other investigation techniques • To appraise rock behavior in a variety of contexts	
Module character	2 hours of lectures per week	

	2 hours of tutorial per week
Prerequisite of attendance	Applied Mathematics and Applied Statistics
Applicability	The module is compulsory for the Master Water Engineering and Management
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade
Frequency of the module	The module is offered annually in winter term
Work load	The work load is 150 hours
Duration of the module	The course takes one semester (1)
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Chow, V.T. et al. (1988) Applied hydrology. McGraw-Hill. ISBN 0-07-010810-2 ▪ Fetter, C.W. Applied Hydrogeology, 4th ed., Macmillan, 1994;ISBN: 0-3-088239-9 ▪ Foster et al. (1998) Groundwater in Urban Development. World Bank Technical Paper No. 390

Module Number	**Module Name**	**Professor in Charge**
MWEM.09	**Groundwater Modeling**	**Dr. ………**
Contents and qualification aims	**Contents:** Groundwater exploration: reconnaissance survey, surface investigation methods. Subsurface investigations including test drilling, drilling methods, resistivity logging, radiation logging, temperature logging, velocity measurement and other methods. Well design, construction and development. Deterioration of wells; its causes and remedial measures. Groundwater monitoring: observation network, water table fluctuation. Selection of sites for the observation network. Installation of observation wells and piezometers. Conjunctive use of surface and groundwater. **Qualification aims:** • To equip the students groundwater exploration techniques, well design, groundwater monitoring and conjunctive use of surface and groundwater	
Module character	2 hours of lectures per week 2 hours of tutorial per week	
Prerequisite of attendance	Applied Hydrology and Hydrogeology and Geo informatics/GIS	
Applicability	The module is compulsory for the Master Water Engineering and Management	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (3)	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Anderson, M.P. and W.W. Woessner , 1992, Applied Groundwater Modeling: Simulation of Flow and Advective Transport,Academic Press, 381 p ▪ Zheng, C., and G. D. Bennett, 2002, Applied Contaminant Transport Modeling Second Edition, Wiley, New York, 621 pp	

Module Number	**Module Name**	**Professor in Charge**
MWEM.10	**Hydraulic Structures**	**Dr. ………**
Contents and qualification aims	**Contents:** Introduction: Minor Irrigation Projects, crops and crop seasons, Canal Irrigation, Canal outlets, Canal Regulation, Design of retaining walls - Design of Canal falls, Design of distributary's head Regulator and Cross Regulator, Canal Escapes Design of Intakes and Canal Drop - Design of Cross- Drainage structures, uplift pressure under weir, protection works - Sediment Control Devices. **Qualification aims:** • To recognize the different types of hydraulic structures, to understand its purpose and function and to select the most appropriate structure and location for a specific problem • To design, to analyze and to proof that the hydraulic structure is save and economical • To broaden skills in team work, communication and planning through small projects	
Module character	2 hours of lectures per week 2 hours of tutorial per week	
Prerequisite of attendance	Applied Hydrology and Hydrogeology	
Applicability	The module is compulsory for the Master Water Engineering and Management	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (1)	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Arora K.R., "Irrigation Water Power and Water Resources Engineering", Standard Publishers Distributors, Delhi, 2002 ▪ Garg S.K., "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, New Delhi, 2002 ▪ Sharma R.K., "Irrigation Engineering and Hydraulic Structures", Oxford and IBH Publishing Co., New Delhi, 1984 ▪ Varshney R.S., Gupta S.C. and Gupta.R.L., "Theory and Design of Irrigation Structures", Nemchand & Brothers ,Roorkee, 1992	

Module Number	**Module Name**	**Professor in Charge**
MWEM.11	**Decision Support Systems**	**Dr. ………**
Contents and qualification aims	**Contents:** **Introduction (**Hydrologic Modeling Principles-Definitions: Process; System; Model; Decision Support System-Roles of models and DSS in the context of IWRM- Examples of commonly used models **Principles of Mathematical Modeling (**Collection and Analysis of Data (Pre-test)-Conceptual Design of a Model-Mathematical formulation of the conceptual design-Calibration of the Model- 2.5 Validation of the Model-Model Application: Forecast vs. Prediction-Classification of Models **Software Packages for Modeling & Decision Support (**MIKE BASIN, MIKE 11, MIKE SHE, - documentation & presentation) **Decision Support Systems – Practical Training (**Introduction to WEAP: Idea, Concept & Basic Tools-Data handling & scenario building in WEAP- Calculation of crop water and irrigation requirements-Demand & supply analysis, reservoirs & power production, water quality, financial analysis- Groundwater: The WEAP-MODFLOW linkage-Case Study: Creating a DSS for one of the main hydrological in Syria. **Qualification aims:** • To understand the basic principles of modeling and the necessary steps for a successful model application • To distinguish different options of modeling, their requirements and complexity • To know about various models with respect to different fields of application • To run at least one mathematical model and one decision support system independently	
Module character	2 hours of lectures per week 1 hour of tutorial per week	
Prerequisite of attendance	Applied Hydrology and Hydrogeology and Groundwater Modeling	
Applicability	The module is compulsory for the Master Water Engineering and Management	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (4)	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University.	

	Recommended: ▪ Jacques W. Delleur. „Frontmatter, The Handbook of Groundwater Engineering Editor-in-Chief Jacques W. Delleur Boca Raton: CRC Press LLC,1999:ftp://58.192.112.18/Pub2/EBooks/Books_from_EngnetBase/pdf/2698/2698fm.pdf (15.03.2011) Fundamentals of Ground Water [Paperback] ▪ Franklin W. Schwartz, Hubao Zhang , 2003; ISBN 0-471-13785-5, 2010, Gupta, S. K.Modern Hydrology and Sustainable Water Development, ISBN-10: 1-4051-7124-3ISBN-13: 978-1-4051-7124-3 - John Wiley & Sons ▪ Loucks, D.P., and E. van Beek. 2005. Water Resources Systems Planning and Management: An Introduction to Methods, Models, and Applications. Paris, France: UNESCO Press. Available online at http://ecommons.library.cornell.edu/handle/1813/2798. ▪ WEAP Tutorial: http://www.weap21.org/downloads/WEAP_Tutorial.pdf ▪ WEAP Manual: http://www.weap21.org/downloads/WEAP_User_Guide.pdf

Module Number	**Module Name**	**Professor in Charge**
MWEM.12	**Water System Management**	**Dr. ………**
Contents and qualification aims	**Contents:** **Overview on the IWRM relevant assessment and planning process** **Water Utility Management** • Transformation Experience and Organizational Structures of Water Utilities in Syria • Steering Control and Leakage Management. • Water Production • Pricing and Tariffs • Customer Relations and Accounting **Water Resources System Analysis** • Preparatory analysis • Stakeholder analysis • Policy analysis • Problem analysis • Analysis of objectives and strategies **Water Resources Planning and Management** • Revisited: Project Cycle Management • The Logical Framework Approach • Activity, resource and cost schedules • **Qualification aims:** • To conduct a comprehensive analysis of the water sector: social, environmental, and economic factors • To conduct a comprehensive water resources assessment at the watershed level • To name and critically analyze the steps needed to implement a comprehensive IWRM strategy at the national level • To set up general goals for the future development of a watershed and know participatory methods to achieve these goals • To select adequate instruments and methods in order to plan a project at national and international level • To translate the methods and theories into a case study (group work) that will be presented to the class	
Module character	2 hours of lectures per week 1 hour of seminar per week	
Prerequisite of attendance	Applied Hydrology and Hydrogeology	
Applicability	The module is compulsory for the Master Water Engineering and Management	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (2)	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University.	

	Recommended: ▪ CapNet: IWRM tutorial: http://www.cap-net.org/iwrm_tutorial/mainmenu.htm ▪ Cech, T.V. 2004, Principles of Water Resources: History, Development, Management, and Policy. John Wiley and Sons: New YorkGWP (2001). Tool Box for Integrated Water Resources Management , Stockholm, Sweden ▪ Heun, J. (2000), Water Resources Planning – A framework for analysis, Volume 2 supporting examples, IHE ▪ Hussein, I. A., "Application of Expert Decision Support Systems for Optimizing Water Supply in the Jordan Valley; The case of King Abdallah Canal" Water International, Volume 30, Number 3, September 2005, pp294-302 ▪ Hussein, I. A., Trainers Manual, " ToT Manual in Integrated Water Resources Management"under the supervision and fund of UNESCO – Cairo Offi ce, May 2006 ▪ United Nations Agencies: UNEP/ROWA, ESCWA and UNESCO-Cairo Offi ce, Water Resources Management in the Arab World: Problems and Prospective ▪ Journal of Water Resources Planning and Management ASCE, Reston VA, USA

Module Number	**Module Name**	**Professor in Charge**
MWEM.13	**Principles of Integrated Water Resources Management**	**Dr. ………**
Contents and qualification aims	**Contents:** **Water Problems and Issues of Concern** • Global and regional water crisis (specific reference to the Arab Region): water availability and scarcity, water & food security, water & environmental degradation, water & health, floods and droughts, climate change, conflicts over water between users, sectors, countries • Solutions inside and outside the water box. Demand for alternative approaches in water management **IWRM: Definitions, Concept and Status** • Comparing different approaches and definitions (integrated/adaptive/sustainable WRM) • Elements and levels of integration in IWRM • Implementation of IWRM **IWRM and Sustainable Development** • Water and development: water and poverty; equity; governance, gender; participation, MDGs • Value, ownership and management of water (monetary vs non-monetary; public vs. private, water rights) • International institutions, guidelines and policies **Water Resources Systems: Interactions between human and natural factors** • System definition and analysis; application to water resources (boundaries, elements, interactions, DPSIR, problem analysis) • Water cycle and water bodies, water quantity and quality concepts, water and its relation to other natural resources • The hydro-social cycle; human impacts on quantity and quality; storage, transport, distribution, uses of water • Water system management: external factors of water resources systems: environmental, economic and social realities and demands outside the water system; options to steer water systems **Qualification aims:** • To define causes and impacts of the most relevant water resources related problems in a global context and in the Arab Region • To distinguish current IWRM concepts and principles and reflect them critically • To have a clear understanding of the possible levels of integration (sectoral, multi-sectoral, holistic) and the regional extension of integrated concepts (trans-boundary, national, river basin, multi-sectoral, holistic) and the regional extension of integrated concepts (trans-boundary, national, river basin, local) • To describe the role of water for development proc-	

	esses of societies. • To express the value of water applying monetary and non-monetary concepts • To distinguish different approaches to ownership and right to use water • To explain the roles of international organizations and policies regarding water resources management • To describe water resources problems using the system approach • To understand the interactions between the natural and human factors within and outside of water resources systems
Module character	2 hours of lectures per week 2 hours of tutorial per week
Prerequisite of attendance	Basic knowledge in hydrology, meteorology, ground water management, urban drainage and system analysis
Applicability	The module is compulsory for the Master Water Engineering and Management
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade
Frequency of the module	The module is offered annually in winter term
Work load	The work load is 150 hours
Duration of the module	The course takes one semester (4)
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Allan, Tony: 2003, IWRM/IWRAM: a new sanctioned discourse? Occasional papers 50 SOAS Water Issues Study Group, School of Oriental and African Studies / Kings College London. University of London, April 2003 ▪ Biswas, A.K. 2005. Integrated Water Resources Management: a reassessment. In A.K. Biswas, O. Varis, & C. Tortajada (Eds.) Integrated Water Resources Management in South and Southeast Asia . pp. 325-341. New Delhi : Oxford University Press ▪ CapNet: IWRM tutorial: http://www.cap-net.org/iwrm_tutorial/mainmenu.htm ▪ Cech, T.V. 2004, Principles of Water Resources: History, Development, Management, and Policy. John Wiley and Sons: New York ▪ GWP, 2000, Integrated Water Resources Management, TAC background paper No.4, GWP Stockholm ▪ GWP-INBO, 2009 A Handbook for Integrated Water Resources Management in Basins ▪ Heathcote IW. 2009. Integrated Watershed Management: Principles and Practice. Wiley. Second edition ▪ UNESCO 2006; 2009: World Water Development Reports 2 and 3

Module Number	**Module Name**	**Professor in Charge**
MWEM.14	**Water Resources Planning**	**Dr. ………**
Contents and qualification aims	**Contents:** Introduction; planning principles; engineering and economic planning concepts; elements of project formulation and appraisal; mathematical models; analysis of risk and uncertainty; environmental impact assessment; water resources in Syria; sustainable development of water resources. **Qualification aims:** • arn the principles of integrated water resources management • To learn the optimization techniques in water resourcTo learn how to assess surface and ground water resources • To learn how to develop suitable plans for water resource development and management • To learn how to estimate sustainable yield of the water resources and how to determine the needed storage of water reservoirs • To learn about water resources management issues using structural and non-Structural measures • To lees planning and management	
Module character	2 hours of lectures per week 2 hours of tutorial per week	
Prerequisite of attendance	Applied Mathematics and Applied Hydrology and Hydrogeology	
Applicability	The module is compulsory for the Master Water Engineering and Management	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in winter term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (1)	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Loucks D.P., Stedinger J.R. and Haith D.A., Water Resources Systems Planning and Analysis,Prentic Hall,USA,1981 ▪ Mays L.W. and Tung Y.k., Hydro systems Engineering and Management, McGraw Hill, USA, 1992 ▪ Vendula S. and Mujumdar P.P., Water Systems: Modeling Techniques and Analysis, Tata-McGraw Hill,2005 ▪ Jain S.K. and Singh V.P., Water Systems Engineering and Management, Elsevier, The Netherlands, 2003 ▪ Loucks D.P. and Van Beek E., Water systems Planning and Management, UNESCO Publishing, The Netherlands, 2005	

Module Number	**Module Name**	**Professor in Charge**
MWEM.15	**Public Health and Sanitation**	**Dr. ………**
Contents and qualification aims	**Contents:** **Introduction** • Role of sanitation for economic development, environment and health, relation to MDGs • Relation to other sectors: housing, energy, environment **Public Health** • **Water borne diseases** • **Water supply and public health** • **Sewage disposal and public health** • **Water reuse and public health** • **Interactions** for wastewater **Wastewater composition and quantity** • **Domestic wastewater characteristics** • **Industrial wastewater characteristics** • **Storm water characteristics** • Flow rates **Environmental aspects of wastewater** • Quality issues in watercourses • Quality demands for treated wastewater (regulations) **Wastewater collection** • Components • Appurtenances • Design • Construction • Operation and maintenance • Centralized and decentralized systems **Wastewater treatment** • Mechanical treatment • Biological treatment (aerobic and anaerobic treatment systems) • Nutrient removal (P,N) • Disinfection • Ponds and wetlands • Decentralized and centralized treatment • Wastewater reuse • Effluent ultimate disposal options • Wastewater treatment options for small communities **Qualification aims:** • Understand major environmental factors and influences in wastewater treatment plants and public health interactions for wastewater reuse • Understand basic theoretical aspects of wastewater microbiology and pathogen removal and wastewater reuse impact on human health Estimate wastewater flow rates • Distinguish different wastewater characteristics and know how they are measured or quantified • Know wastewater collection system components, appurtenances, operation and maintenance; know the basics of sewer design	

	• Know wastewater treatment options for small communities • Understand the concept of water chain • Distinguish the concepts of centralized and decentralized systems • Know the concepts and the existing varieties of biological treatment systems
Module character	2 hours of lectures per week 1 hour of seminar per week
Prerequisite of attendance	None
Applicability	The module is compulsory for the Master Water Engineering and Management
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade
Frequency of the module	The module is offered annually in winter term
Work load	The work load is 150 hours
Duration of the module	The course takes one semester (2)
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University **Recommended:** ▪ McGhee, Terence J., Water Supply and Sewerage, 6th edition, McGraw-Hill series in Water Resources and Environmental Engineering, 1991 ▪ Metcalf and Eddy, Wastewater Engineering, 3rd edition, McGraw-Hill, Inc. 1991 ▪ California State University, Sacramento, Office of Water Programs, Operation and Maintenance of Wastewater Collection Systems, 5th edition, 1999

<table>
<tr><th>Module Number</th><th>Module Name</th><th>Professor in Charge</th></tr>
<tr><td>MWEM.16</td><td>Water Resources Develop-ment</td><td>Dr. ………</td></tr>
<tr><td>Contents and qualification aims</td><td colspan="2">Contents: Global water crisis – Water, industry & develop-ment - Agriculture, water and development – Aridity and climate change – Enhancing supply through technology - Enhancing supply through conservation – Managing demand through pricing – Managing demand through conservation – Catchments, development and integrated management – Water governance and course review.

Qualification aims:
To provide an introduction to the global water crisis
To explore key relationships between water resources and the process of development
To place contemporary problems of water availability in a historical perspective of changing management strategies
To understand the relationships between water supply, sanitation and health
To understand the spatial dimensions of water supply and demand
To understand the potential impacts of climate change on water resources
To gain critical understanding of water supply enhance-ment strategies
To gain critical understanding of water demand manage-ment strategies
To develop cognitive, analytical and communication skills</td></tr>
<tr><td>Module character</td><td colspan="2">2 hours of lecture per week
1 hour of tutorial per week</td></tr>
<tr><td>Prerequisite of attendance</td><td colspan="2">Principles of Integrated Water Resources Management</td></tr>
<tr><td>Applicability</td><td colspan="2">The module is one of 6 optional modules for the Master Wa-ter Engineering and Management</td></tr>
<tr><td>Prerequisite achieve credit points</td><td colspan="2">Having passed the module exam. The module exam is a written examination (120 minutes)</td></tr>
<tr><td>Credit points and grade</td><td colspan="2">The module earns 5 credits
The grade for the examination equals the module grade</td></tr>
<tr><td>Frequency of the module</td><td colspan="2">The module is offered annually in summer term</td></tr>
<tr><td>Work load</td><td colspan="2">The work load is 150 hours</td></tr>
<tr><td>Duration of the module</td><td colspan="2">The course takes one semester (3)</td></tr>
<tr><td>Reference Materials</td><td colspan="2">Essential:
Reference Materials available at Faculty of Civil Engineering, Damascus University.
Recommended:
Allam, Gamal Ibrahim Y., Decision Support System for Integrated Watershed Management, Colorado State Uni-versity, 1994
American Socy. of Civil Engr., Watershed Management, American Soc. of Civil Engineers, New York, 1975
Black Peter E., Watershed Hydrology, Prentice Hall, Lon-don, 1991
Michael A.M., Irrigation Engineering, Vikas Publishing House, 1992</td></tr>
</table>

Module Number	**Module Name**	**Professor in Charge**
MWEM.17	**Water Supply and Sanitation**	**Dr. ………**
Contents and qualification aims	**Contents:** Introduction: Overview of water supply and sanitation in Syria; Health aspects of water supply and sanitation; water quality criteria. Water supply: sources of water, choices of water sources (spring, wells etc.) and their protection; forecasting population; consumption for various purposes, factors effecting consumption; economics of community water supply. Water treatment and distribution: sedimentation tank; coagulation; flocculation, usual coagulants, mixing devices, filtration, filter sand, classification of filters, disinfections, and chlorination. Sanitation and wastewater treatment: purpose of sanitation, site for sewage treatment work; water borne diseases and their control; health and water chemistry; planning and design of low cost sanitation; composting and biogas, sanitation and irrigation; agriculture and aqua cultural reuse. **Qualification aims:** • To provide the students with basic knowledge of water supply and sanitation	
Module character	2 hours of lecture per week	
Prerequisite of attendance	Drinking Water System / Modeling and Water System Management	
Applicability	The module is one of 6 optional modules for the Bachelor Water Engineering and Management	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in summer term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (3)	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ WHO Guidelines for Drinking Water Quality, 3rd Edition.Ch.3:Health-based targets ▪ Loomis and Wing. 2001. Theories of Causation.Ch.3in Thomas& Weber, eds. Epidemiologic Methods for the Study of Infectious Diseases. Oxford University Press ▪ Fewtrell,L.,R.B.Kaufmann,D.Kay,W.Enanoria,L.Haller,andJ.M.Colford,J.r.2005.Water, sanitation, and hygiene interventions to reduce diarrhea in less developed countries: a systematic review and meta-analysis. Lancet Infectious Diseases 5:42-52	

Module Number	**Module Name**	**Professor in Charge**
MWEM.18	**Public Education and Participation**	**Dr. ………**
Contents and qualification aims	**Contents:** Stakeholders; Benefits of public participation; Levels of participation; Techniques used including: printed materials, information centers, press information, site visits or field trips, exhibitions, information hotlines, public forums, workshops, individual interview and/or survey, focus groups, coffee meetings, technical assistance to public Stakeholders, using NGO's to consult the affected public, and advisory committees. **Qualification aims:** Through participation in assigned activities, students will: • Recognize and understand the interactive model of communication • Understand how culture, ethnicity, and gender influence communication	
Module character	2 hours of lecture per week	
Prerequisite of attendance	None	
Applicability	The module is one of 6 optional modules for the Bachelor Water Engineering and Management	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in summer term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (3)	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Hanson, T. L.and Mallard, J. S. (eds.). (2010).More than public speaking: An introduction to communication. Boston, MA: Pearson Custom Publishing.(ISBN 13:978-0-558-69059-5) ▪ Jerom Delli Priscol. Participation, Consensus Building and Conflict Management-Training Course, UNESCO, IHP, WWAP, PC→CP series no. 22 ▪ Mallard, J. S. and Hanson, T. L. (2010).More than public speaking: An introduction to communication work book. Boston, MA: Pearson Custom Publishing. (ISBN0558764762)	

Module Number	**Module Name**	**Professor in Charge**
MWEM.19	**Optimal Use of Irrigation Water**	**Dr. ………**
Contents and qualification aims	**Contents:** The relations between water use and crop yield: crop water use, concept of relative yield and relative evapotranspiration, FAO method and its limitations, difference between seasonal ET deficit and ET deficit within a growth cycle. Elementary optimization principles and practices: choice of crop and variety, comparison of late vs. early varieties, adapting cropped area to water application (concept of full and deficit irrigation), distributing water deficit between crops in dependence of the sensitivity to seasonal and periodical water stress. Different sowing/planting dates and staggering: shifting of crop water requirements and irrigation requirements in time and quantity, staggering sowing/planting: attenuating crop water requirements and irrigation requirements, effects of staggering. The soil moisture reservoir; irrigation scheduling and deficit irrigation: soil properties that can effect crop water requirements, different irrigation scheduling options (optimal vs. practical irrigation), adequacy of irrigation scheduling options, pre-irrigation, carry-over of soil moisture to the next crop, improving irrigation scheduling by water exchange. Optimization of cropping pattern in relation to the availability of land and water resources: how to optimize the cropping pattern of one example farm; Optimization of cropping pattern taking in account farming goals, resources and constraints: effect of farmers goals (subsistence vs. generating cash income), resources (land, labour, water etc.) on the farm-level decisions; how to avoid or minimize risks. **Qualification aims:** • To equip the students with detailed knowledge of optimization principles and practices at the farm level in order to get maximum yield
Module character	2 hours of lecture per week 1 hour of tutorial per week
Prerequisite of attendance	Water System Management
Applicability	The module is one of 6 optional modules for the Bachelor Water Engineering and Management
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade
Frequency of the module	The module is offered annually in summer term
Work load	The work load is 150 hours
Duration of the module	The course takes one semester (2)
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** ▪ Majumdar D. P., Irrigation Water management Principles and Practices, Prentice Hall of India, New Delhi,

	2005 ▪ Dewasish Choudhary, Irrigation Theory and Practice, Anmol Pub., 2008 ▪ Michal A.M., Irrigation Theory and Practice, Vikas Publishing House, New Delhi, 1999 ▪ Van den Bosch B.E., Hoevenaars J. and Broumer C., Irrigation Water Management Training Manual No.1 to 7, FAO, Rome, 1999 ▪ Asawa G.L., Irrigation Engineering, New Age International Private Limited, New Delhi, 1996

Module Number	**Module Name**	**Professor in Charge**
MWEM.20	**Reservoirs Operations and Management**	**Dr. ………**
Contents and qualification aims	**Contents:** Purpose of reservoir operation. Reservoirs classification; storage, flood control, retarding, detention and distribution reservoirs. Hydrological data required for reservoir operation, reservoir operation rules, policies and procedures. Major reservoirs of Pakistan and their operational and management rules. Regulation of flood control, power generation, irrigation reservoirs. Single and multipurpose operation, reservoir operation using system analysis techniques and operational research. Determination of reservoir capacity required for specific yield or demand using mass curve. Demand pattern for various type of reservoirs. Flood routing by graphical inflow; outflow discharge curve method; Trial and error method. Sources of sediment; Factors affecting erosion, silt load estimate for reservoirs; Mechanism of sediment distribution in reservoirs; Prediction of sediment distribution; Estimation of life of a reservoir. Operation and Maintenance of small dams: Maintenance of spillways, outlet pipes, earth embankments and foundation, storage dams, diversion dams, flood detention reservoirs; emergency preparedness plan, periodic examination and evaluation, reservoirs problem, silting seepage control, toxic algae, reservoir safety, marine life. **Qualification aims:** • To acquaint the students with the understanding of reservoir operation and problems related to management of reservoirs	
Module character	2 hours of lecture per week 2 hour of tutorial per week	
Prerequisite of attendance	Hydraulic Structures and Water System Management	
Applicability	The module is one of 6 optional modules for the Bachelor Water Engineering and Management	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in summer term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (2)	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University. **Recommended:** • Loucks, D. P. and Ellco Van Beek (2005)Â Water Resources Systems Planning and Management : An Introduction to Methods, Models and Applications, UNESCO, Netherlands • Vedula, S. and Mujumdar, P. P. (2005) Water Resources Systems: Modeling Techniques and Analysis,	

	A Tata McGraw Hill, New Delhi. • Mays L.W and Tung Y-K, (1992) Hydro systems Engineering and Management, McGraw Hill, USA • Simonovic, S. P. (2009) Managing Water Resources: Methods and Tools for a Systems Approach, UNESCO Publishing, France

Module Number	**Module Name**	**Professor in Charge**
MWEM.21	**Water Right and Conflict Resolution**	**Dr. ………**
Contents and qualification aims	**Contents:** **Water Law And Legislation (**Introduction to Water Law in Ancient Civilizations, Sources of Water Laws and Exiting Water Laws, Syrian National Specifics and Legislation, Islamic Water Laws, International laws). **Participation, Consciences Building and Conflict Management (**The need for Process Tools for Water Manager, Conflict Management and Disputes Resolution, Negotiation and Dialog in Water Management, Negotiation Tools and Techniques). **Shared Vision Planning. Possible Scenarios for Resolving Water Conflicts over Country's Needs**. **Application to Case Studies at regional and international levels.** **Qualification aims:** • To provide participants with some background information on water law and legislation including water law in ancient civilizations, sources of water laws, exiting water law, Syrian national specifics, and legislation, Islamic and international water laws • To introduce participants to the decisions taken at the international and regional meetings related to water conflicts • To discuss water conflicts in both the regional and international context • To discuss water conflicts in both the regional and international context • To develop skills of the participants in the course on how the best to use the UN system to their advantage, and stakeholder analysis and participation, drafting and negotiation skills • Identify the characteristics of effective participatory, shared vision planning and consensus building	
Module character	2 hours of lectures per week 1 hour of seminar per week	
Prerequisite of attendance	None	
Applicability	The module is one of 6 optional modules for the Bachelor Water Engineering and Management	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in summer term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (2)	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University **Recommended:**	

	▪ Guptu, J. (2004): International Water Law, UNESCO, Institute for Water Education (IHE), Netherlands ▪ Ingram, Helen and Anne Schneider,Science, Democracy, and Water Policy ,Water Resources Update 133(autumn 1999) ▪ Islamic Education, Scientific and Cultural Organization (1997): Water Management, Rabat Morocco ▪ Priscol, Jerome Delli, (2003): Participation, Consensus Building and Conflict Management, Training Course, Institute for Water Education (IHE), Netherlands ▪ Roux, Georges (1980): Ancient Iraq, Penguin Books, London, England

Module Number	**Module Name**	**Professor in Charge**
MWEM.22	**Writing of proposals for water projects**	**Dr. ………**
Contents and qualification aims	**Contents: Introduction, Writing a Funding Proposal** (Useful Tips for Planning- Useful Tips for Planning-Some Useful Tips on Writing-Hints on the Appearance), **Components of a Typical Proposal** (Title Page or Cover Page- Project Overview or Summary - Contents Page), **Background Information or Statement of the Problem**, **Project Details** (Goals and Objectives- Rationale - Target Group-Methodology (Activities)- Project Management / Staff / Administration), **Available and Needed Resources** (Available Resources- Needed Resources- The Budget), **Evaluation of Project Outcomes, Appendices, Covering Letter, Annexes.** **Qualification aims:** • To acquaint the students with the understanding of writing of proposals for water projects	
Module character	2 hours of lecture per week	
Prerequisite of attendance	All modules	
Applicability	The module is compulsory for the Master Water Engineering and Management	
Prerequisite achieve credit points	Having passed the module exam. The module exam is a written examination (120 minutes)	
Credit points and grade	The module earns 5 credits The grade for the examination equals the module grade	
Frequency of the module	The module is offered annually in summer term	
Work load	The work load is 150 hours	
Duration of the module	The course takes one semester (3)	
Reference Materials	**Essential:** Reference Materials available at Faculty of Civil Engineering, Damascus University **Recommended:** Theory and practice will be presented mostly from the reference materials available at Faculty of Civil Engineering, Damascus University; however additional material will be used from various sources. Example problems will be solved in class. Practical applications will be presented. Students are responsible for all lecture and recitation material. There is no attendance policy, however, there will be a significant amount of information that will be covered in class that is not found in the reference materials available at Faculty of Civil Engineering, Damascus University.	

Module Number	**Module Name**	**Professor in Charge**
MWEM 23	**Practical Training/ Project Study**	**Dr. ………**
Contents and qualification aims	The Student must carry out practical training about one Problem belongs to subjects of the Master course of Water Engineering and Management in one or more institution or incorporation, and he must present full study about this problem.	
Module character	Practical Training/ Project Study: 10 Hours tutorial per week	
Prerequisite of attendance	Basic Knowledge of Practical Training/ Project Study, the student must be in the 3rd Semester.	
Applicability	the module is suitable for the professional and research oriented studies in civil and environmental engineering	
Prerequisite achieve credit points	Having passed the module seminar and presentation before a commission.	
Credit points and grade	The module earns 10 Cr. The final Grade is generated with 100% as presentation in front of committee.	
Frequency of the module	The module is offered annually.	
Work load	The work load is 300 hours.	
Duration of the module	The module takes one term starting in Semester 3.	
Reference Materials	1. **Old Master, Bachelor thesis** and **Practical Training** reports which are available in the Libraries of the University. 2. James E. Mauch and Namgi Park: **Guide to the Successful Thesis and Dissertation, A Handbook for Students and Faculty**. 2003. 5th ed. Copyright ©2003 by Marcel Dekker. ISBN: 0-8247-4288-5.	

Module Number	**Module Name**	**Professor in Charge**
MWEM.24	**Master Thesis plus Defense**	**Dr. ………**
Contents and qalification aims	The Student must work Master Thesis with Defense about one Problem belongs to the subjects of the Master course of Water Engineering and Management in one or more institution or incorporation, and he must present full study about this problem.	
Module character	Master Thesis with defense: 30 hours tutorial per week.	
Prerequisite of attendance	Basic Knowledge of Master Thesis with Defense, the student must be in 6 Semester.	
Applicability	the module is suitable for the professional and research oriented studies in civil and environmental engineering	
Prerequisite achieve credit points	Having passed the module presentation before a commission.	
Credit points and grade	The module earns 30 Cr. The final Grade is generated with 100% as presentation in front of committee.	
Frequency of the module	The module is offered in 6 semester	
Work load	The work load is 900 hours.	
Duration of the module	The module takes one term starting in Semester 4.	
Reference Materials	1. James E. Mauch and Namgi Park: **Guide to the Successful Thesis and Dissertation, A Handbook for Students and Faculty**. 2003. 5th ed. Copyright ©2003 by Marcel Dekker. ISBN: 0-8247-4288-5. 2. Derek Swetnam: **Writing Your Dissertation, How to plan, prepare and present successful work**.2007, 3rd ed. ISBN: 978 1 84803 126 5. 3. Louis Cohen; Lawrence Manion and Keith Morrison: **Research Methods in Education**, 2005, 5th ed. ISBN 0-203-22434-5 Master e-book ISBN. 4. **Old Master and Bachelor thesis**, which are available in the Libraries of the University.	

28. Course Requirements

Assignments

Assignments will be due either one or two weeks after they are handed out depending on their length. Grades will be reduced 10% for each day late.

Exams

In-class midterm and a final examination.

Grading

Activity	Percentage
Assignments	20%
In-class Midterm Exam	10%
Final Exam	70%

Below is a table that lists University letter grades (last column) and the equivalent percentages The Instructor will use for grading. All numerical grades will be rounded up or down to the nearest integer. The Instructor reserves the right to adjust the scores of any exam or the cumulative average in the students' favor if necessary, i.e. The Instructor reserves the right to add a few percentage points to every student's grade. No work for extra credit shall be given. An "Incomplete" grade will not be given to students who have missed exams.

Grading Matrix

Numerical value		Equivalent University Letter grade
greater than or equal to (%)	and less than (%)	
90	100	A
87	90	A-
84	87	B+
80	84	B
77	80	B-
74	77	C+
70	74	C
67	70	C-
64	67	D+
60	64	D
---	60	F

Master Thesis plus Defense:

IX. The Master thesis meets the basis requirements of Bologna System.

- The Master thesis covers 30 ECTS.
- Supervisors have to meet the requirements of the university at which the thesis is undertaken.
- A thesis proposal and a preliminary report of the thesis are presented in a seminar.
- The thesis is written in Arabic (or English).
- The written thesis is an independent work which has to cover the following aspects
  - Relevant, clearly formulated and testable problem definition
  - Theoretical framework and research methodology
  - Description of the research project
  - Analysis and interpretation of the results, conclusions
  - Responsible and transparent use of relevant references

X. An examiner independent of the supervisor examines the thesis.

XI. The candidate must defend his/her thesis in a public defense. The evaluation of the thesis and of the thesis defense is carried out on the basis of the Thesis Evaluation Form and the Thesis Defense Evaluation Form.

XII. The student participating in a degree programme will be awarded a diploma by the university which had been attended by the student.

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MODULE COMPENDIUM

Water Engineering and Environment

(BWEAE)

Bachelor Programme

Tishreen University Lattakia

Department of Water Engineering and Irrigation
Faculty of Civil Engineering

2015

EDUWAT: 511251-TEMPUS-1-2010-1-DE-TEMPUS-SMHES
Development of a Modern Higher Education System for Water Engineering in Syria

Developed by
Prof.Dr. Eng. Izzeddin Hassan
Prof. Dr. Eng. Camille Bouras
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1-Goals of the Bachelor Course of Water Engineering and Environment

The academic plan in the Bachelor course of water engineering and environment program, aims at providing the students the following items:

1. High level information in science and computer techniques, and developing the skills in engineering sciences and its applications.
2. Developing the ability of the students to achieve various water engineering and environmental studies, check and use it according to the engineering codes.
3. Comparing between the engineering solutions, and choose the optimum ones.
4. Developing the work skills and regulate the relationship between the work team which the best and have many specialists.
5. Strengthening the research ability and developing and working with the modest software's, equipments… etc.
6. Developing the item of the scientific, social and cultural of the student's characters.
7. Continuous developing to get the high quality of the research, teaching...etc.

2. Modules of Bachelor Course Water Engineering and Environment BWEAE

	Credits	**%**
Modules with Basics in Mathematics and Natural Sciences	26	14
Modules with Basics in Engineering	74	41
Modules with Basics in Hydro Sciences	16	9
Modules with specialized Basics	30	17
Elective Modules	9	5
Modules for general Qualification	10	6
Practical Training /Project	6	3
Bachelor examination	9	5
Total	**180**	**100**

Module/ Semester	**1**	**2**	**3**	**4**	**5**	**6**	**Total/ ECTS**
Basics in Mathematics and Natural Sciences	18	5	3				**26**
Basics in Engineering	8	18	21	13	9	5	**74**
Basics in Hydro Sciences		3	5	8			**16**
Specialized Basics				5	12	13	**30**
Elective Modules				3	3	3	**9**
General Qualification	4	4	2				**10**
Practical Training/ Project Study						6	**6**
Bachelor Thesis incl. Defense						9	**9**
Total	**30**	**30**	**30**	**30**	**30**	**30**	**180**

	Modules in Natural Sciences 25%		Modules inTechnical Sciences 25%		Modules in Economic & Social Sciences 25%		Modules in Variable Sciences 25%

Nr of Module	**Course Semester**	**1**	**2**	**3**	**4**	**5**	**6**	**Total/ ECTS**
	Basics in Mathematics and Natural Sciences	**18**	**5**	3				**26**
BWEAE 01	Mathematics (1,2,3)	5	5	3				13
BWEAE 02	Physics for Engineering	5						3
BWEAE0 3	Chemistry for Engineering	5						3
BWEAE 04	Basic of Informatics	3						3
	Basics in Engineering	**8**	**18**	**21**	**13**	**9**	**5**	**74**
BWEAE 05	Mechanical Engineering	5						5
BWEAE 06	Building Materials		5					**3**
BWEAE0 7	Mechanics of materials		5					**6**
BWEAE 08	Geometrical Representation	3						**3**
BWEAE 09	Engineering Geology		5					**3**
BWEAE 10	Structures Analysis			5				**5**
BWEAE 11	Soil Mechanics			5				**5**
BWEAE 12	Reinforced Concrete (1+2)				3	3		**6**
BWEAE 13	Numerical Analysis and Modeling					3		**3**
BWEAE 14	Foundation Engineering				5			**3**
BWEAE 15	Metal and Mixed Structures				5			**5**
BWEAE 16	Building Construction		3					**3**
BWEAE 17	Roads and Transportation Engineering					3		**3**
BWEAE 18	Geodesy			5				**5**
BWEAE 19	Economic and Engineering Projects Management						5	**3**
BWEAE 20	Technical equipments			3				**3**
BWEAE 21	Technology of Construction			3				**3**
	Basics in Hydro Sciences		**3**	**5**	**8**			**16**
BWEAE 22	Hydrology		3					**3**
BWEAE 23	Fluids Mechanics			5				**4**
BWEAE 24	Basics of Environment and Sanitary Engineering				3			**4**
BWEAE 25	Hydraulics				5			**3**
	Specialized Basics				**5**	**12**	**13**	**30**
BWEAE 26	Drinking and Waste Water Networks				5			3
BWEAE 27	Drinking and Waste Water Treatment					5		3
BWEAE 28	Irrigation and Drainage					3		3
BWEAE 29	Water Structures					4		3
BWEAE 30	Dams						5	3
BWEAE 31	Pumping Station and Hydraulics Machines						3	3
BWEAE 32	Harbors Engineering						5	**5**

	Elective Modules				**3**	**3**	**3**	**9**
BWEAE 33	Solid Waste Management and Contaminates Treatment				+	+	+	**3**
BWEAE 34	Water Exploitation and Management				+	+	+	**3**
BWEAE 35	Water Chemistry and Microbiology				+	+	+	**3**
BWEAE 36	Execution Technology of Water Structures				+	+	+	**3**
BWEAE 37	Water Resources development and advanced Technologies				+	+	+	**3**
BWEAE 38	Municipal and Industrial Water Management				+	+	+	**3**
BWEAE 39	Engineering Hydrogeology				+	+	+	**3**
BWEAE 40	Drainage and Land Reclamation				+	+	+	**3**
BWEAE 41	Irrigation and Drainage Networks				+	+	+	**3**
BWEAE 42	Dams related Structures				+	+	+	**3**
BWEAE 43	Coastal Protection Engineering				+	+	+	**3**
BWEAE 44	Exploitation and Management of Sea Structures				+	+	+	**3**
BWEAE 45	Exploitation and Management of Water Structures				+	+	+	**3**
BWEAE 46	Water Tanks				+	+	+	**3**
	From these Courses students must select one course in each Semester 4, 5 and 6 (from 4 groups (sanitary Engineering, Harbor and Coastal Engineering, Water structures, Water resources management).							
	General Qualification	**4**	**4**	**2**				**10**
BWEAE 47	English	**+**						**2**
BWEAE 48	Arabic		**+**					**2**
BWEAE 49	Arabic Culture	**+**						**2**
BWEAE 50	History of Sciences and Technologies		**+**					**2**
BWEAE 51	Rights and Water Legislations			**+**				**2**
BWEAE 52	**Practical Training/ Project Study**					**6**		**6**
BWEAE 53	**Bachelor Thesis with Defense**						**9**	**9**
	Total	**30**	**30**	**31**	**29**	**30**	**30**	**180**

3- Study Plan of Bachelor Course Water Engineering and Environment BWEAE,

Nr of Module	Courses	S. 1	S. 2	S. 3	S. 4	S. 5	S. 6	Total/ ECTS
	Modules in Basic Sciences							
BWEAE 01	Mathematics (1,2,3)	4/2/0/0	4/2/0/0	2/2/0/0				12
BWEAE 02	Physics for Engineering	4/0/2/0						5
BWEAE 03	Chemistry for Engineering	4/0/2/0						5
BWEAE 04	Basic of Informatics	2/2/0/0						3
	Basics in Engineering							
BWEAE 05	Mechanical Engineering	4/2/0/0						5
BWEAE 06	Building Materials		4/2/0/0					5
BWEAE 07	Mechanics of material		4/2/0/0					5
BWEAE 08	Geometrical Representation	1/3/0/1						3
BWEAE 09	Engineering Geology		4/2/0/0					5
BWEAE 10	Structures Analysis			4/2/0/0				5
BWEAE 11	Soil Mechanics			4/2/0/0				5
BWEAE 12	Reinforced Concrete (1+2)				2/2/0/0	2/2/0/0		6
BWEAE 13	Numerical Analysis and Modeling					2/2/0/0		3
BWEAE 14	Foundation Engineering				4/2/0/0			5
BWEAE 15	Metal and Mixed structures				4/2/0/0			5
BWEAE 16	Buildings Construction		1/3/0/1					3
BWEAE 17	Roads and Transportation Engineering					4/2/0/0		5
BWEAE 18	Geodesy			4/2/0/0				5
BWEAE 19	Economic and Engineering Projects Management						4/2/0/0	5
BWEAE 20	Buildings Services			2/2/0/0				3
BWEAE 21	Technology of Construction			2/2/0/0				3
	Basics in Hydro Sciences							

BWEAE 22	Hydrology		2/2/0/0					3
BWEAE 23	Fluids Mechanics			3/2/2/0				5
BWEAE 24	Basics of Environment and Sanitary Engineering				2/2/0/0			
BWEAE 25	Hydraulics				3/2/2/0			5
	Specialized Basics							
BWEAE 26	Drinking and Waste Water Networks				4/2/0/0			5
BWEAE 27	Drinking and Waste Water Treatment					4/2/0/0		5
BWEAE 28	Irrigation and Drainage Engineering					2/2/0/0		3
BWEAE 29	Water Structures					2/2/1/1		4
BWEAE 30	Dams Engineering						4/2/0/0	5
BWEAE 31	Pumping Station and Hydraulics Machines						2/2/0/0	3
BWEAE 32	Harbors Engineering						4/2/0/0	5
	Elective Modules							
BWEAE 33	Solid Waste Management and Contaminates Treatment				2/2/0/0	2/2/0/0	2/2/0/0	**3**
BWEAE 34	Water Exploitation and Management							**3**
BWEAE 35	Water Chemistry and Microbiology							**3**
BWEAE 36	Execution Technology of Water Structures							**3**
BWEAE 37	Water Resources development and advanced Technologies							**3**
BWEAE 38	Municipal and Industrial Water Management							**3**
BWEAE 39	Engineering Hydrogeology							**3**
BWEAE 40	Drainage and Land Reclamati-							**3**

	on							
BWEAE 41	Irrigation and Drainage Networks							**3**
BWEAE 42	Dams related Structures							**3**
BWEAE 43	Coastal Protection Engineering							**3**
BWEAE 44	Exploitation and Management of Sea Structures							**3**
BWEAE 45	Exploitation and Management of Water Structures							**3**
BWEAE 46	Water Tanks							**3**
	From these Courses students must select one course in each Semester 4, 5 and 6							
	General Qualification							
BWEAE 47	English	2/0/0/0						2
BWEAE 48	Arabic		2/0/0/0					2
BWEAE 49	Arabic Culture	2/0/0/0						2
BWEAE 50	History of Sciences and Technologies		2/0/0/0					2
BWEAE 51	Rights and Water Legislations			2/0/0/0				2
	Practical Training/ Project Study							
BWEAE 52	Practical Training/ Project Study					**6**		**6**
	Bachelor Thises with Defense							
BWEAE 53	Bachelor Thesis with Defense					**9**		**9**
	Total	**30**	**30**	**30**	**30**	**30**	**30**	**180**

Lecture/Tutorial/Laboratory/Excursion(Homeworks)

4- Definition of the modules of Bachelor Course Water Engineering and Environment BWEAE- TIU

Basics in Mathematics and Natural Sciences		
Module Number	**Module Name**	**Prof. in Charge**
BWEAE 01-1	**Mathematics 1 (analysis, algebra)**	**Prof. Dr.**
Contents and Qualification aims	The module deals with understanding the basics of analysis such as Functions, limits, continuity and the inverse functions, dogmatic, inverse dogmatic and The differential and derivative-partial derivatives, vector analysis and the complex analysis. The module covers in the part algebra The complex numbers, The matrixes-determinant and operations on it and Linear equations system. And The module covers in the part annalistic geometry in space- the differential geometry Plane, line, surface and curves in space sphere, The general equation of second degree surfaces, The spatial curves, theorem in (normal and irregular points). The students' knowledge will be developed during tutorials to give the students enough knowledge and ability in these fields.	
Module Character	Mathematic 1 (analysis, algebra): 4 Hours of lectures per week, 2 hour of tutorial.	
Prerequisite of attendance	Basic Knowledges of Mathematics 1(analysis, algebra) are mathematics and physics in the secondary school.	
Applicability	The module is one of 3 mandatory compulsory of the Basics in mathematics of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 1.	

BWEAE 1-2	**Mathematic 2 (Integrals)**	**Prof. Dr.**
Contents and Qualification aims	The module deals with understanding the basics of Integrals such as Indefinite integrals and their applications and definite integral, their applications and Multiple integrals and their applications. The students' knowledge will be developed during tutorials to give the students enough knowledge's and ability in these fields.	
Module Character	Mathematic 2 (Integrals): 4 Hours of lectures per week, 2 hour of tutorial.	
Prerequisite of attendance	Basic Knowledges of Mathematic 2 (Integrals) are mathematic 1 and physics in the secondary school.	
Applicability	The module is one of 3 mandatory compulsory of the Basics in mathematics of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 2.	

BWEAE0 1-3	**Mathematic 3 (Differential equations and statistics and probability)**	**Prof. Dr.**
Contents and Qualification aims	The module deals with understanding the basics of Differential equations such as The normal Differential equations of first order (solved and not solved as for derivative) and The Differential equations of higher order, The partial Differential equations. And in the part the statistics and probability cover the module Principles of probabilities:(the probability, the random events, the conditional probability, autonomy of the events), Bays formula (the first and second, Random variable, distribution function, discrete and connected variable, expectation standard deviation. Laws of the famous distribution: (Poisson, Bernoulli, Laplace lam waver, normal, distribution, uniform, cushy, intercalation). The students' knowledge will be developed during tutorials to give the students enough knowledge's and ability in these fields.	
Module Character	Mathematic 3 (Differential equations and statistics and probability): 4 Hours of lectures per week, 2 hour of tutorial.	
Prerequisite of attendance	Basic Knowledges of Mathematic 3 (Differential equations and statistics and probability) are mathematic 1 and mathematic 2 and physics.	
Applicability	The module is one of 3 mandatory compulsory of the Basics in mathematics of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 3.	
Proposal references	• **Walter RUDIN: Principles of Mathematical Analysis, 3rd ed., McGraw. Hill, inc 1997.** Rahman, M.: Integral Equations and their Applications, WIT Press, ISBN: 978-1-84564-101-6, 2007. Gibbs, J. Willard: Vector Analysis, New Haven: Yale University Press, QA 261 G4 MATH, University of California Berkeley, Oughst K. E.: Vector Analysis, EE 141 Lecture Notes, Topic 2, School of Engineering, College of Engineering & Mathematical Sciences, University of Vermont, 2014. Bennewitz, Christer: Proposal references, University of north Carolina, M Taylor, CI Numbers - Preprint, 2014 - unc.edu. 6. Kincaid D; Cheney W.: Numerical Analysis: Mathematics of Scientific Computing, Vol. 2, - American Mathematical Society, 2002.	

BWEAE02	**Physics for Engineering**	**Dr.**
Contents and Qualification aims	The module deals with understanding the basics of Thermal expansion, Fundamental laws of ideal gases, Kinetic theory of gases, Fundamental of thermodynamic, Radioactivity, Fluid dynamic, Geometrical optic, Refraction, Reflection, Lenses, Interference and Diffraction. In the other Part the module covers the subjects Vectors, Forces, Work, Moment, Concussion, Energy, Equilibrium, Newton laws, and Principle relativity. The students' knowledge will be developed during tutorials and laboratory experiments to give the students enough knowledge's and ability in these fields.	
Module Character	Physics for Engineering: 4 Hours of lectures per week, 2 hour of tutorial and laboratory experiments.	
Prerequisite of attendance	Basic Knowledges of Physics for Engineering are mathematics and physics in the secondary school.	
Applicability	The module is one of 4 mandatory compulsory of the Basics in mathematics and Natural Sciences of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 1.	
Proposal references	• **Rajasekar K. a. other Authors: Engineering Physics Diploma Couse in Engineering, First & Second Semester, First Edition – 2011, Er. S. Govindarajan; K. Subramanian; This book has been prepared by the Directorate of Technical Education and has been printed on 60 G.S.M Paper.** • **. Riley K. Fhobson, M.P. and BENCE S.J.: Mathematical Methods for Physics and Engineering, Third Edition, Cambridge university press, 2006, 1363 Pages.**	

BWEAE 03	**Chemistry for Engineering**	**Dr.**
Contents and Qualification aims	The module deals with understanding the General Principles of chemistry, Chemical Arithmetic, Atomic Structure and The Periodic Table of elements, Chemical Bonding and Molecular Structure, State of Material, dissolution, Thermo chemistry, Chemical Kinetics, Chemical Equilibrium and Oxidation-Reduction Reactions. The students' knowledge will be developed during tutorials and laboratory experiments to gives the students enough knowledge's and ability in these fields.	
Module Character	Chemistry for Engineering: 4 Hours of lectures per week, 2 hour of tutorial and laboratory experiments.	
Prerequisite of attendance	Basic Knowledges of Chemistry for Engineering are mathematics, physics, and chemistry in the secondary school.	
Applicability	The module is one of 4 mandatory compulsory of the Basics in mathematics and Natural Sciences of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 1.	
Proposal references	• **1. Directorate of Technical Education Government of Tamil Nadu; Engineering Chemistry, Government of Tamilnadu, First Edition- 2011.** • **2.Michael E. Essington: Soil and Water Chemistry: An Integrative Approach, 2004, University of Tennessee, [CRC Press].** • **3.Robert H. Perry, Don. W. Green: Chemical Engineering's Handbook. 7th ed., 1997. ISBN 0-07-049841-5.**	

BWEAE0 4	**Basics of Informatics**	**Dr.**
Contents and Qualification aims	The module deals with understanding the Computer structure and its work mechanism, Software computer components, Presentation of information in computer, Algorithms, Flow and procedure charts and Database. The students' knowledge will be developed during tutorials and computer training and use some modern software to give the students enough knowledge and ability in these fields.	
Module Character	Basic of Informatics: 2 Hours of lectures per week, 2 hour of tutorial.	
Prerequisite of attendance	Basic Knowledges of Basic of Informatics are mathematics and physics in the secondary school.	
Applicability	The module is one of 4 mandatory compulsory of the Basics in mathematics and Natural Sciences of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 3 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 90 hours.	
Duration of the module	The module takes one term starting in Semester 1.	
Proposal references	• **1. Valerie Hobbs; John Gammack: Book of Informatics. 1st ed. 2011.** • **2.Shiksha Kendra: a text Book on Informatics Practics, 1st ed. 2010 CBSE, India**	

Basics in Engineering		
Module Number	Module Name	Professor in Charge
BWEAE0 5	**Mechanical Engineering**	**Dr.**
Contents and Qualification aims	The module deals with followings objectives in plain and in space (Statics) such as: General principles of mechanics, Forces, Vectors (formulations-main operations), Equivalent substitutions of force and moment systems (Reduction – further reduction – deduction), Reduction of distributed loads, Center of gravity – centric, Equilibrium of load systems working of a particle or rigid bodies, Friction, Structural systems in the other part of module cover the following subjects in statics: Structural analysis of determinate systems (Trusses – Frames – Arches) Internal forces (Trusses – Frames – Arches) and in Dynamic: Kinematic of a particle, Kinematic of a rigid body, Kinetic of a particle, Planar Kinetic of a rigid body and Vibration. The stu-	

	dents' knowledge will be developed during tutorials and laboratory experiments to give the students enough knowledge and ability in these fields.
Module Character	Mechanical Engineering: 4 Hours of lectures per week, 2 hour of tutorial.
Prerequisite of attendance	Basic Knowledges of Mechanical Engineering are mathematics and physics in the secondary school.
Applicability	The module is one of 16 mandatory compulsory of the Basics in Engineering of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 70% written exam and 30% term paper.
Frequency of the module	The module is offered annually.
Worked load	The workload is 150 hours.
Duration of the module	The module takes one terms starting in Semester 1.
Proposal references	• J. David Irwin: Mechanical Engineer's Handbook, Academic Press Series in Engineering, Auburn University. • R.C. Hibbeler: Engineering Mechanics. Statics, 13th ed.,1997. • Andy Ruina and Rudra Pratap: Introduction to Statics and Dynamics, 2014, Oxford University Press. • R.C. Hibbeler: Engineering Mechanics: Statics & Dynamics plus Mastering Engineering with Pearson e Text - Access Card Package (13th Edition). ISBN-13: 978-0133014624 ISBN-10: 0133014622, 13th ed. • Ruina and Pratap: Partial Solutions Manual ” Introduction to Statics and Dynamics”, 2013.

BWEAE 06	**Building Materials**	**Dr. Eng.**
Contents and Qualification aims	The module introduces the students to the principal information about construction materials, their characteristics and their experiments. It helps students to choose building materials in his practical life. The module introduces students to the principal basics of polymers, minerals, construction materials and their characteristics and uses too. The students' knowledge will be developed during tutorials and laboratory experiments to give the students enough knowledge and ability in these fields.	
Module Character	Building Materials: 4 Hours of lectures per week, 2 hour of tutorial and laboratory experiments.	
Prerequisite of attendance	Basic Knowledges of Building Materials are mathematics, physics, and mechanical engineering.	
Applicability	The module is one of 16 mandatory compulsory of the Basics in Engineering of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 2.	
Proposal references	• 1. Ken Ward-Harvey, ASTC, LFRAIA: FUNDAMENTAL BUILDING MATERIALS, Fourth Edition, Universal-Publishers Boca Raton, Copyright © 1984-2009 Ken Ward-Harvey, Florida • USA 2009, ISBN-10: 1-59942-954-3/ISBN-13: 978-1-59942-954-0 (paper), ISBN-10: 1-59942-951-9/ISBN-13: 978-1-59942-951-9 (Ebook). • 2. K. Duggal: BUILDING MATERIALS, NEW AGE INTERNATIONAL (P) LIMITED, PUBLISHERS, 3rd REVISED EDITION, 2008, ISBN (13): 978-81-224-2975-6. • 3. Arora: Introduction to Optimum Design. Second Edition. The University of Iowa. Amsterdam Boston Heidelberg London New York Oxford. Paris San.	

BWEAE 07	**Mechanics of materials**	**Dr. Eng.**
Contents and Qualification aims	The module covers the following subjects: Experimental and Theoretical Fundamentals, Stresses, Strains and displacements for deformed Body, Generalized Hook's Law, Geometric specifications, Normal Stresses Due To Axially Loading And A Bending Moments In Longitudinal Constructions, Consisted Of One Or Heterogeneous Materials And In Fixing Elements Of Structural Connections, Pure Shear Stresses And Transversal Shear Stresses In Bending Shearing For Sections Consisted Of One Or Heterogeneous Materials and Stresses trajectories, Elastic Strain energy, Deflection Of beams And Elements Of Structural Systems, Structural Analysis Of Statically Indeterminate Systems, Influence Line in Structures, Beams on elastic Foundations, Torsion, Plastic Analysis - Behavior Of Plastic-elastic Materials and Theory Of Stability in Straight Members. The students' knowledge will be developed during tutorials and laboratory experiments to give the students enough knowledge and ability in these fields.	
Module Character	Mechanics of materials: 4 Hours of lectures per week, 2 hour of tutorial.	
Prerequisite of attendance	Basic Knowledges of Mechanics of materials are mechanical engineering, Building Materials, mathematics and physics.	
Applicability	The module is one of 16 mandatory compulsory of the Basics in Engineering of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 2.	
Proposal references	• **R.C. Hibbeler: Mechanics of materials, 9th edition , 2014, Solution manual.** • Beer; Johnston; De Wolf: Mechanics of Materials, 3rd ed., © 2002 The McGraw-Hill Companies, Inc. • **Young, George, Jr; Baxter, Hubert Eugene: Mechanics of Materials, Applied; Strength of materials, New York, Macmillan,, b15346985, Northeastern University, Snell Library, northeastern; blc; Americana, MARCUM. 1927.** • 4. James M. Gere and Barry J. Goodno: Mechanics of Materials, 7th Edition, Cengage Learning	

BWEAE 08	**Geometrical Representation**	**Dr. Eng.**
Contents and Qualification aims	The module covers the following subjects: Geometric representation methods and use the drawing tools, Architectural perspective, (Central), axonometric projection, Representation in a vertical projection of two orthogonal (mung method), dropping objects geometric representation level, the conclusion projected third projections broken, The representation of many faces, Deployment of the engineering objects surfaces, without projection, Representation of civilian installations, Representation of curved lines and surfaces, computer assisted drawing (Auto CAD). The students' knowledge will be developed during tutorials and Computer training and use some modern software to give the students enough knowledge's and ability in these fields.	
Module Character	Geometrical Representation: 1 Hours of lectures per week, 4 hour of tutorial.	
Prerequisite of attendance	Basic Knowledges of Geometrical Representation are mathematics and physics in secondary school.	
Applicability	The module is one of 16 mandatory compulsory of the Basics in Engineering of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 3 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 2.	
Proposal references	• **1. GEOMETRIC REPRESENTATION THEORY, FALL 2005.** • **2. Steven M. Lavalle, Chapter 3 Geometric Representations and Transformations, University of Illinois Copyright Steven M. Lavalle 2006, Published by Cambridge University Press.**	

BWEAE0 9	**Engineering Geology**	**Prof. Dr.**
Contents and Qualification aims	The module covers the following subjects: Earth's Interior and Spheres, Minerals, Introduction to Rocks, Igneous Rock, Sedimentary Rocks, Metamorphism and Metamorphic Rocks, Geologic Structures of rocks, Geologic Maps and Profile, Endogen Geodynamic Processes, Endogen Geodynamic Phenomena, External Geodynamic Processes and Phenomena, Groundwater, Soil and Rocks Properties and Classifications and Geological Investigations and Explorations. The students' knowledge will be developed during tutorials and laboratory experiments to give the students enough knowledge and ability in these fields.	
Module Character	Engineering Geology: 4 Hours of lectures per week, 2 hour of tutorial and laboratory experiments.	
Prerequisite of attendance	Basic Knowledges of Engineering Geology are mathematics, physics and chemistry.	
Applicability	The module is one of 16 mandatory compulsory of the Basics in Engineering of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 2.	
Proposal references	• **Geology for Civil Engineers (Second Edition).** • Michael H. de Freitas: Engineering Geology" Principles and Practice", 2009, ISBN: 978-3-540-29249-4 (Print) 978-3-540-68626-2 (Online). • C. Gribble, A. McLean: Geology for Civil Engineers, Second Edition, CRC Press, Sep 2, 2003 - 336 pages.	

BWEAE 10	**Structures Analysis**	**Prof. Dr. Eng.**
Contents and Qualification aims	Depends on the concepts learned in STATICS & MECHANICS OF MATERIALS, this module aims at familiarizing students with the difference between, determinate or indeterminate, prismatic structures and their practical use. Then it tends to exploit the virtual work and energy based methods to allow the students to grasp the force method and displacement method techniques in structural Analysis. This module provides in the other part the necessary knowledge and skills enabling the students to determine the response elements of prismatic structural systems using the classical and matrix displacement methods and train them to use simple structural analysis software as a preparation phase to structural design part, which provides an introduction to the design of steel and reinforced concrete structures in addition to the concepts of optimum structural design. The students' knowledge will be developed during tutorials and laboratory experiments to give the students enough knowledge's and ability in these fields.	
Module Character	Structures Analysis: 4 Hours of lectures per week, 2 hour of tutorial.	
Prerequisite of attendance	Basic Knowledges of Structures Analysis are mechanical engineering building material and mechanic of material.	
Applicability	The module is one of 16 mandatory compulsory of the Basics in Engineering of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 3.	
Proposal references	• **1. Jasbir S. Arora: Basics of engineering analysis and design, need for optimal design, Mc Graw-Hill, New York, 1989.** • **2. Kassimali, A.: Structural Analysis, 4th ed., Civil Engineering books 2014.** • **3. Mario Paz; Williem Leigh: Structural Dynamics, Theory and Computation, 5th ed., Updated with SAP 2000, Kluwer Academic Publisher. Boston Dordrecht/ London 2004.** • **4. Chopra Anil K.: Dynamics of Structures (3rd ed.), Book by Anil K. Chopra, 1995. 2012.**	

BWEAE 11	**Soil Mechanics**	**Prof. Dr.**
Contents and Qualification aims	The module aims at determining the physical and mechanical properties used in calculation of soil undergo under the Foundation of the Engineering structures, and the stabilization and equilibrium of slope. The students' knowledge will be developed during tutorials and laboratory experiments to give the students enough knowledge's and ability in these fields.	
Module Character	Soil Mechanics: 4 Hours of lectures per week, 2 hour of tutorial.	
Prerequisite of attendance	Basic Knowledges of Soil Mechanics are mechanical engineering building material and mechanic of material and engineering geology.	
Applicability	The module is one of 16 mandatory compulsory of the Basics in Engineering of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 3.	
Proposal references	• Arnold, Verruijt: Soil Mechanics, Delft University of Technology, 001,2004. • Muni Bodhu: Soils Mechanics & Foundations, John Wiley and Sons Inc., 3rd Edition, January 2011, ©2011.	

BWEAE 12	**Reinforced Concrete (1,2)**	**Prof. Dr**
Contents and Qualification aims	The module gives the students the ability to classify the construction systems in the water structures and design the construction elements and water structures from reinforcement. The students' knowledge will be developed during tutorials and laboratory experiments and use some modern software to give the students enough knowledge and ability in these fields.	
Module Character	Reinforced Concrete (1,2):2 Hours of lectures per week, 2 hour of tutorial.	
Prerequisite of attendance	Basic Knowledges of Reinforced Concrete (1, 2) are mechanical engineering building material and mechanic of material.	
Applicability	The module is two of 16 mandatory compulsory of the Basics in Engineering of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 6 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 180 hours.	
Duration of the module	The module takes two terms starting in Semester 4 a. 5.	
Proposal references	• 1. Design of Reinforced Concrete Structures: Dayarantnam P, Oxford & IBH. • 2. Fundamentals of Reinforced Concrete: Sinha & Roy, S. Chand & Co. Ltd • 3. Wang, C. K., Salmon, C.G., and Pincheira, J.A: Reinforced Concrete Design, 7 th Edition, Jon Wiley,2007 • 4. Ferguson, P.M., Breen J.E., and Jirsa J.O.: Reinforced Concrete Fundamentals:, 5th ed., Jon Wiley&sons,1988 • 5.Shah V.L.; Karve S.R.: Ilusreated Reinforced Concrete Design, Structure Publication, Pune.	

BWEAE 13	**Numerical Analysis and Modeling**	**Prof. Dr.**
Contents and Qualification aims	The module gives the students the ability to use the numerical methods for solution the engineering problems using computers. The students' knowledge will be developed during tutorials and computer training and some modern software to give the students enough knowledge's and ability in these fields.	
Module Character	Numerical Analysis and Modeling: 2 Hours of lectures per week, 2 hour of tutorial.	
Prerequisite of attendance	Basic Knowledges of Numerical Analysis and Modeling are mathematics and other modules needs computers.	
Applicability	The module is one of 16 mandatory compulsory of the Basics in Engineering of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 3 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually	
Worked load	The workload is 90 hours	
Duration of the module	The module takes one term starting in Semester 5.	
Proposal references	• 1. The physical, mathematical and computational models, University of Albetra. • 2. UmutHanoglu: Mathematical and Physical Modeling, University of Nova Gorica, 2009. • 3. Masato Nakamura: Mathematical and Physical Modeling of Mixing and Flow Phenomena of Municipal Solid Waste Particles on a Reverse Acting Grate, Columbia University, 2008, 198 pages. • 4. Richard L. Burden; J. Douglas Faires: Numerical Analysis, 9th Edition, Brooks/Cole, 2010, ISBN-13: 978-0-538-73351-9, ISBN-10: 0-538-73351-9	

BWEAE 14	**Foundations Engineering**	**Dr. Eng.**
Contents and Qualification aims	The module gives the students the ability to choose the type of Foundations and the method of founding and design of Foundation several water structures. The students' knowledge will be developed during tutorials, Laboratory experiments, and use computer programs to give the students enough knowledge and ability in these fields.	
Module Character	Foundations Engineering Hours of lectures per week, 2 hour of tutorial.	
Prerequisite of attendance	Basic Knowledges of Foundations are soil mechanics, mechanical engineering, building material and mechanic of material and engineering geology.	
Applicability	The module is one of 16 mandatory compulsory of the Basics in Engineering of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one terms starting in Semester 4.	
Proposal references	• 1. Braja M. DAS: Principals of foundation engineering Cengage Learning, Seventh Edition. Publisher, Global Engineering: Christopher M. Shortt. • 2. Muni Bodhu: Soils Mechanics & Foundations, John Wiley and Sons Inc., 3rd Edition, January 2011, ©2011. • 3. Braja Das: Principles of Foundation Engineering, Brooks/Cole, Thomson, 7th edition, 780 page,2010. • 4. Shenbaga R. Kaniraj: Design Aids in Soil Mechanics and Foundation Engineering, Tata Mc Graw-Hill Publishing Company. Length, 698.	

BWEAE 15	**Metal and mixed Structures**	**Prof. Dr.**
Contents and Qualification aims	The module gives the students the basic knowledge required to enable them to understand the phenomena of construction steel elements such as tight elements, compressed elements, beams and joints. This module introduces the students the general philosophy followed in design of steel elements construction according European specifications. In addition to this module gives the primary principles of understanding the phenomena of mixed elements steel-concrete. The students' knowledge will be developed during tutorials and Laboratory experiments and use computer programs to give the students enough knowledge and ability in these fields.	
Module Character	Metal mixed Structures: 4 Hours of lectures per week, 2 hour of tutorial.	
Prerequisite of attendance	Basic Knowledge of Metal mixed Structures are Structures Analysis, reinforcement concrete, mechanical engineering, building material and mechanic of material	
Applicability	The module is one of 16 mandatory compulsory of the Basics in Engineering of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one terms starting in Semester 4.	
Proposal references	• Xianzhong ZHAO: Basic principles of steel structures, x.zhao@mail.tongji.edu.cn. • Gary S. Berman, PE: Structural Steel Design and Construction, GREYHAWK North America, LLC, pages 59. • Brian Kirke; Iyad Hassan Al-Jamel: Steel Structures, Design Manual To AS 4100, First Edition, pages 269. • JOHNSON R.P.: Composite Structures of Steel and Concrete: Beams, slabs, columns, and frames for buildings, John Wiley & Sons, 3rd Edition. R. P. Johnson. ISBN: 978-1-4051-0035-9. • Euro code 4 ; Design of composite steel and concrete structures- Part 1-1: General rules and rules for buildings, EN 1994-1-1, General rules and rules for buildings (2004).	

BWEAE 16	**Buildings Construction**	**Dr.**
Contents and Qualification aims	The module gives the students the basic components, elements, specifications and properties of building projects and how can they construct the executions drawings, plans, gross sections, fronts and architectural details of buildings projects. The next part explains the special details of common and private habitation buildings. The students' knowledge will be developed during tutorials and auto cad computer programs to give the students enough knowledge and ability in these fields.	
Module Character	Buildings Construction: 1 Hours of lectures per week, 4 hour of tutorial.	
Prerequisite of attendance	Basic Knowledge of Building Construction is Geometrical Representation.	
Applicability	The module is one of 16 mandatory compulsory of the Basics in Engineering of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (180 minutes) and some written tests.	
Accredit points and grades	The module earns 3 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 90 hours.	
Duration of the module	The module takes one term starting in Semester 2.	
Proposal references	• 1. FREDERICK S.: Building Design and Construction Handbook, Merritt& Jonathan T. Rickettis, 6th Edition. • 2. Barrie D.S. & Paulson B. C.: Professional Construction Management:, McGraw Hill. • 3. Anteill J M &Woodhead R W: Critical Path Methods in Construction Practice, Willey.	

BWEAE 17	**Roads and Transportation Engineering**	**Dr.**
Contents and Qualification aims	The module aims at giving the students the basic and important information related to transportation engineering such as vehicle motion on the road and forces which effect on it, highway design (path selection, horizontal and vertical curves, elements of cross section, grades, ….), urban streets, intersection, rail ways transportation, airports, sea transportation. The students' knowledge will be developed during tutorials, Laboratory Experiments and using computer programs to give the students enough knowledge and ability in these fields.	
Module Character	Roads and Transportation Engineering: 2 Hours of lectures per week, 2 hour of tutorial.	
Prerequisite of attendance	Basic Knowledges of Roads and Transportation Engineering are geodesy, Building Materials, Mechanical Engineering, and Mechanics of materials, mathematics, physics, and chemistry.	
Applicability	The module is one of 16 mandatory compulsory of the Basics in Engineering of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (180 minutes) and some written tests.	
Accredit points and grades	The module earns 3 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 90 hours.	
Duration of the module	The module takes one term starting in Semester 5.	
Proposal references	• 1. Transportation Engineering and Planning, 2007 By C S Papacostas and P D Prevedouros Upload: 2014, 14:24 UTC. • 2. Lester A. Hoel, Nicholas J.Garber, Adel W.Sadek: Transportation Infrastructure Engineering: A Multimodal Integration. Copyright 2010 Cengage Learning.	

BWEAE 18	**Geodesy**	**Dr.**
Contents and Qualification aims	The module aims at giving the students General information about surveying in several parts, enables the students to read maps and topographic schemes, knowing some surveying apparatus and doing measurements on it, using mathematical methods to handle these measurements, making topographic schemes to design several engineering projects. The students will be able to apply these projects. The students knowledge will be developed during tutorials, using apparatus, and computer programs to give the students enough knowledge and ability in these fields.	
Module Character	Geodesy: 4 Hours of lectures per week, 2 hour of tutorial.	
Prerequisite of attendance	Basic Knowledges of Geodesy are geology, mathematics.	
Applicability	The module is one of 16 mandatory compulsory of the Basics in Engineering of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 3.	
Proposal references	• 1. Edward Arnold: Site surveying and Leveling, Technology & Engineering - 315 pages, 2nd Edition 1991. London, Educational Book. • 2. Gershberg, M.A.:Geodesy, Moscow 1967. • 3. Shepherd, F.A.: Advanced Engineering Surveying: Problems and Solutions (Book) (1982), Hodder Arnold, ISBN 9780713134162. • 4. Liu, J. G., and P. Mason: Essential Image Processing and GIS for Remote Sensing. John Wiley & Sons Inc., New York, USA. 2009. • 5. Weng, Q.:Remote Sensing and GIS Integration: Theories, Methods, and Applications: Theory, Methods, and Applications. McGraw-Hill Professional, Dubuque, IA, USA. 2009.	

BWEAE 19	**Engineering Economic and Projects Management**	**Dr. Eng.**
Contents and Qualification aims	The module aims at introducing the students execution phases of several elements constructions and several mechanisms used in the construction phases, so the students know the time of execution of several constructions in sites during details video films. In addition to, the students calculate the productivity of machineries used in the construction during practical examples and the cost of several construction projects. The students' knowledge will be developed during tutorials and computer programs to gives the students enough knowledge and ability in these fields.	
Module Character	Engineering Economic and Projects Management: 4 Hours of lectures per week, 2 hour of tutorial	
Prerequisite of attendance	Basic Knowledges of Engineering Economic and Projects Management are Construction Technology building material and building construction, mechanics of materials and mathematics.	
Applicability	The module is one of 16 mandatory compulsory of the Basics in Engineering of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually	
Worked load	The workload is 150 hours	
Duration of the module	The module takes one term starting in Semester 6.	
Proposal references	• 1. R. Panneerselvam: ENGINEERING ECONOMICS, 2001 by PHI Learning Private Limited, New Delhi. 13th ed., 2012 ISBN-978-81-203-1743-7. • 2. Donald G. Newnan, Jerome P. Lavelle, Ted G. Eschenbach: Engineering Economic Analysis,2011, 11th ed., *only-books.org.* • 3. Newnan D., Eschenbach Ted G., Lavelle, J.: Engineering Ecnomics Analyses. 10th ed., Oxford university Press, 2004.	

BWEAE 20	**Buildings Services**	**Dr.**
Contents and Qualification aims	The module introduces students to the basic components, elements, specifications and properties of building projects and how they can design the several equipment such drinking and waste water network in the building, conditioning network (warming and cooling) and electrical, phone, television networks. The students' knowledge will be developed during tutorials and auto cad computer programs to give the students enough knowledge and ability in these fields.	
Module Character	Buildings Services: 1 Hours of lectures per week, 4 hour of tutorial.	
Prerequisite of attendance	Basic Knowledge of Buildings Construction are Buildings Construction and Geometrical Representation.	
Applicability	The module is one of 16 mandatory compulsory of the Basics in Engineering of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (180 minutes) and some written tests.	
Accredit points and grades	The module earns 3 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 90 hours.	
Duration of the module	The module takes one term starting in Semester 3.	
Proposal references	• William L. Gamble: Building Construction and Equipment, The City College, The City University of New York. • Jagdish Lal.: Construction Equipment. • R.G. Hopkinson and J.D. Kay: The Lighting of buildings, Faber and Faber, London, 1969. • William H. Sevems and Julian R. Fellows: Air- Conditioning and Refrigeration, John Wiley and Sons, London 1988. • A.F.C. Sherratt: Air- Conditioning and Energy Conservation, The Architectural Press. London 1980. • National Building Code, BIS Publications New Delhi. • A.C. Panchhari: Water Supply and Sanitary Installtions, New age International Publication, Delhi.	

BWEAE 21	**Technology of Construction**	**Dr. Eng.**
Contents and Qualification aims	The module introduces students to the construction process in site. Through this module the students will be able to identify the steps to construct each building's element and the characteristics of construction equipment’s and machinery. The students' knowledge will be developed during tutorials and use some modern software and computer Training.	
Module Character	Construction Technology: 2 Hours of lectures per week, 2 hour of tutorial.	
Prerequisite of attendance	Basic Knowledges of Construction Technology are building material and building construction, mechanics of materials and mathematics.	
Applicability	The module is one of 16 mandatory compulsory of the Basics in Engineering of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 3 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually	
Worked load	The workload is 90 hours	
Duration of the module	The module takes one term starting in Semester 3.	
Proposal references	• 1. Handbook of Heavy Construction: Stubbs, McGraw Hill, New York. • 2. Chikara K K: Construction Project Management:, Tata Mc Graw Hill. • 3. Construction Hazard and Safty Handbook: King&Hudson, Butterworth. • 4. Madan M.; Walter S.; Diane A.: BUILDING CONSTRUCTION, Principles, Materials, and Systems, 2013, Pearson Education, Inc., publishing as Prentice Hall.	

Basics in Hydro Sciences		
Module Number	Module Name	Professor in Charge
BWEAE 22	**Hydrology**	**Prof. Dr.**
Contents and Qualification aims	The module deals with Air and climatic phenomena; Evaporation; Water Shed؛ Hydrograph؛ Statistics and probability in hydrology; runoff and Floods؛ urban and small watershed hydrology ؛ Physical and chemical properties of groundwater; origin of groundwater and forms of it's exists in the earth crust؛ principles of Groundwater flow. The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and Use some advanced software to give the students enough knowledge's and ability in the fields.	
Module Character	Hydrology: 2 Hours of lectures per week, 2 hour of tutorial Laboratory experiments per week.	
Prerequisite of attendance	Basic Knowledges of Hydrology are mathematics and physics and environment	
Applicability	The module is one of 4 mandatory compulsory of the Basics in Hydro Sciences of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 3 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually	
Worked load	The workload is 90 hours.	
Duration of the module	The module takes one terms starting in Semester 2.	
Proposal references	• Warren Viessman, Jr.; Gary L. Lewis.: Introduction to Hydrology, 4th ed. New York,1996, • Linsley, Rey K.; Max, JR.; Kohler, A.; Paulhlus, Joseph L. H.: Hydrology for Engineering. • 3. ALASAAD, A.M.; AMMAR, Gh. A. Hydrology. 2014, Tishreen University, 400 pgs.	

BWEAE 23	**Fluid Mechanics**	**Prof. Dr.**
Contents and Qualification aims	The module deals with general and basic information about stillness of fluid (hydrostatic); Basics of Dynamics of fluid mechanics (Basic concepts of kinematics and dynamic fluids); power loss (head loss) water flow in pressured pipes; flow of liquids through openings and in the situation of steady flow of liquids. Hydraulic resistance; Steady water flow in pressured pipes; unsteady orifices. Free water Jets; free, steady and regular Water Flow in open Canals. Free, steady and irregular Water Flow in open Canals. The students' knowledge will be developed during tutorials and necessary laboratory tests and practical computer training and Use some advanced software to give the students enough knowledge's and ability in this fields.	
Module Character	Fluid Mechanics: 3 Hours of lectures per week, 2 hour of tutorial per week. 2 hour of Laboratory test per week	
Prerequisite of attendance	Basic Knowledges of Fluid Mechanics are mathematics and physics and environment.	
Applicability	The module is one of 4 mandatory compulsory of the Basics in Hydro Sciences of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 3.	
Proposal references	• Joseph H. Spurk; Nuri Aksel: Fluid Mechanics, Springer Verlag, 2008, 2nd ed., ISBN 978-3-540-73536-6, e-ISBN 978-3-540-73537-3, • Bruce Hunt: Fluid Mechanics for Civil Engineering, 1995	

BWEAE 24	**Basics of Environment and Sanitary Engineering**	**Dr. Eng.**
Contents and Qualification aims	The module deals with understanding the actual environmental problems within drinking water, surface water resources and waste water. The module gives the students the ability to evaluate and choose the best solution to design the drinking and waste water nets and treatment station. In other hand the students can evaluate the quality of water resources using the possible and suitable equipment's based on analytical and structural thinking. The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and Use some advanced software to give the students enough knowledge and ability in this fields.	
Module Character	Basics of Environment and Sanitary Engineering: 2 Hours of lectures per week, 2 hour of tutorial and 2 hour Laboratory experiments per week.	
Prerequisite of attendance	Basic Knowledges of Basics of Environment and Sanitary Engineering are Fluid Mechanics, hydrology mathematics and physics and environment.	
Applicability	The module is one of 4 mandatory compulsory of the Basics in Hydro Sciences of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 3 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 90 hours.	
Duration of the module	The module takes one terms starting in Semester 4.	
Proposal references	• Ruth, F. Weiner; Robin A. Matthews: Environmental Engineering, Butter Worth Heinemann, 4th Edition, 2003, 484 page. • Morris, P. and Therivel R.: Methods of Environmental Impact Assessment. Rutledge, Oxon, UK. 2009. • Therivel R, Glasson, J. and Chadwick A.: Introduction to Environmental Impact Assessment. Routledge, Taylor & Francis Group, Kentucky, USA, 2009. • Rao. S.V.: An Introduction to Water Pollution. Icfai University Press, 2007. • Green, Colin H.: Handbook of Water Economics: Principles and Practice, Wiley, J. (2003).	

BWEAE 25	**Hydraulics**	**Prof. Dr.**
Contents and Qualification aims	The module deals with Water jump; unsteady flow in open Canals, Weirs; Connection structures and energy depression; spillway ; weirs; aqueduct; Laboratory experiments, computing programs about this subjects. Boundary flow and its application in water engineering; principles of hydraulics geometric. Similarity; principles of theoretical modeling of hydraulic phenomena; two-and three-dimensional flow and its application; wind waves; Laboratory experiments; computer applications in hydraulic. The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and Use some advanced software to give the students enough knowledge and ability in this fields.	
Module Character	Fluid Mechanics: 3 Hours of lectures per week, 2 hour of tutorial per week. 2 hour of Laboratory test per week.	
Prerequisite of attendance	Basic Knowledges of Hydraulics are Fluid Mechanics, hydrology mathematics and physics and environment.	
Applicability	The module is one of 4 mandatory compulsory of the Basics in Hydro Sciences of the Bachelor course of water engineering and environment. the module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 4.	
Proposal references	• 1. Montanes, J.L.: Hydraulic Canals " Design, construction, Regulation and Maintenances", Taylor and Frances, 2006. • 2.Canson,H.: Environmental Hydraulics of Open Channel Flows, Elsevier Butterworth-Heinemann, 2004. Site Surveying and Leveling, John chancy, Edward Arnold, 1991 - Technology & Engineering - 315 pages.	

Specialized Basics		
BWEAE 26	**Drinking and Waste Water Networks**	**Prof. Dr.**
Contents and Qualification aims	The module introduces the students the main principles and details of calculation and design of drinking water supply networks to cities and towns and related structures and equipment's. In the other part give the module students the basic knowledge's of waste water systems and how can be designed, after that the student know how they calculate it hydraulically and how the student can design several waste water networks (separate, un separate, half separate). In addition to the students will be introduce the related structures on these Networks and how can maintain these Networks. The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and Use some advanced software to give the students enough knowledge's and ability in this fields.	
Module Character	Drinking and Waste Water Networks: 4 Hours of lectures per week, 2 hour of tutorial and Laboratory experiments per week.	
Prerequisite of attendance	Basic Knowledges of Drinking and Waste Water Networks are Fluid Mechanics, Basics of Environment and Sanitary Engineering and hydrology.	
Applicability	The module is one of 7 mandatory compulsory of the Specialized Basics of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 4.	
Proposal references	• D. Duncan Mara and Charles G. Gunnerson: Appropriate Technology for Water Supply and Sanitation, A Planner's Guide, By John M Kalber matten, De Anne S. Julius, 1980. • Small Systems Guide to Safe Drinking Water Act Regulations, Office of Ground Water and Drinking Water,WWW.epa.gov/safe water, September 2003.	

BWEAE 27	**Drinking and Waste Water Treatment**	**Prof. Dr.**
Contents and Qualification aims	The module introduces the students the main principles and details of calculation and design of drinking water treatment stations and related structures and its equipment. In the other part give the module students the basic knowledge's about the properties of waste water and the hazards resultant from pollution with it, after that the student should know the general treatment methods (how they calculate it hydraulically and how the student can design several waste water networks (simple, secondary and tertiary). In addition to the students will be introduce details the hydraulically calculations of the related structures each method and how can take out the sediments and sludge resultant from the several treatment phases. The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and Use some advanced software to give the students enough knowledge's and ability in this fields.	
Module Character	Drinking and Waste Water Treatment: 4 Hours of lectures per week, 2 hour of tutorial and Laboratory experiments per week.	
Prerequisite of attendance	Basic Knowledges of Drinking and Waste Water Treatment are Drinking and Waste Water Networks Fluid Mechanics, Basics of Environment and Sanitary Engineering and chemistry.	
Applicability	The module is one of 7 mandatory compulsory of the Specialized Basics of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 5.	
Proposal references	• Mark J. Hammer: Water and Wastewater Technology/ Mark J. Hammer, 7th edition, 2008, Amazon Book. • Rao. D. G.; Senthilkumar, R.; Byrne, J. Anthony; Feroz, S.: Wastewater Treatment: Advanced Processes and Technologies, Published: July 09, 2012 - ISBN: 9781439860441.	

BWEAE 28	**Irrigation and Drainage Engineering**	**Prof. Dr.**
Contents and Qualification aims	The module introduces the students the several Soil properties and its determination, and relationship between Soil, water and plants, water demands of agriculture gropes; Irrigation system, method of irrigation; irrigation system and its calculation, maintenance of irrigation networks and related structures. In the other part, the module gives general concepts of drainage and land reclamation; saline soils remediation methods; drainage methods of land; drainage systems and networks, regulation of Drainage Collectors and rivers. The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and Use some advanced software to give the students enough knowledge and ability in this fields.	
Module Character	Irrigation and Drainage Engineering: 2 Hours of lectures per week, 2 hour of tutorial and Laboratory experiments per week.	
Prerequisite of attendance	Basic Knowledges of Irrigation and Drainage Engineering are fluid mechanics, hydraulics, physics, and chemistry.	
Applicability	The module is one of 7 mandatory compulsory of the Specialized Basics of the Bachelor course of water engineering and environment. the module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 3 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 90 hours.	
Duration of the module	The module takes one term starting in Semester 5.	
Proposal references	• 1. H. P. Ritzema: Drainage principles and applications, (Editor-in-Chief) 1994. ILRI. ISBN: 90 70754 3 39. • 2. Frederick Haynes Newell: Principles of Irrigation Engineering. McGraw-Hill Publication (2010). • 3. Etcheverry: Irrigation Practice and Irrigation Engineering. McGraw-Hill Publisher (2010). • 4. Larry G. James: Principles of Farming Irrigation System Design, Washington State University (Wiley) (2004). • 5. Ahmad, Nisar: Participatory Irrigation Management. Higher Education Commission, Islamabad, 2008.	

BWEAE 29	**Water Structures**	**Prof. Dr.**
Contents and Qualification aims	The module deals with problems Classification of hydraulic structures work and design; water seepage through foundation of hydraulic structures and bypass seepage; canals, regulation structures; water conveyance structures; hydraulic tunnels; connection structures (Falls and drops); gates; river streams regulation; river water intakes; deposition (sedimentation) basins; Water reservoirs (Lakes) and water decade planning; methods of construction, exploitation, maintenance processes in hydraulics structures. The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and Use some advanced software to give the students enough knowledge's and ability in this fields.	
Module Character	Water Structures: 2 Hours of lectures per week, 2 hour of tutorial, 2 hour of experiments per week.	
Prerequisite of attendance	Basic Knowledges of Water Structures is Irrigation and Drainage Engineering, fluid mechanics, hydraulics, Building Construction, Building Materials, Mechanics of materials, Soil Mechanics, geology and reinforcement concrete.	
Applicability	The module is one of 7 mandatory compulsory of the Specialized Basics of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 4 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 120 hours.	
Duration of the module	The module takes one term starting in Semester 5.	
Proposal references	• Montanes,J.L.: Hydraulic Canals " Design, construction, Regulation and Maintenances", Taylor and Frances, 2006. • 2.Canson,H.: Environmental Hydraulics of Open Channel Flows, Elsevier Butterworth-Heinemann, 2004. Site Surveying and Leveling, John chancy, Edward Arnold, 1991 - Technology & Engineering - 315 pages. • Novak, P., Moffat, A. Nalluri, C. and Narayanan, R.: Hydraulic Structures, 4th ed., 2007.	

BWEAE 30	**Dams Engineering**	**Prof. Dr.**
Contents and Qualification aims	The module deals with problems Earth dams Classification, Characteristics and Location of the construction of the dam, Design elements of the dam, elements of waterproof (impermeable elements) ; hydraulically calculation of Earth dams ; Stability of earth dams slopes; and calculation of settlement, earth dams art, water intake in the earth dams; spillway of earth dams(insides, pipes, tunnels. Siphons). The other part of module deals with Concrete dams; general information; classification; characteristics; influence forces; gravity concrete dams; cross section; design of dams body ; design of several art of concrete dams, calculation of stress situation; calculating of stability and displacement; ways to reduce the cost of gravity dams; control and maintenance and repair of concrete dams. The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and Use some advanced software to give the students enough knowledge and ability in this fields.	
Module Character	Dams: 4 Hours of lectures per week, 2 hour of tutorial and Laboratory and experiments per week.	
Prerequisite of attendance	Basic Knowledges of Dams are Water Structures, Irrigation and Drainage Engineering, fluid mechanics, hydraulics, Building Construction, Building Materials, Mechanics of materials, Soil Mechanics reinforcement concrete and geology.	
Applicability	The module is one of 7 mandatory compulsory of the Specialized Basics of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 6.	
Proposal references	• 1. Robin, Fill; Patrick Mac George ; David Stapledion: Geotechnical engineering of Embankment Dams,,A.A. Balkema, P.o.B 1675,3000 BR, Rotterdam, Netherlands, 1992. 2nd ed., 671 page. • 2. Design of Small Dams, A Water Resources Technical Publication, Third Edition, 1987. United States, Department of the Interior, Bureau of Reclamation, 860 pages .	

BWEAE 31	**Pumping Station and Hydraulics Machines**	**Prof. Dr.**
Contents and Qualification aims	The module deals with problems hydraulic machines ; Potential energy; Basic Equation of pumps; types of pumps; parts of centrifugal pump; characteristic curves of pumps; working and connection of pumps; pumping pipes; Pumping stations; water hammer and cavitation; used measurement instruments; renewable energy; hydroelectric power plants; turbines; power generation and environment. The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and Use some advanced software to give the students enough knowledge's and ability in this fields.	
Module Character	Pumping Station and Hydraulics Machines: 2 Hours of lectures per week, 2 hour of tutorial and Laboratory and experiments per week.	
Prerequisite of attendance	Basic Knowledges of Pumping Station and Hydraulics Machines are Water Structures, Irrigation and Drainage Engineering, fluid mechanics, hydraulics, Building Construction, Building Materials, Mechanics of materials, Soil Mechanics reinforcement concrete and geology.	
Applicability	The module is one of 7 mandatory compulsory of the Specialized Basics of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 3 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 90 hours.	
Duration of the module	The module takes one term starting in Semester 6.	
Proposal references	• James B. Rishel, P.E: Water Pumps and Pumping Systems, Copyright 2002. • David Stephenson: Pipe Line Design for Water Engineers, 2nd Edition (Completely revised) Elsevier Scientific Publishing Company, 1981.	

BWEAE 32	**Harbors Engineering**	**Dr. Eng.**
Contents and Qualification aims	The module deals with the main principles of Harbors Engineering, planning and design of all elements of Harbor, the main basics of water harbor facilities design, forces acting on sea installations, loading capacity calculation, calculation of deformations and stability; breakwater facilities, vertical protection facilities; types of protective installations, Sea quays, Landing area outside basin; calculation of anchor installation and protection; Container handling; General information about building institutions and ships repair; gliders, design of basics elements, determine of loads and calculation of ships, draw railway; ships docks, basics elements; chambers of Dry docks, gates, equipment, dimensioning, the hydraulic calculation of loading and discharging systems (cranes), static calculation ; floating quays; methods of control and test facilities in the harbor and in nature; strengthening and rehabilitation and repair of sea plants; Types and material of construction; the protection of water against pollution.. The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and Use some advanced software to give the students enough knowledge's and ability in this fields.	
Module Character	**Harbors Engineering**: 4 Hours of lectures per week, 2 hour of tutorial per week.	
Prerequisite of attendance	Basic Knowledges of **Harbors Engineering** are Water Structures, fluid mechanics, Building Materials, Soil Mechanics, reinforcement concrete, Hydrology and geology.	
Applicability	The module is one of 7 mandatory compulsory of the Specialized Basics of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 6.	
Proposal references	• Tsinker Gregory: Handbook of Port and Harbor Engineering, • Coastal Engineering Manual – Part II, USArmy Corps of Engineers, 2006. • John Herbich: Handbook of Coastal and Ocean Engineering, Vol. I, II, and III, Gulf Publishing Company, 1990. • Per Bruun: Port Engineering, Vol. I and II, Gulf Publishing Company, 1990. • J.W. Gaythwaite: Design of Marine Facilities for the Berthing, Mooring, and Repair of Vessels,, ASCE Press, 2004.	

Elective Modules		
Module Number	**Module Name**	**Professor in Charge**
BWEAE 33	**Solid Waste Management**	**Prof. Dr.**
Contents and Qualification aims	The module introduces the Solid Waste resultant from several human activities, its component, resources, types, properties, management system, the Management and optimum methods to calculate this waste, transporting, storage, burring, in addition to safety riddance methods of this waste and its rotation methods and treats it with purpose of using it and minimizes its influences on human and environment. The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and Use some advanced software to give the students enough knowledge and ability in these fields.	
Module Character	Solid Waste Management: 2 Hours of lectures per week, 2 hours of tutorial and Laboratory and experiments per week.	
Prerequisite of attendance	Basic Knowledges of Solid Waste Management are Basics of Environment and Sanitary Engineering, fluid mechanics, hydraulics, Chemistry, hydrology and geology.	
Applicability	The module is one of 14 mandatory elective modules of the Bachelor course of water engineering and environment. the module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 3 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 90 hours.	
Duration of the module	The module takes one terms starting in Semester 4, 5,6.	
Proposal references	• A.D. Bhide: Solid Waste Management in Developing Countries, Nagpur Publigations • Integrated Solid Waste Management, Techobanglous, Thisen and Vigil, Mc Grae Hill International. • 3. Hazardous Waste Management: Lagrega, Buckingham and Evans, Mc Grae Hill International.	

BWEAE 34	**Water Exploitation and Management**	**Prof. Dr**
Contents and Qualification aims	The module introduce the conditions of water Exploitation as sufficient water storage, required quantity, influence of climatic change, required water legislation, integrated planning, water exploitation, several uses of water (as drinking water, irrigation, industry, tourism, environment flow, flood protection, river transport). The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and Use some advanced software to give the students enough knowledge and ability in these fields.	
Module Character	Water Exploitation and Management: 2 Hours of lectures per week, 2 hour of tutorial and Laboratory and experiments per week.	
Prerequisite of attendance	Basic Knowledges of Water Exploitation and Management are Basics of Environment and Sanitary Engineering, fluid mechanics, hydraulics, and hydrology.	
Applicability	The module is one of 14 mandatory elective modules of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 3 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 90 hours.	
Duration of the module	The module takes one terms starting in Semester 4, 5,6.	
Proposal references	• 1. Warren Viessman Jr. and Timothy D. Feather: Water Resources Planning in the United State, American Society of Civil Engineers, Reston, VA, 2006.. • 2. Loucks, D. P. and E. van Beek: Water Resources Systems Planning and Management: An Introduction to Methods, Models and Applications. UNESCO Publishing. 2005. • 3., Patricia H.:Harvesting rainwater for land use Water fall Extension Agent, University of Arizona Cooperative Extension/Low 4 Program 2nd ed., October 2004. • 4. Jain, S.K.: Revised Water Resources Systems Planning and Management, National Institute of Hydrology Roorkee 247 667, Uttarachal, India; V.P. Singh Department of Civil and Environmental Engineering Louisians State University, Baton Rouge, LA 70803-6405, USA.	

BWEAE 35	**Water Chemistry and Microbiology**	**Dr. Eng.**
Contents and Qualification aims	The module introduces the general information of water solution Chemistry and the important parameters indicated of water quality and the methods of chemical treatment. In addition to give the module the Microbiological properties of several water resources. The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and Use some advanced software to give the students enough knowledge and ability in this fields.	
Module Character	Water Chemistry and Microbiology: 2 Hours of lectures per week, 2 hour of tutorial and Laboratory and experiments per week.	
Prerequisite of attendance	Basic Knowledges of Water Chemistry and Microbiology are Water Exploitation and Management is Basics of Environment and Sanitary Engineering, fluid mechanics, Chemistry, hydrology and geology.	
Applicability	The module is one of 14 mandatory elective modules of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 3 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 90 hours.	
Duration of the module	The module takes one term starting in Semester 4, 5,6.	
Proposal references	• Michael E. Essington: Soil and Water Chemistry: An Integrative Approach, 2004, University of Tennessee, [CRC Press]. • 2. H L. BOHN; B.L. McNEAL; G.A. O’CONNOR: SOIL CHEMISTRY, JOHN WILEY & SONS, INC, 2001 by John Wiley & Sons, Inc, 2nd Edition. ISBN 0-471-36339-1	

BWEAE 36	**Execution Technology of Water Structure**	**Dr. eng.**
Contents and Qualification aims	The module introduces students to the construction process of water structures in site. Through this module the students will be able to identify the steps to construct each structure element and the properties of construction process and used machinery. The students' must know how to calculate the costs of the construction and the time plan. The students' knowledge will be developed during tutorials , use some modern software and computer training to give the students enough knowledge and ability in these fields.	
Module Character	Execution Technology of Water Structure: 2 Hours of lectures per week, 2 hour of tutorial and Laboratory and experiments per week.	
Prerequisite of attendance	Basic Knowledges of Execution Technology of Water Structure are Water Exploitation and Management, Basics of Environment and Sanitary Engineering.	
Applicability	The module is one of 14 mandatory elective modules of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 3 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 90 hours.	
Duration of the module	The module takes one term starting in Semester 4, or 5, or 6.	
Proposal references	• Specifications Volumes I - CPWD construction technologies cpwd.gov.in/Publication/Specs2009V1.pdf • Concrete technology and durability design, COWI company. • XIV National Conference on Structural Engineering, Acapulco 2004, Offshore Structures – A new challenge,	

BWEAE 37	**Water Resources development and advanced Technologies**	**Prof. Dr.**
Contents and Qualification aims	The module deals with general and basic information about understanding, estimating and qualification of available water resources and its development and protection from Pollution and depletion and use some advanced software to manage and conserve it during giving the students enough knowledge and skill (ability) in these fields. The students' knowledge will be developed during tutorials and practical computer training.	
Module Character	Water Resources development and advanced Technologies: 2 Hours of lectures per week, 2 hour of tutorial per week.	
Prerequisite of attendance	Basic Knowledges of Water Resources development and advanced Technologies are general hydrology and other special watercourses of Water engineering and environment.	
Applicability	The module is one of the 14 mandatory electives of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 3 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 90 hours.	
Duration of the module	The module takes one term starting in Semester 6.	
Proposal references	• Giupponi, C., D. A. J. Karssenberg, and P. H. Matt P. Hare: **Sustainable Management of Water Resources: An Integrated Approach**. Edward Elgar Publishing, 2006. • United Nations: **Indicators of Sustainable Development: Guidelines and Methodologies**. 3rd ed., United Nations, New York, 2007. • Cech, T.V.: **Principles of Water Resources: History, Development, management, and Policy**. John Wiley and Sons: New York. 2004.	

BWEAE 38	**Municipal and Industrial Water Management**	**Dr. eng.**
Contents and Qualification aims	The module introduces the student's methods of water supply for industrial structures and methods of waste water treatment resultant from these structures. This means that the student must know resources, properties and quantity required for industrial water supply, methods of water treatment required for using in industry, resources, properties and quantity of industry wastewater. Industry waste water treatment (simple, chemical, physical-chemical, air- biological industry waste water, no air biological, treatment, advanced treatment of industry waste water and reuse this water. riddance from the sediments resultant from this treatment, the students must able to put technological planning for treatment station of waste water some industries. The students' must know how to calculate the costs of the construction and the time plan. The students' knowledge will be developed during tutorials and practical computer training.	
Module Character	Industrial Water: 2 Hours of lectures per week, 2 hour of tutorial and Laboratory and experiments per week.	
Prerequisite of attendance	Basic Knowledges of Industrial Water is Water Exploitation and Management are Basics of Environment and Sanitary Engineering, Drinking and Waste Water Treatment, fluid mechanics, hydraulics, Chemistry, hydrology and geology.	
Applicability	The module is one of 14 mandatory elective modules of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 3 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 90 hours.	
Duration of the module	The module takes one term starting in Semester 4, or 5, or 6.	
Proposal references	• 1. William Weseley Eckenfelder: Industrial Water pollution Control, Mc Graw-Hill,2000,, 3rd ed., 584 Page. • 2. Lawrence K. Wang: Handbook of Industrial and Hazardous Wastes Treatment, Book by Lawrence K. Wang, 2004. • 3. Haestad, Thomas, M. Walski, Donald V. Chase, Dragan, A. Savic, Walter, Grayman, Stephen Beckwith, and Edmundo Koelle: Advanced water distribution modeling and management Methods, 1st edition 2003. Bolstad, P., 2008. GIS fundamentals: A first text on Geographic Information Systems. 3rd ed., Eider Press, White Bear Lake, Minnesota	

BWEAE 39	**Engineering Hydrogeology**	**Prof. Dr.**
Contents and Qualification aims	The module introduces students the Physical and chemical properties of groundwater; origin of groundwater and its forms in the earth crust: Groundwater flow laws ;steady groundwater flow into homogeneous aquifers ; steady groundwater flow into no homogeneous aquifers ; groundwater flow in the unsaturated media; groundwater investigation; field infiltration tests; pumping tests and analyzing it's data; hydraulic and design of wells; artificial recharge of groundwater; Protect the groundwater from pollution und depletion; principles of groundwater modeling;. The students' knowledge will be developed during tutorials and Laboratory Experiments and practical computer training to give the students enough knowledge and ability in these fields.	
Module Character	Engineering Hydrogeology: 2 Hours of lectures per week, 2 hour of tutorial and Laboratory and experiments per week.	
Prerequisite of attendance	Basic Knowledges of Engineering Hydrogeology are Basics of Environment and Sanitary Engineering, fluid mechanics, hydraulics, Chemistry, hydrology and geology.	
Applicability	The module is one of 14 mandatory elective modules of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 3 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 90 hours.	
Duration of the module	The module takes one term starting in Semester 4, or 5, or 6.	
Proposal references	• Neven Kresic: **Hydrogeology and Groundwater Modeling**, 2007,2nd ed., Taylor & Francis Group, London New York. • Rushton, K.R.: **Groundwater Hydrology Conceptual and Computational Models**, 2003.John Wiley & Sons Ltd. ISBN 0-470-85004-3. • 3. ALASAAD, A. M. **Hydrogeology**, 2010, Tishreen University. 600 pgs.	

BWEAE 40	**Drainage and Land Reclamation**	**Prof. Dr.**
Contents and Qualification aims	The module introduces students General Concepts of drainage and land reclamation; salinity in agricultural soils; saline soils remediation methods; calculation of water demand for washing the saline, design of drainage networks (horizontal drainage of irrigated land; Vertical drainage of irrigated land); Regulation of Drainage Collectors stream, River streams regulation; The students' knowledge will be developed during tutorials and practical computer training to give the students enough knowledge's and ability in these fields.	
Module Character	Drainage and Land Reclamation: 2 Hours of lectures per week, 2 hour of tutorial and Laboratory and experiments per week.	
Prerequisite of attendance	Basic Knowledges of Drainage and Land Reclamation are Engineering Hydrogeology, irrigation and drainage engineering, fluid mechanics, hydraulics, Chemistry, hydrology and geology.	
Applicability	The module is one of 14 mandatory elective modules of the Bachelor course of water engineering and environment. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 3 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 90 hours.	
Duration of the module	The module takes one term starting in Semester 4, or 5, or 6.	
Proposal references	• 1. H. P. Ritzema: Drainage principles and applications, (Editor-in-Chief) 1994. ILRI. ISBN: 90 70754 3 392. • 2. McComas, Murray R.: Geology and Land Reclamation, The Ohio Journal of Science. v72 n2 (March, 1972), 65-75. • 3. LAND RECLAMATION AND PLANNING. • 4. Guidence for Planning Authorities on Drainage and Reclamation of wetlands, consultation draft, 2011, Environment, Community and Local Government.	

BWEAE 41	**Irrigation and Drainage Networks**	**Prof.Dr.**
Contents and Qualification aims	The module deals with general and basic information about planning and design of the open and close Irrigation and drainage networks, and drop and drizzle Networks, Choose the regular and distribution elements, and put them in the right place, choose the most active methods to distribute and regulate the flow in the irrigation networks to maintain the irrigation water lost in the minimum amount, and with minimum costs, planning an active drainage network, and putting necessary exploitation and maintenance plans. Use some advanced software to give the students enough knowledge and ability in these fields. The students' knowledge will be developed during tutorials and practical computer training.	
Module Character	Irrigation and Drainage Networks: 2 Hours of lectures per week, 2 hour of tutorial per week.	
Prerequisite of attendance	Basic Knowledges of Irrigation and Drainage Networks are irrigation and drainage engineering, fluid mechanics, hydrology, hydraulics.	
Applicability	The module is one of the 14 mandatory elective modules of the Bachelor course of water engineering and environment. Out of which 3 have to be chose. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 3 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 90 hours.	
Duration of the module	The module takes one term starting in Semester 5.	
Proposal references	• Sharma, V.; Agarwal, R.N.: **Planning Irrigation Network,** New Age International Publishers,2005. • Hanson, B.: **Scheduling Irrigations: When and how much water to apply**. University of California Irrigation Program, USA, 1999.	

BWEAE 42	**Dams related Structures**	**Prof.Dr.Eng.**
Contents and Qualification aims	The module deals with design of the under cascade; design of Concrete dams provided with weirs; design of spillway, water intakes, water intake in the earth dams; water intakes as pipes and tower; water intakes without tower, water intakes as tunnel; spillway of earth dams(insides, pipes, tunnels. Siphons). Stilling basins, type of gates, execution of stability and monitoring equipment. Use some advanced software to give the students enough knowledge and ability in these fields. The students' knowledge will be developed during tutorials and practical computer training.	
Module Character	Dams related Structures: 2 Hours of lectures per week, 2 hour of tutorial per week.	
Prerequisite of attendance	Basic Knowledges of Dams related Structures are hydraulic structures, dams, irrigation and drainage engineering, fluid mechanics, hydrology, hydraulics.	
Applicability	The module is one of the 14 mandatory of elective modules of the Bachelor course of water engineering and environment. Out of which 3 have to be chose. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 3 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 90 hours.	
Duration of the module	The module takes one term starting in Semester 5.	
Proposal references	• Novak, A.I.B. Moffat and C. Nalluri; R. Narayanan: **Hydraulic Structures**, 4th ed., published 2007 by Taylor & Francis. • Crager, J. and Hinds, John Wiley. **Engineering for Dams**, Vol. I to III. • 3. R.S. Varshney: **Concrete Dams**, Oxford and IBH Publishing Co.	

BWEAE 43	**Coastal Protection Engineering**	**Dr. Eng.**
Contents and Qualification aims	The module deals with Introduction to coastal processes: sediment characteristics and analysis; beach profiles and profile change; long – terms processes. Hydrodynamics of the coastal zone; tides and storm surges; waves and wave – induced hydrodynamics; coastal response; field measurement techniques and analysis; equilibrium beach profiles; sediment transport and rates; miscellaneous coastal features; shoreline modification and analysis; beach nourishment and soft engineering structures; hard engineering structures; shoreline management. The students' knowledge will be developed during tutorials and practical computer training.	
Module Character	Coastal Protection Engineering: 2 Hours of lectures per week, 2 hour of tutorial per week.	
Prerequisite of attendance	Basic Knowledges of Coastal Protection Engineering are hydraulic structures, fluid mechanics, hydrology and hydraulics.	
Applicability	The module is one of the 14 mandatory elective modules of the Bachelor course of water engineering and environment. Out of which 3 have to be chose. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 3 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 90 hours.	
Duration of the module	The module takes one term starting in Semester 5 or 6.	
Proposal references	• US Army Corps of Engineers: **Coastal Structures**: Types, Functions and Applications, Presentation to Shoreline Erosion Task Force, August 15, 2012, Hartford, CT. • **Shore Erosion Control Guidelines**, Maryland Department of Natural resources, 2006. • Thomas O. Herrington: **Manual for Costal Hazard Mitigation**, NEW JERSEY SEA GRANT COLLEGE PROGRAM, Rutgers University, 108 Pages.	

BWEAE 44	**Exploitation and Management of marine Structures**	**Dr. Eng.**
Contents and Qualification aims	The module introduces the conditions of Exploitation and Management of marine Structures as sufficient capacity, required exploitation legislation, integrated exploitation planning, sufficient budget and experts, shoreline management, studying of pollution and its prevention, maintenance of shores, observation of marine common owns, establishment training centers, modeling of shore changes, control of shore eroding. The students' will be developed during tutorials and practical computer training.	
Module Character	Exploitation and Management of marine Structures: 2 Hours of lectures per week, 2 hour of tutorial per week.	
Prerequisite of attendance	Basic Knowledges of Exploitation and Management of marine Structures are Coastal Protection Engineering, hydraulic structures, fluid mechanics, hydrology and hydraulics.	
Applicability	The module is one of the 14 mandatory elective modules of the Bachelor course of water engineering and environment. Out of which 3 have to be chose. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 3 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 90 hours.	
Duration of the module	The module takes one term starting in Semester 5 or 6.	
Proposal references	• 1. George Somerville: Management of Deteriorating Concrete Structures:, Taylor and Francis Publication. • 2. Glenn Smock: Guide to Concrete Repair. US Department of the Interior Bureau of Reclamation, Technical Service. • 3. John H. Bungrey; Stephen G. Millard and Michael G. Grantham: Testing of Concrete in Structures, Taylor & Francis Publication. • 4. Durability of Concrete and Cement composites: C.L. Page & M.M. Page. Woodhead Publishing.	

BWEAE 45	**Exploitation and Management of Water Structures**	**Prof.Dr.**
Contents and Qualification aims	The module introduces the management of the working of the Water Structures and their exploitation, execute technical measurements and the required calibration of working of Water Structures and their exploitation, measurements apparatus and observation of water structures changes, required maintenance working for water projects and structures according their components. Management of water structures, execute several programs of water structures projects and manage and exploit them. The students will be developed during tutorials and practical computer training.	
Module Character	Exploitation and Management of Water Structures: 2 Hours of lectures per week, 2 hour of tutorial per week.	
Prerequisite of attendance	Basic Knowledge of Exploitation and Management of Water Structures is hydraulic structures, fluid mechanics, hydrology, hydraulics.	
Applicability	The module is one of the 14 mandatory elective modules of the Bachelor course of water engineering and environment. Out of which 3 have to be chose. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 3 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 90 hours.	
Duration of the module	The module takes one terms starting in Semester 6.	
Proposal references	• George Somerville: Management of Deteriorating Concrete Structures:, Taylor and Francis Publication. • Glenn Smock: Guide to Concrete Repair. US Department of the Interior Bureau of Reclamation, Technical Service. • John H. Bungrey; Stephen G. Millard and Michael G. Grantham: Testing of Concrete in Structures, Taylor & Francis Publication. • Durability of Concrete and Cement composites: C.L. Page & M.M. Page. Woodhead Publishing. • 5. I. Hassan: Irrigation Networks, 2011, Tishreen University.	

BWEAE 46	**Water Tanks**	**Prof. Dr.**
Contents and Qualification aims	The module introduces the main principles of water tanks design, the constructive basics in the design of the holding elements in these tanks, design of the circular tanks, design of rectangular tanks and high tanks. Analysis and distribution of forces in the holding framework, analysis and design of circular slabs, analysis and design of circular beams, analysis and design of scurfy. The students' will be developed during tutorials and practical computer training.	
Module Character	Water Tanks: 2 Hours of lectures per week, 2 hour of tutorial per week.	
Prerequisite of attendance	Basic Knowledges of Water Tanks are reinforced concrete, hydraulic structures, fluid mechanics and hydraulics.	
Applicability	The module is one of the 14 mandatory elective modules of the Bachelor course of water engineering and environment. Out of which 3 have to be chose. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 3 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 90 hours.	
Duration of the module	The module takes one terms starting in Semester 5 or 6.	
Proposal references	• 1. Nibedita Sahoo: Design of Water Tank, DEPARTMENT OF CIVIL ENGINEERING NATIONAL INSTITUTE OF TECHNOLOGY ROURKELA MAY 2008. • 2. IITK- GSDMA GUIDELINES for SEISMIC DESIGN OF LIQUIDS STORAGE TANKS, Provisions with Commentary, Indian Institute of Technology Kanpur Kanpur, 2007. • 3. DESIGN RECOMMENDATION FOR STORAGE TANKS AND THEIR SUPPORTS WITH EMPHASIS ON SEISMIC DESIGN, 2010, ARCHITECTURAL INSTITUTE OF JAPAN.	
From these Courses students must select one module for each of the 4^{th}, 5^{th} and 6^{th} Semester		

General Qualification		
Module Number	**Module Name**	**Professor in Charge**
BWEAE 47	**English**	**faculty of Culture**
Contents and Qualification aims	The module introduces English grammar and the basis of the English conversation. The students will be developed during some tests, seminars, and representation.	
Module Character	English: 2 Hours of lectures per week	
Prerequisite of attendance	Basic Knowledge of English not concrete (not necessary)	
Applicability	The module is one of the 5 mandatory general qualifications of the Bachelor course of water engineering and environment. The module is suitable for the professional oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 2 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 60 hours.	
Duration of the module	The module takes one term starting in Semester 1.	
Proposal references	English references are available.	

BWEAE 48	**Arabic**	**faculty of Culture**
Contents and Qualification aims	The module introduces Arabic grammar of Arabic language. The students will be developed during some tests, seminars, and representation.	
Module Character	Arabic: 2 Hours of lectures per week	
Prerequisite of attendance	Basic Knowledge of Arabic not concrete (not necessary)	
Applicability	The module is one of the 5 mandatory general qualifications of the Bachelor course of water engineering and environment. The module is suitable for the professional oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 2 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 60 hours.	
Duration of the module	The module takes one term starting in Semester 2.	
Proposal references	Arabic references are available.	

BWEAE 49	**Arabic Culture**	**Faculty of Culture**
Contents and Qualification aims	The module introduces Arabic culture and its relationship with other world civilizations. The students will be developed during some tests, seminars, and representation.	
Module Character	Arabic Culture: 2 Hours of lectures per week.	
Prerequisite of attendance	Basic Knowledge of Arabic Culture is not concrete (not necessary).	
Applicability	The module is one of the 5 mandatory general qualifications of the Bachelor course of water engineering and environment. The module is suitable for the professional oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 2 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 60 hours.	
Duration of the module	The module takes one term starting in Semester 1 St.	
Proposal references	Books and references of **Arabic Culture** are available.	

BWEAE 50	**History of Sciences and Technologies**
Contents and Qualification aims	The module introduces the history of sciences and technologies in world and in the Arabian and Islamic regions.
Module Character	History of Sciences and Technologies: 2 Hours of lectures per week.
Prerequisite of attendance	Basic Knowledge of History of Sciences and Technologies is not concrete (not necessary).
Applicability	The module is one of the 5 mandatory general qualifications of the Bachelor course of water engineering and environment. The module is suitable for the professional oriented studies in civil and environmental engineering.
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.
Accredit points and grades	The module earns 2 Cr. The final Grade is generated with 70% written exam and 30% term paper.
Frequency of the module	The module is offered annually.
Worked load	The workload is 60 hours.
Duration of the module	The module takes one term starting in Semester 3.
Proposal references	• Ahti- Veikko Pietarinen: History and Philosophy of Science and Technology, 2011, Veikko.pietarinen@helsinki.fi. • Katharine Park ; Lorraine Daston: The Cambridge History of Science Volume 3: Early Modern Science, Cambridge University Press, 2006, Cambridge University Press, ISBN: 9780521572446, Online ISBN:9781139054010. • Jaroslav Folta: What to do with the 20 th Century in the History of Science and Technology, (Problems of historiography of science and technology). New series, Vol. 9(2007).

BWEAE 51	**Rights and Water Legislations**	**Dr.Eng.**
Contents and Qualification aims	The module introduces the laws and legislation of water using and environment in Syria, Arab lands and in the world. The students will be developed during some tests, seminars, and representation.	
Module Character	Rights and Water Legislations: 2 Hours of lectures per week	
Prerequisite of attendance	Basic Knowledge of Rights and Water Legislations is not concrete (not necessary).	
Applicability	The module is one of the 5 mandatory general qualifications of the Bachelor course of water engineering and environment. The module is suitable for the professional oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 2 Cr. The final Grade is generated with 70% written exam and 30% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 60 hours.	
Duration of the module	The module takes one term starting in Semester 3.	
Proposal references	• Stephen Hodgson: Modern Water Rights Theory and Practice, FAO Legislative Study. • Water Rights in Montana, Montana University System Water Center, April 2012.	

Practical Training/ Project Study		
Module Number	**Module Name**	**Professor in Charge**
BWEAE 52	**Practical Training/ Project Study**	**Not definite**
Contents and Qualification aims	The Student must carry out practical training about one Problem belongs to subjects of Water engineering and Environment in one or more institution or incorporation, and he must present full study about this problem.	
Module Character	Practical Training/ Project Study: 12 Hours tutorial per week	
Prerequisite of attendance	Basic Knowledge of Practical Training/ Project Study, the student must be in the 5 th Semester.	
Applicability	the module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module seminar and presentation before commission.	
Accredit points and grades	The module earns 6 Cr. The final Grade is generated with 100% as presentation in front of committee.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 180 hours.	
Duration of the module	The module takes one term starting in Semester 5.	
Proposal references	• James E. Mauch and Namgi Park: **Guide to the Successful Thesis and Dissertation, A Handbook for Students and Faculty**.2003. 5th ed., Copyright ©2003 by Marcel Dekker. ISBN: 0-8247-4288-5. • Louis Cohen; Lawrence Manion and Keith Morrison: Research Methods in Education, 2005, 5th ed., ISBN 0-203-22434-5 Master e-book ISBN. • Derek Swetnam: Writing Your Dissertation, How to plan, prepare and present successful work.2007, 3rd ed., ISBN: 978 1 84803 126 5.	

Bachelor Thesis with Defense		
Module Number	**Module Name**	**Professor in Charge**
BWEAE 53	**Bachelor Thesis with Defense**	**Not definite**
Contents and Qualification aims	The Student must work Bachelor Thesis with Defense about one Problem belongs to the subjects of Water engineering and Environment in the semester, he must present full study about this problem.	
Module Character	Bachelor Thesis with Defense: 18 Hours tutorial per week.	
Prerequisite of attendance	Basic Knowledge of Bachelor Thesis with Defense, the student must be in 6 Semester.	
Applicability	the module is suitable for the professional and research oriented studies in civil and environmental engineering	
Prerequisite to active credit points	Having passed the module presentation before a commission.	
Accredit points and grades	The module earns 9 Cr. The final Grade is generated with 100% as presentation in front of committee.	
Frequency of the module	The module is offered in 6 th Semester.	
Worked load	The work load is 270 hours.	
Duration of the module	The module takes one term starting in Semester 6.	
Proposal references	• James E. Mauch and Namgi Park: Guide to the Successful Thesis and Dissertation, A Handbook for Students and Faculty. 2003. 5th ed., Copyright ©2003 by Marcel Dekker. ISBN: 0-8247-4288-5. • Louis Cohen; Lawrence Manion and Keith Morrison: Research Methods in Education, 2005, 5th ed., ISBN 0-203-22434-5 Master e-book ISBN. • Derek Swetnam: Writing Your Dissertation, How to plan, prepare and present successful work. 2007, 3rd ed. ISBN: 978 1 84803 126 5. • 4. Old Master and Bachelor thesis, which are available in the Libraries of the University.	

5-Training Course of Bachelor Water Engineering and Environment

1- Training course: Dam safety

The course has been put to engineers working in field, water structures, water resources management and in general engineering works. The goal of course is giving the absolvent the experience in field dam safety.

Course contents:

- Introduction to dam safety
-Types of dams
- Hydraulics inlet and outlet structures
- Causes of dam failure
- The inspection program
- Dam safety laws
- Inspection of dams and reporting
- Operation and maintenance of dams and control structures
- Emergency actions and procedures.

2- Training course: Irrigation

The course has been put to engineers working in field, water structures, water resources management and in general engineering works. The goal of course is giving the absolvent the experience in field **irrigation**.

Course contents:

- Properties of agricultural lands;
- Properties of agricultural soils and soil classification and characteristics;
- Irrigation hydraulic structures – storage reservoirs, spillways, canals, gates and check structures;
- Water conveyance, distribution, drainage and seepage;
- Crop water management - crop water requirements, measurements and irrigation scheduling;
- Irrigation project operation and maintenance;
- GIS application in irrigation management.

3- Training course: Introduction to Water Resources

The course has been put to engineers working in field, water structures, water resources management and in general engineering works. The goal of course is giving the absolvent the experience in field **water resources.**

Course contents:

- Basic mathematics and computer skills related to water resources;
- Introduction to water resources engineering;
- Surface hydrology, groundwater hydrology and principles of groundwater hydrology and models;
- Soil classification – standard of soil classification, laboratory soil sieve analysis, soil porosity and density, etc.
- Principles in environmental engineering and science - physical, chemical and biological processes in water and wastewater treatment systems and their relationship to the environment.

Quality Management

Water Engineering and Environment

(BWEAE)

Bachelor Programme

Tishreen University Lattakia

Department of Water Engineering and Irrigation
Faculty of Civil Engineering

2015

EDUWAT: 511251-TEMPUS-1-2010-1-DE-TEMPUS-SMHES
Development of a Modern Higher Education System for Water Engineering in Syria

Developed by
Prof.Dr. Eng. Izzeddin Hassan
Prof. Dr. Eng. Camille Bouras
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This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein	Tempus

Quality management and accreditation

University: Tishreen University
Faculty: Faculty of Civil Engineering

1- Specification of the Programme

1-1- Basic Data

- Programme name (BWEAE): programme of Water Engineering and Environment
- **Type of the Programme**: single: include one specific from two Departments.
- **Name of the participated Programmes**: (none).
- **Duration of the Programme:** 6 Semesters.
- **Qualification (Certificate), which the Student get at the End of the Programme**: Bachelor of Civil Engineering (specialist in Water Engineering and Environment).
- **Language or Languages used in the Programme**: Arabic is the main language. English Language is used to explain the scientific terms.
- **Place of Programme application:** University Campus, Building of Faculty of Civil Engineering.
- **External Check Person:**
- **Date the latest acceptance of specification of the Programme:**

1-2- Professional Data

1-2-1- Message and Goal of the Programme

- **Notification of message and Goal of the Programme:**

The Department of Water Engineering and Irrigation, and Department of Environment Engineering in the Faculty of Civil Engineering in Tishreen University undertake the preparation of an excellent absolvent in the fields of Water and Sanitary Engineering and Environment, qualified to continue his qualification and his professional development, able to compete and cover the need of the labour market in these Engineering fields. In addition to, the both Departments give a very good studying and research plan aims to development the scientific research and participation in professional and research projects. Which contribute in supporting and covering the needs of development plans of the country, during the cooperation with the related scientific, research and service sides.

- Goals of the programme:

The academic plan in the **Bachelor course of water engineering and environment programme**, aims at providing the students the following items:

8. High level information in science and computer techniques, and developing the skills in engineering sciences and its applications.
9. Developing the ability of the students to achieve various water engineering and environmental studies, check and use it according to the engineering codes.
10. Comparing between the engineering solutions, and choose the optimum ones.
11. Developing the work skills and regulate the relationship between the work team which the best and have many specialists.
12. Strengthening the research ability, developing, and working with the modest software's, equipment's… etc.
13. Developing the item of the scientific, social and cultural of the student's characters.
14. Continuous developing to get the high quality of the research, teaching…...etc.

8- High level information in science and computer techniques, and developing the skills in engineering sciences and its applications.

1-2-2- Programme Composition and its Contents

a) Admission conditions in the Programme:

The a**dmission** will be done through the competition among the students, who have got the secondary school certificate – scientific branch, national level.

b) The conditions of success in the Programme:

Presence of theoretical, tutorial, and laboratory lectures and present the required projects and scientific and laboratories reports.

c) **Success from year to year**: Succes in all modules in 1st and 2nd Semester each studying year.

d) Completion of Programme:

Condition of accomplish (get over) of studying years	
1st year	Success in modules of 1st and 2nd semesters, the student can hold max. 4 modules.
2nd year	Success in modules of 3rd and 4th semesters, the student can hold max. 4 modules from all foregone semesters
3rd year	Success in modules of 5th and 6th semesters, and in all foregone semesters

C) Conditions of the completion of the Programme:

- Brief description of the kind of Practical Training/ Project Study:

The Student must carry out practical training about one Problem related to the subjects of Water engineering and Environment in one or more institution or incorporation, and he must present full study about this problem.

- In which phase or phases of the programme this Practical Training/ Project Study is carried out : This Study or Project must be carried out in the 5th semester.

- Number of Credit / or semesters for this Practical Training/ Project Study:

Offered in 5th semester with 6 cr. per week.

- **Description of evaluation procedures**: The evaluation should be done by a commission, which is formed by the delegacy of faculty of civil engineering; the student must pass the module seminar and presentation in front of the commission.

- Brief description of the kind of Bachelor Thesis

The Student must carry out Bachelor Thesis about one Problem related to the subjects of Water engineering and Environment in the 6th semester, and he must present full study about this problem in front of the commission.

- In which phase from the programme the Bachelor Thesis with Defense should be carried out: This **Bachelor Thesis** must be carried out in the 6th semester.

- Number of Credit / or semesters for this Bachelor Thesis with Defense:

Offered in 6th semester with 9 cr. per week.

- **Description of evaluation procedures:** the evaluation should be done by a commission, which formed by the delegacy of faculty of civil engineering; the student must pass the module and presentation in front of the commission.

1-3- The Programme description:

The programme of Water Engineering and Environment is based on theoretical lectures, laboratory meeting, scientific excursion and summer training approved in the study plan.

- Brief description of praxis experiences activity:

∗ Summer training in surveying works in field;

∗ Summer training in sanitary projects;

∗ Summer training in water engineering and irrigation projects;

* Summer training in harbor and coastal engineering projects;
* Scientific excursion to water engineering and sanitary projects;

- In which phase or phases of the programme the field experience should be introduce:

* Surveying works in 3rd semester;
* Summer training in sanitary projects in 5th semester;
* Summer training in water engineering and irrigation projects in 4th and 5th semester;
* Summer training in harbor and coastal engineering projects in 6th semester;
* Scientific excursion to water engineering and sanitary projects in 2, 3,4,5,6 semester

2- Modules of Bachelor Course Water Engineering and Environment BWEAE

Nr of Module								
		Actual		**Goal**				
		Credits	%	**Credits**	%			
	Modules with Basics in Mathematics and Natural Sciences	26	14%	30	17%			
	Modules with Basics in Engineering	74	41%	60	33%			
	Modules with Basics in Hydro Sciences	16	9%					
	Modules with specialized Basics	30	17%	45	25%			
	Elective Modules	9	5%					
	Modules for general Qualification	10	6%	9	5%			
	Practical Training /Project	6	3%	18	10%			
	Bachelor examination	9	5%	18	10%			
	Total	**180**	**100 %**	**180**	**100 %**			
	Module/ Semester	**1**	**2**	**3**	**4**	**5**	**6**	**Total/ECTS**
	Basics in Mathematics and Natural Sciences	18	5	3	0	0	0	**26**
	Basics in Engineering	8	18	21	13	9	5	**74**
	Basics in Hydro Sciences	0	3	5	8	0	0	**16**
	Specialized Basics	0	0	0	5	12	13	**30**
	Elective Modules	0	0	0	3	3	3	**9**
	General Qualification	4	4	2	0		0	**10**
	Practical Training/ Project Study	0	0	0		0	6	**6**
	Bachelor Thesis incl. Defense	0	0	0	0		9	**9**
	Total	**30**	**30**	**30**	**30**	**30**	**30**	**180**
	Course Semester	**1**	**2**	**3**	**4**	**5**	**6**	**Total/ ECTS**
	Basics in Mathematics and Natural Sciences	**18**	**5**	3				**26**
BWEAE 1	Mathematics (1,2,3)	5	5	3				13
BWEAE 2	Physics for Engineering	5						3
BWEAE 3	Chemistry for Engineering	5						3
BWEAE 4	Basic of Informatics	3						3
	Basics in Engineering	**8**	**18**	**21**	**13**	**9**	**5**	**74**
BWEAE 5	Mechanical Engineering	5						5
BWEAE 6	Building Materials		5					**3**
BWEAE 7	Mechanics of materials		5					**6**
BWEAE 8	Geometrical Representation	3						**3**
BWEAE 9	Engineering Geology		5					**3**

BWEAE 10	Structures Analysis			5				**5**
BWEAE 11	Soil Mechanics			5				**5**
BWEAE 12	Reinforced Concrete (1+2)				3	3		**6**
BWEAE 13	Numerical Analysis and Modeling					3		**3**
BWEAE 14	Foundation				5			**3**
BWEAE 15	Metal and Structures				5			**5**
BWEAE 16	Building Construction		3					**3**
BWEAE 17	Roads and Transportation Engineering					3		**3**
BWEAE 18	Geodesy			5				**5**
BWEAE 19	Economic and Engineering Projects Management						5	**3**
BWEAE 20	Technical equipments			3				**3**
BWEAE 21	Technology of Construction			3				**3**
	Basics in Hydro Sciences		**3**	**5**	**8**			**16**
BWEAE 22	Hydrology		3					**3**
BWEAE 23	Fluids Mechanics			5				**4**
BWEAE 24	Basics of Environment and Sanitary Engineering				3			**4**
BWEAE 25	Hydraulics				5			**3**
	Specialized Basics				**5**	**12**	**13**	**30**
BWEAE 26	Drinking and Waste Water Networks				5			3
BWEAE 27	Drinking and Waste Water Treatment					5		3
BWEAE 28	Irrigation and Drainage					3		3
BWEAE 29	Water Structures					4		3
BWEAE 30	Dams						5	3
BWEAE 31	Pumping Station and Hydraulics Machines						3	3
BWEAE 32	Harbors Engineering						5	**5**
	Elective Modules				**3**	**3**	**3**	**9**
BWEAE 33	Solid Waste Management and Contaminates Treatment				+	+	+	**3**
BWEAE 34	Water Exploitation and Management				+	+	+	**3**
BWEAE 35	Water Chemistry and Microbiology				+	+	+	**3**
BWEAE 36	Execution Technology of Water Structures				+	+	+	**3**
BWEAE 37	Water Resources development and advanced Technologies				+	+	+	**3**
BWEAE 38	Municipal and Industrial Water Management				+	+	+	**3**
BWEAE 39	Engineering Hydrogeology				+	+	+	**3**
BWEAE 40	Drainage and Land Reclamation				+	+	+	**3**
BWEAE 41	Irrigation and Drainage Networks				+	+	+	**3**
BWEAE 42	Dams related Structures				+	+	+	**3**
BWEAE 43	Coastal Protection Engineering				+	+	+	**3**
BWEAE 44	Exploitation and Management of Sea Structures				+	+	+	**3**
BWEAE 45	Exploitation and Management of Water Structures				+	+	+	**3**
BWEAE 46	Water Tanks				+	+	+	**3**

	From these Courses students must select one course in each Semester 4, 5 and 6 (from 4 groups (sanitary Engineering, Harbor and Coastal Engineering, Water structures, Water resources management)							
	General Qualification	**4**	**4**	**2**				**10**
BWEAE 47	English	**2**						**2**
BWEAE 48	Arabic		**2**					**2**
BWEAE 49	Arabic Culture	**2**						**2**
BWEAE 50	History of Sciences and Tech-nologies		**2**					**2**
BWEAE 51	Rights and Water Legislations			**2**				**2**
BWEAE 52	**Practical Training/ Project Study**					**6**		**6**
BWEAE 53	**Bachelor Thesis with Defense**						**9**	**9**
	Total	**30**	**30**	**31**	**29**	**30**	**30**	**180**

3- Study Plan of Bachelor Course Water Engineering and Environment

Nr of Module	Courses	S. 1	S. 2	S. 3	S. 4	S. 5	S. 6	Total/ECTS
	Modules in Basic Sciences							
BWEAE 1	Mathematics (1,2,3)	4/2/0/0	4/2/0/0	2/2/0/0				12
BWEAE 2	Physics for Engineering	4/0/2/0						5
BWEAE 3	Chemistry for Engineering	4/0/2/0						5
BWEAE 4	Basic of Informatics	2/2/0/0						3
	Basics in Engineering							
BWEAE 5	Mechanical Engineering	4/2/0/0						5
BWEAE 6	Building Materials		4/2/0/0					5
BWEAE 7	Mechanics of material		4/2/0/0					5
BWEAE 8	Geometrical Representation	1/3/0/1						3
BWEAE 9	Engineering Geology		4/2/0/0					5
BWEAE 10	Structures Analysis			4/2/0/0				5
BWEAE 11	Soil Mechanics			4/2/0/0				5
BWEAE 12	Reinforced Concrete (1+2)				2/2/0/0	2/2/0/0		6
BWEAE 13	Numerical Analysis and Modeling					2/2/0/0		3
BWEAE 14	Foundation Engineering				4/2/0/0			5
BWEAE 15	Metal and Mixed structures				4/2/0/0			5
BWEAE 16	Buildings Construction		1/3/0/1					3
BWEAE 17	Roads and Transportation Engineering					4/2/0/0		5
BWEAE 18	Geodesy			4/2/0/0				5
BWEAE 19	Economic and Engineering Projects Management						4/2/0/0	5
BWEAE 20	Buildings Services			2/2/0/0				3
BWEAE 21	Technology of Construction			2/2/0/0				3
	Basics in Hydro Sciences							
BWEAE 22	Hydrology		2/2/0/0					3
BWEAE 23	Fluids Mechanics			3/2/2/0				5
BWEAE 24	Basics of Environment and Sanitary Engineering				2/2/0/0			
BWEAE 25	Hydraulics				3/2/2/0			5
	Specialized Basics							
BWEAE 26	Drinking and Waste Water				4/2/0/0			5

	Networks							
BWEAE 27	Drinking and Waste Water Treatment					4/2/0/0		5
BWEAE 28	Irrigation and Drainage Engi-neering					2/2/0/0		3
BWEAE 29	Water Structures					2/2/1/1		4
BWEAE 30	Dams Engineering						4/2/0/0	5
BWEAE 31	Pumping Station and Hydraulics Machines						2/2/0/0	3
BWEAE 32	Harbors Enginee-ring						4/2/0/0	5
	Elective Modules							
BWEAE 33	Solid Waste Ma-nagement and Contaminates Treatment				2/2/0/0	2/2/0/0	2/2/0/0	3
BWEAE 34	Water Exploitation and Management				+	+	+	3
BWEAE 35	Water Chemistry and Microbiology				+	+	+	3
BWEAE 36	Execution Tech-nology of Water Structures				+	+	+	3
BWEAE 37	Water Resources development and advanced Tech-nologies				+	+	+	3
BWEAE 38	Municipal and Industrial Water Management				+	+	+	3
BWEAE 39	Engineering Hydrogeology				+	+	+	3
BWEAE 40	Drainage and Land Reclamation				+	+	+	3
BWEAE 41	Irrigation and Drainage Net-works				+	+	+	3
BWEAE 42	Dams related Structures				+	+	+	3
BWEAE 43	Coastal Protection Engineering				+	+	+	3
BWEAE 44	Exploitation and Management of Sea Structures				+	+	+	3
BWEAE 45	Exploitation and Management of Water Structures				+	+	+	3
BWEAE 46	Water Tanks				+	+	+	3
	From these Courses students must select one course in each Semester 4, 5 and 6							
	General Qualification							
BWEAE 47	English	2/0/0/0						2
BWEAE 48	Arabic		2/0/0/0					2
BWEAE 49	Arabic Culture	2/0/0/0						2

BWEAE 50	History of Sciences and Technologies		2/0/0/0					2
BWEAE 51	Rights and Water Legislations			2/0/0/0				2
	Practical Training/ Project Study							
BWEAE 52	Practical Training/ Project Study					**6**		**6**
	Bachelor Thises with Defense							
BWEAE 53	Bachelor Thesis with Defense					**9**		**9**
	Total	**30**	**30**	**30**	**30**	**30**	**30**	**180**

Lecture/Tutorial/Laboratory/Excursion(Homeworks)

a: Knowledge and Understanding

a1: Mathematic with all branches: differential, integral, matrices, mathematical functions, differential equations, numerical mathematics.
Basics sciences: language, geometrical representation, physics, chemistry, informatics and mathematical molding. Tidy development his methods of scientific thought to continue his scientific studying and his professional works as civil engineer in field Water and sanitary Engineering and Environment.

a2: Engineering Principles in field of civil engineering: Mechanical Engineering, Mechanics of material, Building and Technology of Materials, Geometrical Representation, Engineering Geology, Structures Analysis, Soil Mechanics, Reinforced Concrete (1+2), Numerical Analysis and Modeling, Geotechnical and Foundation Engineering, Metal and Mixed structures, Buildings Construction, Roads and Transportation Engineering, Geodesy, Technology of Construction, Economic and Engineering, Projects Management, Buildings Services, Technology of Construction, Hydrology, Fluids Mechanics, Basics of Environment and Sanitary Engineering.

a3: Engineering Principles in field of Water and sanitary engineering and Environment:

Hydraulics, Engineering Hydrology, Hydrogeology, Water Structures, Drinking and Waste Water Networks, Drinking and Waste Water Treatment, Dams Engineering, Pumping Station and Hydraulics Machines, Harbors and Coastal Engineering. Ability of application these Engineering Principles and their development.

a4: **Knowledge** related to Informatics and exploitation of Computing Programs in Geometrical Representation and Buildings Construction and its Services and Water Resources development and to solve the different Engineering problems and show the innovation ability.

a_5: Principles of sustainable environmental Engineering of water resources and waste water and air pollution and principles of beautiful and culture distance in design.

a6: Knowledge related to technologies of execution methods of engineering contracts and projects taking into consideration the economical social and environmental input data.

a7: Ethics of exercises of professional and scientific work and their social and environmental reflections.

a8: Supply the graduate with required knowledge and understanding in accreditation principles and required common health and safety and other environmental subjects

a9: Supply the graduate with required knowledge in exercises of related professional systems and their criterions, cods, laws and legislation, especially Legislations of Water and Environment and stick to them.

a10: Supply the graduate with required ability knowledge to conflate the knowledge of civil engineering with the different fields, and execute an integral engineering project.

a11 Supply the graduate with related required scientific and practical strange terms.

A- ARS- Academic Reference Standard

Nr of Module and symbol	AR (Academic Reference Standard)											
	Module Name	National Academic Reference Standard NARS										Additional Standards
		a_1	a_2	a_4	a_5	a_6	a_7	a_8	a_9	a_{10}	a_{11}	a_3
	Modules in Basic Sciences											
BWEAE 1	Mathematics (1,2,3)	+										
BWEAE 2	Physics for Enginee-ring	+										
BWEAE 3	Chemistry for Engi-neering	+										
BWEAE 4	Basic of Informatics	+										
	Basics in Engineering											
BWEAE 5	Mechanical Enginee-ring		+									
BWEAE 6	Building Materials		+									
BWEAE 7	Mechanics of material		+									
BWEAE 8	Geometrical Repre-sentation		+	+								
BWEAE 9	Engineering Geology		+									
BWEAE 10	Structures Analysis		+									
BWEAE 11	Soil Mechanics		+									
BWEAE 12	Reinforced Concrete (1+2)		+									
BWEAE 13	Numerical Analysis and Modeling		+	+								
BWEAE 14	Foundation Enginee-ring		+									
BWEAE 15	Metal and Mixed structures		+									
BWEAE 16	Buildings Constructi-on		+	+	+							
BWEAE 17	Roads and Transpor-tation Engineering		+		+							
BWEAE 18	Geodesy		+									
BWEAE 19	Economic and Engi-neering Projects Ma-nagement		+		+	+						
BWEAE 20	Buildings Services		+	+	+							
BWEAE 21	Technology of Const-ruction		+		+							
	Basics in Hydro Sciences											
BWEAE 22	Hydrology		+									
BWEAE 23	Fluids Mechanics		+									+
BWEAE 24	Basics of Environ-ment and Sanitary Engineering		+		+							
BWEAE 25	Hydraulics		+									
	Specialized Basics											
BWEAE 26	Drinking and Waste Water Networks				+							+

BWEAE 27	Drinking and Waste Water Treatment				+							+
BWEAE 28	Irrigation and Drainage Engineering				+							+
BWEAE 29	Water Structures											+
BWEAE 30	Dams Engineering											+
BWEAE 31	Pumping Station and Hydraulics Machines											+
BWEAE 32	Harbors Engineering							+				+
	Elective Modules											
BWEAE 33	Solid Waste Management and Contaminates Treatment											+
BWEAE 34	Water Exploitation and Management											+
BWEAE 35	Water Chemistry and Microbiology											+
BWEAE 36	Execution Technology of Water Structures											+
BWEAE 37	Water Resources development and advanced Technologies			+	+							+
BWEAE 38	Municipal and Industrial Water Management				+							+
BWEAE 39	Engineering Hydrogeology											+
BWEAE 40	Drainage and Land Reclamation				+							+
BWEAE 41	Irrigation and Drainage Networks											+
BWEAE 42	Dams related Structures											+
BWEAE 43	Coastal Protection Engineering							+				+
BWEAE 44	Exploitation and Management of Sea Structures			+								+
BWEAE 45	Exploitation and Management of Water Structures								+	+		+
BWEAE 46	Water Tanks											+
	General Qualification											
BWEAE 47	English											+
BWEAE 48	Arabic	+										
BWEAE 49	Arabic Culture	+										
BWEAE 50	History of Sciences and Technologies											+
BWEAE 51	Rights and Water Legislations											+
	Practical Training/ Project Study											
BWEAE 52	Practical Training/ Project Study					+		+	+			+
	Bachelor Thesis with Defense											
BWEAE 53	Bachelor Thesis with Defense					+		+	+	+	+	+

B- Intellectual Abilities

b_1: Evaluation and choosing the building materials and optimum solution to design several civil engineering structures especially hydraulic structures, harbor and coastal structures and structures which used in sanitary Engineering, using suitable tools based on analytical and structural thought.

b_2: Evaluation and choosing the optimum solution of several geological, hydrological and hydro geological problems using suitable tools based on analytical thought.

b_3: Evaluation and choosing the optimum solution for design of irrigation and drainage networks and their related structures and the pumping and hydropower stations using suitable tools based on analytical thought.

b_4: Evaluation and choosing the optimum solution for design of drinking and waste water networks and their related structures, in addition to the drinking water purification and waste water treatment stations using suitable tools based on analytical thought.

b_5: Evaluation and choosing the optimum solution for water resources management and development using suitable tools and software based on analytical thought.

b_6**:** Implementation the acquired knowledge and the engineering principles to design the sea and rivers harbors, also the several dam types and their related structures or some parts of them.

b_7: Integral application and connection the engineering knowledge and understanding the other engineering competences requirements to get innovative engineering solutions.

b_8: Offering the engineering solutions of civil engineering problems especially Water, Irrigation, harbors and sanitary engineering, based on finite resources and incongruent information.

b_9: Analysis of engineering systems and their components and evaluating their consequences.

b_{10}: Self-learning for dealing with modern innovative problems of civil engineering, especially Water, Irrigation, harbors and sanitary engineering and technical new software.

b_{11}: Abilities to introduce the engineering solution of several Water, Irrigation, harbors and sanitary engineering based on international secintific references and journals and other resources.

	ARS(Academic reference Standard)											
	Module Name	National Academic reference Standard NARS								Additional Standards		
		b_1	**b_5**	**b_6**	**b_7**	**b_8**	**b_9**	**b_{10}**	**b_{11}**	**b2**	**b3**	**b_4**
Nr of Module	**Modules in Basic Sciences**											
BEWARE 1	Mathematics (1,2,3)				+							
BEWARE 2	Physics for Engineering				+							
BEWARE 3	Chemistry for Engineering				+							
BEWARE 4	Basic of Informatics				+							
	Basics in Engineering											
BEWARE 5	Mechanical Engineering				+							
BEWARE 6	Building Materials	+										+
BEWARE 7	Mechanics of material				+							
BEWARE 8	Geometrical Representation			+								
BEWARE 9	Engineering Geology									+		
BEWARE 10	Structures Analysis				+	+	+				+	+
BEWARE 11	Soil Mechanics				+							
BEWARE 12	Reinforced Concrete (1+2)										+	+
BEWARE 13	Numerical Analysis and Modeling			+	+							
BEWARE 14	Foundation Engineering	+		+							+	+
BEWARE 15	Metal and Mixed structures										+	+
BEWARE 16	Buildings Construction	+		+	+		+				+	+
BEWARE 17	Roads and Transportation Engineering	+		+	+							
BEWARE 18	Geodesy			+	+						+	+
BEWARE 19	Economic and Engineering Projects Management			+	+	+	+				+	+
BEWARE 20	Buildings Services	+		+	+						+	+
BEWARE 21	Technology of Construction	+			+						+	+
	Basics in Hydro Sciences											
BEWARE 22	Hydrology									+		
BEWARE 23	Fluids Mechanics										+	+
BEWARE 24	Basics of Environment and Sanitary Engineering		+	+	+	+					+	+
BEWARE 25	Hydraulics										+	+
	Specialized Basics											

BEWARE 26	Drinking and Waste Water Networks		+		+							+
BEWARE 27	Drinking and Waste Water Treatment	+	+		+							+
BEWARE 28	Irrigation and Drainage Engineering	+			+						+	
BEWARE 29	Water Structures	+									+	+
BEWARE 30	Dams Engineering	+		+								
BEWARE 31	Pumping Station and Hydraulics Machines	+									+	+
BEWARE 32	Harbors Engineering	+		+				+	+		+	
	Elective Modules											
BEWARE 33	Solid Waste Management and Contaminates Treatment					+						+
BEWARE 34	Water Exploitation and Management		+			+					+	+
BEWARE 35	Water Chemistry and Microbiology										+	+
BEWARE 36	Execution Technology of Water Structures	+		+							+	+
BEWARE 37	Water Resources development and advanced Technologies		+		+	+					+	+
BEWARE 38	Municipal and Industrial Water Management		+		+	+						+
BEWARE 39	Engineering Hydrogeology									+		+
BEWARE 40	Drainage and Land Reclamation	+			+						+	+
BEWARE 41	Irrigation and Drainage Networks										+	+
BEWARE 42	Dams related Structures	+		+								+
BEWARE 43	Coastal Protection Engineering	+		+				+	+		+	
BEWARE 44	Exploitation and Management of Sea Structures		+	+							+	+
BEWARE 45	Exploitation and Management of Water Structures									+	+	+
BEWARE 46	Water Tanks	+	+									+
	General Qualification											
BEWARE 47	English											
BEWARE 48	Arabic	+										
BEWARE 49	Arabic Culture	+										
BEWARE 50	History of Sciences and Technologies											

BEWARE 51	Rights and Water Legislations		+	+	+	+	+	+	+			
	Practical Training/ Project Study											
BEWARE 52	Practical Training/ Project Study					+	+	+	+	+		
	Bachelor Thesis with Defense											
BEWARE 53	Bachelor Thesis with Defense					+	+	+	+	+	+	

C- Professional and Practical Skills

C_1: The development of Ability of obligation and restraint of the Professional systems Basics,

C_2: Ability to work within team and regulating, moving and leading the collective team.

C_3: Ability to appoint the practical application of mathematical laws in other engineering modules, and enter them in continuing professional development.

C_4: Ability to expect hazards and develop, apply and improve the systems to manage and avoid them.

C_5: Ability to execute different engineering structures studies in fields Water, Irrigation, harbors and sanitary engineering taking into consideration the economical social and environmental output.

C_6: Ability to evaluate the geological cartography and execute different geological, hydrological and hydrological studies, and estimate the water resources and their management taking into consideration their impact on the other engineering studies and the economical social and environmental output.

C_7: Ability to study and design dams, pumping and hydropower stations, in addition to design irrigation and drainage networks, land reclamation taking into consideration the economical social and environmental output.

C_8: Ability to study and design drinking and waste water networks, drinking purification structures, waste water treatment structures and harbors and coastal engineering projects taking into consideration the economical social and environmental output.

C_9: Ability to execute profitable studies and make financial and time programs of engineering projects. In addition to preparing and executing work plan to achieve the goals of corporation.

C_{10}: Ability to appoint tools, software programs and different field engineering devices with obligation of professional safety basics.

C_{11}: Ability to use and appoint measurement devices, and execute related laboratory and fields experiments and analyzing the results.

	ARS(Academic Reference Standard)											
Nr of Module	Module Name	National Academic Reference Standard NARS								Additional Standards		
		C_1	**C_2**	**C_3**	**C_4**	**C_8**	**C_9**	**C_{10}**	**C_{11}**	**C5**	**C6**	**C_7**
	Modules in Basic Sciences											
BWEAE 1	Mathematics (1,2,3)		+									
BWEAE 2	Physics for Engineering			+								
BWEAE 3	Chemistry for Engineering			+								
BWEAE 4	Basic of Informatics	+			+		+	+	+			
	Basics in Engineering											
BWEAE 5	Mechanical Engineering											
BWEAE 6	Building Materials				+			+	+			+
BWEAE 7	Mechanics of material											
BWEAE 8	Geometrical Representation			+	+							
BWEAE 9	Engineering Geology				+					+		
BWEAE 10	Structures Analysis				+	+	+	+	+		+	+
BWEAE 11	Soil Mechanics				+			+	+			
BWEAE 12	Reinforced Concrete (1+2)							+	+		+	+
BWEAE 13	Numerical Analysis and Modeling		+	+	+							
BWEAE 14	Foundation Engineering			+				+	+		+	+
BWEAE 15	Metal and Mixed structures			+				+	+		+	+
BWEAE 16	Buildings Construction	+		+	+		+	+	+		+	+
BWEAE 17	Roads and Transportation Engineering			+	+			+	+			
BWEAE 18	Geodesy			+	+						+	+
BWEAE 19	Economic and Engineering Projects Management			+	+	+	+	+	+	+	+	+
BWEAE 20	Buildings Services	+		+	+			+	+		+	+
BWEAE 21	Technology of Construction	+		+	+			+	+		+	+
	Basics in Hydro Sciences											
BWEAE 22	Hydrology									+		
BWEAE 23	Fluids Mechanics										+	+
BWEAE 24	Basics of Environment and Sanitary Engineering			+	+	+					+	+
BWEAE 25	Hydraulics										+	+
	Specialized Basics											
BWEAE 26	Drinking and Waste Water Networks				+							+

BWEAE 27	Drinking and Waste Water Treatment				+							+
BWEAE 28	Irrigation and Drainage Engineering				+						+	
BWEAE 29	Water Structures										+	+
BWEAE 30	Dams Engineering	+		+				+	+			
BWEAE 31	Pumping Station and Hydraulics Machines							+	+		+	+
BWEAE 32	Harbors Engineering			+				+	+			
	Elective Modules											
BWEAE 33	Solid Waste Manage-ment and Contamina-tes Treatment					+						+
BWEAE 34	Water Exploitation and Management					+					+	+
BWEAE 35	Water Chemistry and Microbiology										+	+
BWEAE 36	Execution Technology of Water Structures	+		+							+	+
BWEAE 37	Water Resources de-velopment and advan-ced Technologies			+	+	+					+	+
BWEAE 38	Municipal and Industri-al Water Management				+	+						+
BWEAE 39	Engineering Hydrogeo-logy									+		+
BWEAE 40	Drainage and Land Reclamation				+						+	+
BWEAE 41	Irrigation and Drainage Networks				+						+	+
BWEAE 42	Dams related Structu-res	+		+								+
BWEAE 43	Coastal Protection Engineering			+				+	+			
BWEAE 44	Exploitation and Mana-gement of Sea Structu-res			+	+							+
BWEAE 45	Exploitation and Mana-gement of Water Struc-tures			+	+					+	+	+
BWEAE 46	Water Tanks	+		+	+			+	+		+	+
	General Qualification											
BWEAE 47	English	+										
BWEAE 48	Arabic											
BWEAE 50	Arabic Culture											
BWEAE 51	History of Sciences and Technologies											
BWEAE 50	Rights and Water Le-gislations	+	+	+	+	+	+	+	+	+	+	
	Practical Training/ Project Study											
BWEAE 52	Practical Training/ Pro-ject Study	+	+	+	+	+	+	+	+	+	+	+
	Bachelor Thesis with Defense											
BWEAE 53	Bachelor Thesis with Defense	+	+	+	+	+	+	+	+	+	+	+

D- General Transferable Skills

D1: Ability to work actively within team with several specializations.
D2: Ability to show active and personal skills in different work environments.
D3: Ability to develop self-learning and follow a continuing learning processes.
D4: Ability to work within hard business work environment to achieve the required businesses in time, and in different limits.
D5: Ability to manage tasks and resources in active serious form.
D6: Ability to follow and use advanced technologies and software programs in field of civil engineering especially in water and environmental engineering.
D7: Ability to acquire skills of Projects management.
D8: Ability to expose the designs and proposals and writing the scientific reports.
D9: Ability to communicate and discuss with other sides.
D10 : Possession of skills of required strange languages to carry out the profession and follow-up the epistemic development.

		ARS(Academic Reference Standard)									
Nr of Module	Module Name	National Academic Reference Standard NARS									Additional Standards
		D_1	**D_2**	**D_3**	**D_4**	**D_5**	**D_7**	**D_8**	**D_9**	**D 10**	**D 6**
	Modules in Basic Sciences										
BWEAE 1	Mathematics (1,2,3)			+							
BWEAE 2	Physics for Engineering			+							
BWEAE 3	Chemistry for Engineering			+							
BWEAE 4	Basic of Informatics	+		+				+	+		+
	Basics in Engineering										
BWEAE 5	Mechanical Engineering			+							
BWEAE 6	Building Materials			+	+			+			
BWEAE 7	Mechanics of material			+							
BWEAE 8	Geometrical Representation			+							
BWEAE 9	Engineering Geology	+		+	+						
BWEAE 10	Structures Analysis			+				+			
BWEAE 11	Soil Mechanics	+		+	+			+			
BWEAE 12	Reinforced Concrete (1+2)			+	+			+			
BWEAE 13	Numerical Analysis and Modeling			+			+				+
BWEAE 14	Foundation Engineering	+		+	+						
BWEAE 15	Metal and Mixed structures			+				+			
BWEAE 16	Buildings Construction	+		+	+			+			
BWEAE 17	Roads and Transportation Engineering	+		+	+			+			
BWEAE 18	Geodesy	+		+	+			+			
BWEAE 19	Economic and Engineering Projects Management	+		+	+	+	+	+	+		+
BWEAE 20	Buildings Services	+		+	+			+	+		
BWEAE 21	Technology of Construction	+		+	+	+		+	+		
	Basics in Hydro Sciences										
BWEAE 22	Hydrology			+							
BWEAE 23	Fluids Mechanics			+							
BWEAE 24	Basics of Environment and Sanitary Engineering			+		+		+			
BWEAE 25	Hydraulics			+							
	Specialized Basics										
BWEAE 26	Drinking and Waste Water Networks			+				+			

BWEAE 27	Drinking and Waste Water Treatment		+	+	+			+			
BWEAE 28	Irrigation and Drainage Engineering		+	+	+			+			
BWEAE 29	Water Structures		+	+	+			+			
BWEAE 30	Dams Engineering		+	+	+			+	+		
BWEAE 31	Pumping Station and Hydraulics Machines		+	+	+			+	+		
BWEAE 32	Harbors Engineering		+	+	+			+	+		
	Elective Modules										
BWEAE 33	Solid Waste Management and Contaminates Treatment			+	+	+		+			
BWEAE 34	Water Exploitation and Management			+		+	+	+			
BWEAE 35	Water Chemistry and Microbiology			+							
BWEAE 36	Execution Technology of Water Structures	+		+	+						
BWEAE 37	Water Resources development and advanced Technologies			+		+					
BWEAE 38	Municipal and Industrial Water Management			+		+	+	+			
BWEAE 39	Engineering Hydrogeology			+						+	
BWEAE 40	Drainage and Land Reclamation			+	+						
BWEAE 41	Irrigation and Drainage Networks		+	+							
BWEAE 42	Dams related Structures		+	+							
BWEAE 43	Coastal Protection Engineering		+	+	+			+	+		
BWEAE 44	Exploitation and Management of Sea Structures			+	+		+	+			+
BWEAE 45	Exploitation and Management of Water Structures			+	+		+	+		+	+
BWEAE 46	Water Tanks	+	+	+	+						
	General Qualification										
BWEAE 47	English	+		+		+			+	+	
BWEAE 48	Arabic								+		
BWEAE 49	Arabic Culture								+		
BWEAE 50	History of Sciences and Technologies								+		
BWEAE 51	Rights and Water Legislations	+		+		+		+	+	+	+
	Practical Training/ Project Study										
BWEAE 52	Practical Training/ Project Study	+		+	+	+	+	+	+	+	+
	Bachelor Thesis with Defense										

BWEAE 53	Bachelor Thesis with Defense	+		+	+	+	+	+	+	+	+

4- Systems and special lists belong to the evaluation of students and check of standards

Input the programme standards which agreed upon , for min. time for success and for each rate						
Academic semester	1	2	3	4	5	6
Writing examination	Range between (60-70) of max. notes of modules (100%).					
Oral test (interview)	Max. 50 % of term paper note of modules (30-40%).					
Several tests (tutorial – laboratory)	Max. 50 % of term paper note of modules (30-40%).					

5- Evaluation of the aimed output of the programme

Evaluator	tool	sample
Student of final Semester.	questionnaire	all students
Absolvents	Form pages	all absolvents
Appointment sides	Form pages	25% business holders
External checks	-	-
External checks	questionnaire	Education Staff members, some members from the University Quality guarantee center
others	-	-

6- Books and references

- Academic university Book.
- Printed Lectures.
- Arabic and strange available references in the Faculty library.
- Scientific periodically journals.
- Internet website

MODULE COMPENDIUM

Harbor Construction and Coastal Engineering (MHCCE)

Master Programme

Tishreen University Lattakia

Department of Water Engineering and Irrigation
Faculty of Civil Engineering

2015

EDUWAT: 511251-TEMPUS-1-2010-1-DE-TEMPUS-SMHES
Development of a Modern Higher Education System for Water Engineering in Syria

Developed by
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Goals of the Master Course Harbor Construction and Coastal Engineering MHCCE

The academic plan in the Harbor Construction and Coastal Engineering program, aims at providing the students the following items:

1. High level information in science and computer techniques, and developing the skills in engineering sciences and its applications.
2. Developing the ability of the students to achieve various Harbor Construction and Coastal Engineering studies, check and use it according to the engineering codes.
3. Comparing between the water engineering solutions, and choose the optimum ones.
4. Developing the works skills and regulate the relationship between the work team which the best and have many specialists.
5. Strengthening the research ability and developing and working with the modest soft-ware's, equipments… etc.
6. Developing the item of the scientific, social and cultural of the students' characters.
7. Continuous developing to get the high quality of the research, teaching…...etc.

Modules of Master course Harbors Construction and Costal Engineering MHCCE

	Credits	%
Modules in Mathematics and Natural Sciences	15	13
Modules in Engineering	10	8%
Modules in Hydro Sciences	10	8%
Modules with Specialization	30	25%
Elective Modules	10	8%
Modules for general Qualificati-on	5	4%
Practical Training /Project	10	8%
Master Thesis plus Defense	30	25%
Total	**120**	**100%**

Module Semester	**1**	**2**	**3**	**4**	**Total/ECTS**
Mathematics and Natural Sciences	10	5			**15**
Engineering		10			**10**
Hydro Sciences	10				**10**
Specialization	10	10	10		**30**
Elective Modules		5	5		**10**
General Qualification			5		**5**
Practical Training/ Project Study			10		**10**
Master Thesis plus Defense				30	**30**
Total	**30**	**30**	**30**	**30**	**120**

	Modules in Natural Sciences 10% - 25%		Modules inTechnical Sciences 10 - 25%		Modules in Economic & Social Sciences 5% - 15%		Modules in Variable Sciences 55% - 70%

Nr of Module	Course Semester	1	2	3	4	Total/ ECTS
	Mathematics and Natural Sciences	**10**	**5**			**15**
MHCCE 1	Advanced Mathematics	5				**5**
MHCCE 2	Mathematical and physical Modeling	5				**5**
MHCCE 3	Methods of scientific research		5			**5**
	Engineering		10			**10**
MHCCE 4	Construction and protection of shores		5			**5**
MHCCE 5	Planning of Harbors		5			**5**
	Hydro Sciences	**10**				**10**
MHCCE 6	Hydro Physic of Seas and Currents	5				**5**
MHCCE 7	Hydro Dynamic of shores	5				**5**
	Specialization	**10**	**10**	**10**		**30**
MHCCE 8	Sea and Shore Structures	5				**5**
MHCCE 9	Navigation and Sea Measurements Devices		5			**5**
MHCCE 10	Sediments Transport and Movement		5			**5**
MHCCE 11	Harbors Construction			5		**5**
MHCCE 12	Technology of Harbors Structures			5		**5**
MHCCE 13	Sea Navigation	5				**5**
	Elective Modules		**5**	**5**		**10**
MHCCE 14	Sea Geodesy					**5**
MHCCE 15	Dynamics of Sea Waters					**5**
MHCCE 16	Maintenance and Rehabilitation of Harbor Structures					**5**
MHCCE 17	Marine Ecology and Sea Environmental Protection					**5**
MHCCE 18	Economics of Sea Transportation					**5**
MHCCE 19	Naval Safety and assurance					**5**
	From these modules students must select one module for each of the 2nd .and 3rd. Semester					
	General Qualification			**5**		**5**
MHCCE 20	Rights and Sea Legislations			**5**		**5**
MHCCE 21	**Practical Training/Project study**			**10**		**10**
MHCCE 22	**Master Thesis plus Defense**				**30**	**30**
	Total	**30**	**30**	**30**	**30**	**120**

Study Plan of Master Course Harbors Construction and Costal Engineering MHCCE

Nr of Module	Courses	S. 1	S. 2	S. 3	S. 4	Total/ ECTS
	Modules in Mathematics and Natural Sciences					
MHCCE 1	Advanced Mathematics	3/2/0/2				**5**
MHCCE 2	Mathematical and physical Modeling	3/2/0/2				**5**
MHCCE 3	Methods of scientific research		3/2/0/2			**5**
	Engineering					
MHCCE 4	Construction and protection of shores		3/2/0/2			**5**
MHCCE 5	Planning of Harbors		3/2/0/2			**5**
	Hydro Sciences					
MHCCE 6	Hydro Physic of Seas and Currents	3/2/0/2				**5**
MHCCE 7	Hydro Dynamic of shores	3/2/2/0				**5**
	Specialization					
MHCCE 8	Sea and Shore Structures	3/2/2/0				**5**
MHCCE 9	Navigation and Sea Measurements Devices		3/2/2/0			**5**
MHCCE 10	Sediments Transport and Movement		3/2/2/0			**5**
MHCCE 11	Harbors Construction			3/2/2/0		**5**
MHCCE 12	Technology of Harbors Structures			3/2/2/0		**5**
MHCCE 13	Sea Navigation	3/2/2/0				**5**
	Elective Modules					
MHCCE 14	Sea Geodesy		3/2/2/0	3/2/2/0		**5**
MHCCE 15	Dynamics of Sea Waters		0	0		**5**
MHCCE 16	Maintenance and Rehabilitation of Harbor Structures		0	0		**5**
MHCCE 17	Marine Ecology and Sea Environmental Protection		0	0		**5**
MHCCE 18	Economics of Sea Transportation		0	0		**5**
MHCCE 19	Naval Safety and assurance		0	0		**5**
From these Courses students must select one course in each Semester 2 and 3						
	General Qualification					
MHCCE 20	Rights and Sea Legislations			3/2/2/0		**5**
	Practical Training/ Project Study					
MHCCE 21	Practical Training/Project Study			**10**		**10**
	Master Thesis with Defense					
MHCCE 22	**Master Thesis with Defense**				**30**	**30**
	Total	**30**	**30**	**30**	**30**	**120**

Definition of the modules of Master Course Harbor Construction and Coastal Engineering MHCCE

Basics in Mathematics and Natural Sciences		
Module Number	**Module Name**	**Professor in Charge**
MHCCE 1	Advanced Mathematics	Prof. Dr.
Contents and Qualification aims	The module deals with understanding the basics of statistics and probability which cover the module Principles of probabilities:(the probability, the random events, the conditional probability, autonomy of the events), Bays formula (the first and second, Random variable, distribution function, discrete and connected variable, expectation standard deviation. In addition to the Differential equations such as The normal Differential equations of first order (solved and not solved as for derivative) and The Differential equations of higher order, The partial Differential equations. The students' knowledge will be developed with probability distributions and finding the relationship between the variables to give the students enough knowledge's and ability in these fields.	
Module Character	Advanced Mathematics: 4 Hours of lectures per week, 2 hour of tutorial.	
Prerequisite of attendance	Basic Knowledge of Advanced Mathematics (Differential equations and statistics and probability) is Bachelor in Fields: Water Engineering, Water Engineering and Irrigation, Civil Engineering, Environmental Engineering, Marine Engineering.	
Applicability	The module is one of 3 mandatory compulsory of the Mathematics and Natural Sciences of the master course of Harbor Structures and Coastal Engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 1.	
Proposal references	1. Erwin Kreyszig: **Advanced Engineering Mathematics**, 10th Edition, John Wiley& Sons, INC.ISBN 978-0-470-45836-5, 2011 1283 pages. 2. Wolfgang Ertel: **Advanced Mathematics for Engineers**, translated by Elias Drotle and Richard Cubek, Hochschule Ravensburg- Weingarten University of Applied Sciences, October 1, 2012.	

MHCCE 2	**Mathematical and physical Modeling**	Prof. Dr
Contents and Qualification aims	The module deals with understanding the basics of the mathematical and physical modeling in the water engineering, the models types, covering equations, the boundaries conditions, model execution and the calibration process, sensitivity analysis, verification model, validation model, prediction model, post- audit model, documenting and reporting the modeling study. The students' knowledge will be developed during tutorials and specialist software's which give the students enough knowledge's and ability in these fields.	
Module Character	Mathematical and physical Modeling: 4 hours of lectures per week, 2 hour of tutorial and laboratory experiments.	
Prerequisite of attendance	Basic Knowledge of Mathematical and physical Modeling is Bachelor of Water engineering and environment..	
Applicability	The module is one of 3 mandatory compulsory of the Basics in mathematics of the Master Course of Harbor Structures and Coastal Engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 1.	
Proposal references	1. The physical, mathematical and computational models, University of Albetra. .1.1. 2. Umut Hanoglu: Mathematical and Physical Modeling, University of Nova Gorica, 2009. 3. Masato Nakamura: Mathematical and Physical Modeling of Mixing and Flow Phenomena of Municipal Solid Waste Particles on a Reverse Acting Grate, Columbia University, 2008, 198 pages.	

MHCCE 3	**Methods of scientific research**	**Prof. Dr.**
Contents and Qualification aims	The module deals with general and basic information about understanding; importance of scientific research; skills of scientific research; ethics of scientific research; methodology; preparing of scientific research protocol; design of experiment in laboratory or I the field; collecting and analysis of data; searching in references; searching in web; writing of scientific paper, writing of thesis and dissertation. The students' knowledge will be developed during training to write the scientific paper and preparing his scientific research protocol.	
Module Character	Methods of scientific research: 4 Hours of lectures per week, 2 hours of training per week.	
Prerequisite of attendance	Basic Knowledge of Methods of scientific research his Language skills; Basic knowledge of informatics.	
Applicability	The module is one of 3 mandatory compulsory of the Mathematics and Natural Sciences of the Master Course of Harbor Structures and Coastal Engineering. The module is suitable for the research oriented studies in civil and environmental engineering	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 1.	
Proposal references	1. James E. Mauch and Namgi Park: Guide to the Successful Thesis and Dissertation, A Handbook for Students and Faculty. 2003. 5th ed. Copyright ©2003 by Marcel Dekker. ISBN: 0-8247-4288-5. 2. Louis Cohen; Lawrence Manion and Keith Morrison: Research Methods in Education, 2005, 5th ed. ISBN 0-203-22434-5 Master e-book ISBN. 3.Derek Swetnam: Writing Your Dissertation, How to plan, prepare and present successful work. 2007, 3rd ed. ISBN: 978 1 84803 126 5.	

Engineering		
Module Number	Module Name	Professor in Charge
MHCCE 4	**Construction and protection of shores**	**Dr. Eng.**
Contents and Qualification aims	The module deals with fixity of shore line, movement of sediment materials, beach changes, Types of waves, waves energy and power, waves structures interaction, waves forces on structures, design of coastal structures, Types of shore structures, water barriers (surface, subsurface), open barriers for waves), colleagues and their types, Shore barriers structures vertical on shore. Structures extended in the sea, coastal zones process, long shore sediment transport, Floating structures, design of construction works for protection of shores, Choose of construction methods and estimation of influence of Environment. The students' knowledge will be developed during tutorials and laboratory experiments and use some modern software to give the students enough knowledge's and ability in these fields.	
Module Character	Construction and protection of shores: 4 Hours of lectures per week, 2 hour of tutorial.	
Prerequisite of attendance	Basic Knowledge of Construction and protection of shores is Hydro Physic of Seas and Currents, Hydro Dynamic of shores, Sea and Shore Structures, Sea Navigation Advanced Mathematics and Mathematical and physical Modeling.	
Applicability	The module is one of 2 mandatory compulsory of the Engineering of Master Course of Harbor Structures and Coastal Engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 2.	
Proposal references	1. Robert M. Sorensen: **Basic Costal Engineering, Department of Civil and Environmental Engineering**. Lehigh University, Bethlehem, Pennsylvania, Third Edition, Springer verlag, 2006, ISBN-10: 0-387-23332-6, ISBN-10: 0-387-23333-4 (e-book). 2. Robert G. Dean: **Coastal Processes with Engineering Applications**, 2001, Google Book.	

MHCCE 5	**Planning of Harbors**	**Dr. Eng.**
Contents and Qualification aims	The module introduces the Factors influenced the Planning of Harbors, harbors component, harbors entrances, navigational entrances, water areas, distribution of areas according of demand, colleagues planning and determine their dimensions, planning of roads and railways, nature (characteristics) of harbors position, classify of harbors according purpose, harbors types, aims, planning and calculation of navigational entrances, capacity of navigational entrances and their uses. The students' knowledge will be developed during tutorials during tutorials, laboratory experiments and use some modern software to give the students enough knowledge and ability in these fields.	
Module Character	Planning of Harbors Hours of lectures per week, 2 hour of tutorial.	
Prerequisite of attendance	Basic Knowledge of Planning of Harbors is Hydro Physic of Seas and Currents, Hydro Dynamic of shores, Sea and Shore Structures, Sea Navigation Advanced Mathematics and Mathematical and physical Modeling.	
Applicability	The module is one of 2 mandatory compulsory of the Engineering of Master Course of Harbor Structures and Coastal Engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 2.	
Proposal references	1. **Planning and Design Guidelines for Small Craft Harbors**, Third Edition, 2012 / 336 pp. 2. Reported by P N D Engineers. INC: **Harbor System Master - Condition Inventory & Moorage Rate Recommendations**, MAY 2012. 3. J.A. Sciortino: **Fishing harbor planning, construction and management**. FAO Consultant. Harbor Design and Management. St. Paul's Bay, Malta.	

Basics in Hydro Sciences		
Module Number	Module Name	Prof. in Charge
MHCCE 6	**Hydro Physic of Seas and Currents**	Prof. Dr. Eng.
Contents and Qualification aims	The module deals with Air and climatic phenomena; Evaporation; Water Shed؛ Hydrograph؛ Statistics and probability in hydrology; runoff and Floods؛ urban and small watershed hydrology ؛ Physical and chemical properties of groundwater; origin of groundwater and forms of it's exists in the earth crust؛ principles of Groundwater flow. The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and Use some advanced software to give the students enough knowledge's and ability in this fields.	
Module Character	Hydrology: 2 Hours of lectures per week, 2 hour of tutorial Laboratory experiments per week.	
Prerequisite of attendance	Basic Knowledge of Hydro Physic of Seas and Currents is Bachelor in Fields: Water Engineering, Water Engineering and Irrigation, Civil Engineering, Environmental Engineering, Marine Engineering.	
Applicability	The module is one of 2 mandatory compulsory of the Basics in Hydro Sciences of Master Course of Harbor Structures and Coastal Engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one terms starting in Semester 1.	
Proposal references	1. Robert H. Stewart: **Introduction To Physical Oceanography**, Department of Oceanography Texas A & M University, 2008, 353 Pages. 2. Harold V. Thurman; Alan P. Trujillo: Essential of Oceanography, Chapter 8, Waves and Water Dynamic, 7th Edition.	

MHCCE 7	**Hydro Dynamic of shores**	**Prof.Dr.Eng.**
Contents and Qualification aims	The module deals with tide and surd, wind, sea currents (surface, deep, seasonal, stable), sea waves and their types, waves formation, waves propagation, waves energy, relationship between the surface currents and the natural waves, waves produced from natural phenomena (Earthquakes, cyclones).. The students' knowledge will be developed during tutorials and practical computer training and Use some advanced software to give the students enough knowledge and ability in this fields.	
Module Character	Hydro Dynamic of shores' Hours of lectures per week, 2 hour of tutorial per week.	
Prerequisite of attendance	Basic Knowledge of Hydro Dynamic of shores is Bachelor in Fields: Water Engineering, Water Engineering and Irrigation, Civil Engineering, Environmental Engineering, Marine Engineering.	
Applicability	The module is one of 2 mandatory compulsory of the Basics in Hydro Sciences of Master Course of Harbor Structures and Coastal Engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5Cr.The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 1.	
Proposal references	• 1. Zied Driss, Mohamed Ali Jemni, Amin helly, Mohamed Salah Abid: **Modeling and Analysis of the Hydrodynamic Structure around a Vertical Axis Water Turbine**, Lecture Notes in Mechanical Engineering 2013, pp 245-252, springer verlag. 2. Harry Edmar Schulz, André Luiz Andrade Simões and Raquel JaharaLoboscom**: Hydrodynamics – Optimizing Methods and Tools**, Published byintechweb, Copyright © 2011, ISBN 978-953-307-712-3,Printed in Croatia, 434 pages.	

Specialization		
MHCCE 8	**Sea and Shore Structures**	**Prof.Dr.Eng.**
Contents and Qualification aims	The module deals with Types of shore structures, water barriers (surface, subsurface), open barriers for waves), colleagues and their types, Shore barriers structures vertical on shore. Structures extended in the sea, Floating structures, design of construction works for protection of shores, design of cables line and marine cables, Choose of construction methods and estimation of influence of Environment. The students' knowledge will be developed during tutorials and use some modern software and practical computer training.	
Module Character	**Sea and Shore Structures** Hours of lectures per week, 2 hour of tutorial per week.	
Prerequisite of attendance	Basic Knowledge of **Sea and Shore Structures** is Bachelor in Fields: Water Engineering, Water Engineering and Irrigation, Civil Engineering, Environmental Engineering, Marine Engineering.	
Applicability	The module is one of the 6 mandatory compulsory modules of the Master of Harbor Structures and Coastal Engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 1.	
Proposal references	1..Robert G. Dean and Robert A. DaLrymple: **Coastal processes with engineering applications**, Cambridge University Press (2004). 2. US Army Corps of Engineers: **Coastal Structures: Types, Functions and Applications**, Presentation to Shoreline Erosion Task Force, August 15, 2012, Hartford, CT. 3. Thomas O. Herrington: **Manual for Costal Hazard Mitigation**, NEW JERSEY SEA GRANT COLLEGE PROGRAM, Rutgers University, 108 Pages.	

MHCCE 9	**Navigation and Sea Measurement Devices**	**Prof.Dr.**
Contents and Qualification aims	The module introduces types of observation and observation devices of sea floater, devices to waves measurement, measurement devices of several currents (electronically, mechanical, programmed with sensors), measurement devices (saltines, temperature, combinational, observation and radars devices, other devices for the activities of sea geodesy. The students' knowledge will be developed during tutorials and some laboratory experiments and practical computer training.	
Prerequisite of attendance	Basic Knowledge of and Navigation and Sea Measurement Devices is Sea and Shore Structures and Sea Navigation.	
Applicability	The module is one of the 6 mandatory compulsory modules of the Master of Harbor Structures and Coastal Engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 2.	
Proposal references	1. Noel Kruse: **Book Three - Second Edition, The Art of Aerial Navigation, Transcripts of lectures about navigating**, 2011, 87 Pages. 2. G. Longhurs: **General Navigation**, Produced and Published by the CLICK2PPSC LTD Edition 2.00.00, 2001. 3. **Manual on Sea Level Measurement and Interpretation**, Volume I - Basic Procedures, Manuals and Guides 14, 1985 UNESCO.	

MHCCE 10	**Sediments Transport and Movement**	**Prof.Dr.Eng.**
Contents and Qualification aims	The module introduces the classification of shores, sandy, gravelly and stony shores, the relationship between waves and shores, Type of shores and waves force, Type of shores and waves direction, sediment transport under the influence of waves, sediment transport under the influence of deep currents, the relationship between transported sediment mass and the climatically phenomena(currents, waves), waves, force, determination of transported sediment mass, measurement methods of transported and loaded sediments. Estimation of sediments mass and the method of its removing. The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and Use some advanced software to give the students enough knowledge's and ability in these fields.	
Module Character	Sediments Transport and Movement**:** 4 Hours of lectures per week, 2 hour of tutorial per week.	
Prerequisite of attendance	Basic Knowledge of Sediments Transport and Movement are fluid mechanics, hydraulics, physics, and chemistry.	
Applicability	The module is one of 6 mandatory compulsory modules of Specialization of Master Course of Harbor Structures and Coastal Engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 2.	
Proposal references	1. Ina Ibro: **Modeling of Sediment Transport of Sediment Transport and self- Cleansing of Sea outfalls**, Water and Environment Department of Civil Engineering, Aalborg University, 2011 2. Shore Erosion Control Guidelines, Maryland Department of Natural resources, 2006.	

MHCCE 11	**Harbors Construction**	**Prof. Dr. Eng.**
Contents and Qualification aims	The module introduces the required basic information (commodities, wares, ships), Types of harbors, Equipment of anchors and anchor structures, colleague walls (concrete gravity wall, reinforcement wall, metal wall), types of inside colleagues for anchor, types of outside barriers specialized for protection. Methods of calculation and design of inside colleagues each type. Methods of calculation and design of outside barriers, determination of colleague length, and collection areas, calculation of storehouses each wares. The students' knowledge will be developed during tutorials and Use some advanced software to give the students enough knowledge and ability in these fields.	
Module Character	Harbors Construction: 4 Hours of lectures per week, 2 hour of tutorial per week.	
Prerequisite of attendance	Basic Knowledge of Harbors Construction are Sediments Transport and Movement, Sea and Shore structures, Sea Transportation and Harbors and Sea Navigation.	
Applicability	The module is one of 6 mandatory compulsory modules of Specialization of Master Course of Harbor Structures and Coastal Engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 3.	
Proposal references	1. Liu, Zhou; Burcharth, Hans Falk**: Port Engineering**, Aalborg University, Denmark, 1999. 2. Tsinker Gregory: **Handbook of Port and Harbor Engineering**, 1997, ISBN 1978-1-4757-0863-9. 3. **Coastal Engineering Manual** – Part II, US Army Corps of Engineers, 2006. 4. John Herbich**: Handbook of Coastal and Ocean Engineering**, Vol. I, II, and III, Gulf Pub. Company, 1990. 5. Per Bruun**: Port Engineering**, Vol. I and II, Gulf Publishing Company, 1990.	

MHCCE 12	**Technology of Harbors Structures**	**Prof. Dr. Eng.**
Contents and Qualification aims	The module deals with used materials in sea structures, influence of sea water on used materials, chemical formation of sea water, study of used materials (natural stones and rocks, minerals,), conditions which considered during design, influence of sea water on woods and its protection, normal concrete and reinforced concrete in harbors structures, rates of concrete components (water, cement and other materials), influence of sea water on concrete, conditions which considered during pouring and using of concrete in the sea, soils properties in the harbors structures, Protection of harbors and sea structures from natural phenomena. The students' knowledge will be developed during tutorials and necessary laboratory experiments and Use some advanced software to give the students enough knowledge's and ability in these fields.	
Module Character	Construction Technology of Harbors Structures: 4 Hours of lectures per week, 2 hour of tutorial and Laboratory, 2 hour of experiments per week.	
Prerequisite of attendance	Basic Knowledge of Construction Technology of Harbors Structures are Sediments Transport and Movement, Sea and Shore structures, Sea Transportation and Harbors and Sea Navigation.	
Applicability	The module is one of 6 mandatory compulsory modules of Specialization of Master Course of Harbor Structures and Coastal Engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 120 hours.	
Duration of the module	The module takes one term starting in Semester 3.	
Proposal references	.1.1. 1. Specifications Volumes I - CPWD **construction technologies** cpwd.gov.in/Publication/Specs 2009V1.pdf 2. **Concrete technology and durability design**, COWI company. 3. **XIV National Conference on Structural Engineering,** **Acapulco 2004,** Offshore Structures – A new challenge,	

MHCCE 13	**Sea Navigation**	**Prof. Dr.**
Contents and Qualification aims	The module deals with Definition of Sea Navigation, Type of navigation (coastal, very wide from coast (opened)), Methods of sea navigation (simple, with astronomy, with estimation, with radio), sea navigation system (Loran system, Consol system, Decca system, Omega system, Artificial monde). The second part of module enable the students to planning the navigation entrances, hydraulically design of navigation entrances, influence of ships path on the equilibrium of navigation entrances, study of sediment transport and its movement in the navigation entrances area, study of equilibrium of navigation entrances sides and methods used in their fixing. The students' knowledge will be developed during tutorials and Use some advanced software to give the students enough knowledge's and ability in these fields.	
Module Character	Sea Navigation: 4 Hours of lectures per week, 2 hour of tutorial and per week.	
Prerequisite of attendance	Basic Knowledge of Sea Navigation is Bachelor in Fields: Water Engineering, Water Engineering and Irrigation, Civil Engineering, Environmental Engineering, Marine Engineering.	
Applicability	The module is one of 6 mandatory compulsory modules of Master Course of Harbor Structures and Coastal Engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 2 or 3.	
Proposal references	1. Ben Finney: **Nautical Cartography and Traditional Navigation in Oceania**, University of Chicago Press, 51 Pages. 2. Engineering and Design: **Navistar Global Positioning System Surveying**, Department of the Army US Army Corps of Engineers Washington, DC, 2003.	

Elective Modules		
Module Number	**Module Name**	**Prof. in Charge**
MHCCE 14	**Sea Geodesy**	**Dr. Eng. M. BUBU**
Contents and Qualification aims	The module deals with study and drawing maps for water areas and their nearby areas, these maps can use for several engineering, industry and economics and human aactivities in these regions. This module aims to give students enough knowledge about the hydrograph concepts and hydrograph surveying, and the methods of determination of locations in the sea, and the methods of exploration and measurement of depths. The components of the modules are proximal comparison between topographical surveying and water surveying, Explanation of hydrograph concepts and hydrograph surveying, riefly study about the relationship between sea surveying, geodesy and cartography as main topographical sciences (form of the earth, used overthrows in the sea surveying), Technical determination of locations in the coastal and sea regions (classical topographical principles and Technical navigational loased on propagation of electro- magnet in the atmosphere (LORAN-C) and astronaut (GPS) and under the water (UPF). Measurements technologies of depths and audio using single bunch and several bunches (SWATH), bottom exploration (Sweep, Sonar), air loaded laser (LIDAR). At the end introduce the module Application in sea surveying (harbors, shore protection structures). The students' knowledge will be developed during tutorials and practical training and Use some advanced software to give the students enough knowledge and ability in these fields.	
Module Character	Sea Geodesy: 4 Hours of lectures per week, 2 hour of tutorial per week.	
Prerequisite of attendance	Basic Knowledge of Sea Geodesy is Planning of Harbors is Hydro Physic of Seas and Currents, Hydro Dynamic of shores, Sea and Shore Structures, Sea Navigation, Advanced Mathematics and Mathematical and physical Modeling.	
Applicability	The module is one of 6 elective modules of Master Course of Harbor Structures and Coastal Engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 2 or 3.	
Proposal references	1. Ben Finney: Nautical Cartography and Traditional Navigation in Oceania, University of Chicago Press, 51 Pages. 2. Hydrography for the Surveyor and Engineer, Blackwell Science Ltd. Oxford Third edition 1992. 3. Engineering and Design: Navistar Global Positioning System Surveying, Department of the Army US Army Corps of Engineers Washington, DC, 2003. 4. Engineering and design Hydrographic Surveying, Department of the Army U.S. Army Corps of Engineers, Washington, DC, Janua-	

	ry 2002.

MHCCE 15	**Dynamics of Sea Waters**	**Prof. Dr. Eng.**
Contents and Qualification aims	The module introduce the sea currents and their classification, Formation circumstances of a big water masses, classification of sea water masses, movement of water masses in the sea basins, the relationships between movement of water masses and climate circumstances, transmission of water masses (movement direction, transmission speed, relationship between the direction and the transmission speed in natural phenomena. Dynamic of deep water and its relationship with the topography of sea bottom, Dynamic of surface water and its relationship with the wind, the waves, the direction and the speed. The students' knowledge will be developed during tutorials and practical computer training and Use some advanced software to give the students enough knowledge and ability in these fields.	
Module Character	Dynamics of Sea Waters: 4 Hours of lectures per week, 2 hour of tutorial.	
Prerequisite of attendance	Basic Knowledge of Dynamics of Sea Waters are Hydro Physic of Seas and Currents, Hydro Dynamic of shores, Sea and Shore Structures, Sea Navigation, Advanced Mathematics and Mathematical and physical Modeling.	
Applicability	The module is one of 6 elective modules of Master Course of Harbor Structures and Coastal Engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 2 or 3.	
Proposal references	1. Robert H. Stewart: Introduction To Physical Oceanography, Department of Oceanography Texas A & M University, 2008, 353 Pages. 2. M. –E.MIHAILOV;, M.-I. TOMESCU-CHIVU;, V. DIMA: BLACK SEA WATER DYNA MICS ON THE ROMANIAN LITTORAL – CASE STUDY: THE UPWELLING PHENOMENA, Romanian Reports in Physics, Vol. 64, No. 1, P. 232–245, 2012. 3. F. Benduhn; P. Renard: A dynamic model of the Aral Sea water and salt balance, Journal of Marine Systems, Volume 47, Issues 1–4, June 2004, Pages 35–50.	

MHCCE 16	**Maintenance and Rehabilitation of Harbor Structures**	**Dr. Eng.**
Contents and Qualification aims	The module introduces general introduction about the harbor and basics of safety, safety mettle in harbors parts, the planning and management of maintenance, principles of observation on maintenance workings of equipments of harbors, apparatus and exchange pieces and its pick up, introduce the properties of characteristic of equipments of harbors, electrical nets in harbor, new informatics systems, advanced technical equipment of exploration and repair of damages, knowing of sea environment pollution reasons and methods of its protection, protection of naval environment, safe and rehabilitate the old harbor, Rehabilitation consolidation of Harbor in its environment, creation the required budget, priority of maintenance workings. The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and Use some advanced software to give the students enough knowledge and ability in this fields.	
Module Character	Maintenance and Rehabilitation of Harbor Structures: 4 Hours of lectures per week, 2 hour of tutorial and Laboratory and experiments per week.	
Prerequisite of attendance	Basic Knowledge of Maintenance and Rehabilitation of Harbor Structures are Seas and Currents, Hydro Dynamic of shores, Sea and Shore Structures, Sea Navigation.	
Applicability	The module is one of 6 elective modules of Master Course of Harbor Structures and Coastal Engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 2 or 3.	
Proposal references	1.Peter H. Emmons; Gajanan M. Sabnis: **Concrete Repair and Maintenance**, Galgotia Publication. 2. George Somerville: **Management of Deteriorating Concrete Structures**:, Taylor and Francis Publication. 3. Glenn Smock: **Guide to Concrete Repair**. US Department of the Interior Bureau of Reclamation, Technical Service. 4. John H. Bungrey; Stephen G. Millard and Michael G. Grantham: **Testing of Concrete in Structures**, Taylor & Francis Publication. 5. **Durability of Concrete and Cement composites**: C.L. Page & M.M. Page. Wood head Publishing. 6. I. Hassan: **Irrigation Networks**, 2011, Tishreen University.	

MHCCE 17	**Marine Ecology and Sea Environmental Protection**	**Dr. Eng.**
Contents and Qualification aims	The Module introduces Regulations on Marine Environmental Protection, Putting new strategies of Marine Environmental Protection, Activity of Marine Environment, and Management, Strengthening Management of Marine Environmental Testing and Surveying, Making Standards and Basic line of Marine Environment, Strengthening Controlling and Management of Main Pollutants Dumping into Sea Areas, Strengthening Infrastructure Construction for Marine Ecological Environmental Protection, Strengthening Construction of Natural Reserves, Publicizing General Knowledge of Marine Ecological Environment and Improving Public Ecological Awareness, Strengthening Law Implementation. The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and Use some advanced software to give the students enough knowledge and ability in these fields.	
Module Character	Marine Ecology and Sea Environmental Protection: 4 Hours of lectures per week, 2 hour of tutorial and Laboratory and experiments per week.	
Prerequisite of attendance	Basic Knowledge of Marine Ecology and Sea Environmental Protection are Hydro Physic of Seas and Currents, Hydro Dynamic of shores, Sea and Shore Structures, Sea Navigation, Advanced Mathematics and Mathematical and physical Modeling.	
Applicability	The module is one of 6 elective modules of Master Course of Harbor Structures and Coastal Engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 2, or 3.	
Proposal references	1. Hans Chr. Bugge: **UN Law of the Sea Convention Main concepts and principles of environmental protection**, Faculty of Law, University of Oslo, 25 Pages**.**	

MHCCE 18	**Economics of Sea Transportation**	**Prof. Dr.**
Contents and Qualification aims	The module deals with Introduction about the sea transportation activity, general sight on the navigation market, navigational commercial lines, navigational expose and demand, Costs and resources in sea transportation, Economics of Transportation with lined and mobile ships, Economics of Transportation several devices. Knowing of navigational market component and how it works, knowing the prices definitions and laws, factors which influence the design of ships, trade transported in the sea, international frame of sea transportation economics, transportation economics of common wares, types of ships and their economics. At the end of module the student will be have primacy know about the elements and influenced factors on sea transportation economics and economics of other several wares types. The students' knowledge will be developed during tutorials and use some advanced software that gives the students enough knowledge and ability in these fields.	
Module Character	Economics of Sea Transportation: 4 Hours of lectures per week, 2 hour of tutorial per week.	
Prerequisite of attendance	Basic Knowledge of Sea Navigation is Bachelor in Fields: Water Engineering, Water Engineering and Irrigation, Civil Engineering, Environmental Engineering, Marine Engineering.	
Applicability	The module is one of 6 elective modules of Master Course of Harbor Structures and Coastal Engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 2 or 3.	
Proposal references	1. Immers L.H.; Stada J.E.: **Basics of Transport Economics**, KATHOLIEKE UNIVERSITEIT LEUVEN, February 2004 (Updated August 2007), 59 Pages.	

MHCCE 19	**Naval Safety and assurance**	**Dr. Eng.**
Contents and Qualification aims	The module introduces the naval Law, resources of naval Law, and norms of naval (sea) navigation, juristically system of ships, juristically system of harbors, contract sea transportation, responsibility of transporter,, norms of naval collision, assistance and salvation system, naval dispose, development of naval assurance, legislation of naval assurance, corporations of naval assurance, contract naval assurance, sides of contract naval assurance, location of contract naval assurance, rights and obligations of contract naval assurance sides, installments and repayments in naval assurance and assurance claim. The students' knowledge will be developed during tutorials, and use some software that gives the students enough knowledge and ability in these fields.	
Module Character	Naval Safety and assurance: 4 Hours of lectures per week, 2 hour of tutorial per week.	
Prerequisite of attendance	Basic Knowledge of Naval Safety and assurance in Sea Navigation.	
Applicability	The module is one of 6 elective modules of Master Course of Harbor Structures and Coastal Engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 2, or 3.	
Proposal references	1. **Naval Safety Supervisor**, Naval Education and Training Command, NAVEDTRA 12971, June 1993, 0502-LP-477-0400, Training Manual. 192 Pages. 2. Commander Doug O'Reilly: **Naval Ship Safety Management**. 3. Dr. Raymond J. Curts, CDR, USN (Ret.); Dr. Douglas E. Campbell, LCDR, USNR-R (Ret.): **Naval Information Assurance Center (NIAC): An Approach Based on the Naval Aviation Safety Program Model**, Syneca Research Group, Inc. (www.syneca.com), 25	
From these modules students must select one module for each of the 2nd and 3rd Semester.		

General Qualification		
Module Number	**Module Name**	**Professor in Charge**
MHCCE 20	**Rights and Sea Legislations**	**Dr. Eng.**
Contents and Qualification aims	The module introduces the laws history and legislation of sea, naval navigation, ship (definition, its law characteristic, observation on it, and submission for restraint measurements, executive sustentation measurements, law system of ship, people of naval navigation, ship holder, captain, sailors, commission), ship exploitation (rent forms, general norms in rent of ship), naval sells and naval assurance. The students will be developed during some tests and seminars and representation.	
Module Character	Rights and Water Legislations: 4 Hours of lectures per week, 2 hour of tutorial per week.	
Prerequisite of attendance	Basic Knowledge of Rights and Water Legislations is not necessary.	
Applicability	The module is the single mandatory general qualifications of Master Course of Harbor Structures and Coastal Engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 3.	
Proposal references	1. Hans Chr. Bugge: **UN Law of the Sea Convention Main concepts and principles of environmental protection**, Faculty of Law, University of Oslo, 25 Pages**.** 2. Stephen Hodgson: **Modern Water Rights Theory and Practice,** FAO Legislative Study. 3. United Nations: **Convention on the Law of the Sea**.	

Practical Training/ Project Study		
Module Number	**Module Name**	**Professor in Charge**
MHCCE 21	**Practical Training/ Project Study**	**Not definite**
Contents and Qualification aims	The Student must carry out practical training about one Problem belongs to subjects of Master Course of Harbor Structures and Coastal Engineering in one or more institution or incorporation, and he must present full study about this problem.	
Module Character	Practical Training/ Project Study: 10 Hours tutorial per week	
Prerequisite of attendance	Basic Knowledge of Practical Training/ Project Study, the student must be in the 3rd Semester.	
Applicability	the module is suitable for the professional and research oriented studies in civil and environmental engineering	
Prerequisite to active credit points	Having passed the module seminar and presentation before a commission.	
Accredit points and grades	The module earns 10 Cr. The final Grade is generated with 100% as presentation in front of committee.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 300 hours.	
Duration of the module	The module takes one term starting in Semester 3.	
Proposal references	1. **Old Master, Bachelor thesis** and **Practical Training** reports which are available in the Libraries of the University. 2. James E. Mauch and Namgi Park: **Guide to the Successful Thesis and Dissertation, A Handbook for Students and Faculty**. 2003. 5th ed. Copyright ©2003 by Marcel Dekker. ISBN: 0-8247-4288-5.	

Master Thesis with Defense		
Module Number	**Module Name**	**Professor in Charge**
MHCCE 22	**Master Thesis with Defense**	**Not definite**
Contents and Qualification aims	The Student must work Bachelor Thesis with Defense about one Problem belongs to the subjects of Master Course of Harbor Structures and Coastal Engineering in one or more institution or incorporation, and he must present full study about this problem.	
Module Character	Master Thesis with Defense: 30 Hours tutorial per week.	
Prerequisite of attendance	Basic Knowledge of Master Thesis with Defense, the student must be in 6 Semester.	
Applicability	the module is suitable for the professional and research oriented studies in civil and environmental engineering	
Prerequisite to active credit points	Having passed the module presentation before a commission.	
Accredit points and grades	The module earns 30 Cr. The final Grade is generated with 100% as presentation in front of committee.	
Frequency of the module	The module is offered in 4. semester	
Worked load	The work load is 900 hours.	
Duration of the module	The module takes one term starting in Semester 4.	
Proposal references	1. James E. Mauch and Namgi Park: **Guide to the Successful Thesis and Dissertation, A Handbook for Students and Faculty**. 2003. 5th ed. Copyright ©2003 by Marcel Dekker. ISBN: 0-8247-4288-5. 2. Derek Swetnam: **Writing Your Dissertation, How to plan, prepare and present successful work**.2007, 3rd ed. ISBN: 978 1 84803 126 5. 3. Louis Cohen; Lawrence Manion and Keith Morrison: **Research Methods in Education**, 2005, 5th ed. ISBN 0-203-22434-5 Master e-book ISBN. 4. **Old Master and Bachelor thesis**, which are available in the Libraries of the University.	

5- Training Course of Master Harbors Construction and Coastal Engineering

1- Training course: Shore Structures

The goal of the course is definition of shore structures and methods of their design including sea waves breaker, vertical protection facilities and Sea quays.

The course have been suggested to engineers and specialists need more knowledge about Shore engineering basics and design sea and shore structures as waves breaker, vertical and oblique protection facilities and quays.

Course contents:

- Shore processes,
- Waves forecasting,
- Types of Shore Structures and influenced waves loads on them;
- Design of shore and sea structures.

2- Training course: Planning and designing of harbors

The course has been put to engineers working in field of Planning and designing of harbors. The goal of course is developing of knowledge of absolvent about the Planning and designing of harbors.

Course contents:

- Planning of harbors;
- Shores processes;
- Sea waves breakers;
- Sea canals;
- Sea quays;
- Practical examples and case studies.

3- Training course: Sea waves breaker

The course benefits the engineers, which work in designing of shore structures, especially sea wave breaker or which work as supervisor engineer of shore engineering projects.

Course contents:

- Knowing of several types of sea wave breaker and coefficient of defining their use.
- Engineering design of different sea waves breaker from initial to final design and accommodate of designing schemata and digital sections
- Impacts of establishing of sea wave breaker on neighbor shores.

Executing and establishing of sea waves

Quality Management

Harbor Construction and Coastal Engineering (MHCCE)
Master Programme

Tishreen University Lattakia

Department of Water Engineering and Irrigation
Faculty of Civil Engineering

2015

Developed by
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Dr. Eng. Mohammad Dureid Al Addin

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This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein	Tempus

Quality management and accreditation

University: Tishreen University
Faculty: Faculty of Civil Engineering

2- Specification of the Programme

2-1- Basics Data

- **Programme name (MHCCE):** Master Course Harbor Construction and Coastal Engineering
- **Type of the Programme**: single include one specific.

- **Name of the participated Programmes**: (none).
- **Length of Programme (time):** 4 Semester.
- **Qualification (Certificate), which the Student get at End of the Programme:** Master of Science (specialist of Harbor Construction and Coastal Engineering).
- **Language or the used Language in the Programme:** Arabic is the main language. English Language is used to explain the scientific terms.
- **Place of Programme application:** University Campus, Building of Faculty of Civil Engineering.
- **External Check Person**:
- **Date the latest acceptance of Specification of the Programme:**

3-2- Professional Data

1-2-1- Message and Goal of the Programme

- **Notification of message and Goal of the Programme:**

The Department Water Engineering and Irrigation and Department of Environment Engineering in the Faculty of Civil Engineering in the Tishreen University undertake the preparation an excellent absolvent in the fields of Harbor Construction and Coastal Engineering, qualified to continue his qualification and his professional development, able compete and cover the need of the labour market in this Engineering fields. In addition to, the both Departments give a very good study and research plan aims to develop the scientific research and participation in professional and research projects. Which contribute in supporting and covering the needs of developments plans of the country, during the cooperation with the related scientific, research and service sides.

- Goals of the program

The academic plan in the Master Course of Harbor Construction and Coastal Engineering Programme, aims at providing the students the following items:

15. High level information in science and computer techniques, and developing the skills in engineering sciences and its applications.
16. Developing the ability of the students to achieve various Construction problems of Harbors and Coastal Engineering problems and their engineering studies, check and use their according to the engineering codes.
17. Comparing between their engineering solutions, and choose the optimum one.
18. Developing the works skills and regulate the relationship between the work team which the best and have many specialists.
19. Strengthening the research ability and developing and working with the modest software's, equipments… etc.
20. Developing the item of the scientific, social and cultural of the student's characters.
21. Continuous developing to get the high quality of the research, teaching…etc.

1-2-2- Programme Composition and its Contents

a) Admission condition in the Programme: the admission will be done through the competition among the students, who have Bachelor in Fields: Water Engineering, Water Engineering and Irrigation, Civil Engineering, Environmental Engineering, Marine Engineering.

b) The conditions of success in the Programme:
Presence of theoretical, tutorial, and laboratory Lectures and present the required projects and scientific and laboratories reports.

c) Success from year to year: Success in all Modules in 1st and 2 nd Semester each studying year.

d) Completion of Programme:

Condition of accomplish of studying years	
1st year	Success in modules of 1st and 2nd semesters, the student can hold max. 2 Modules.
2nd year	- Success in modules of 3rd semesters, the student can hold max. 2 Modules from all foregone semesters. - Success in modules of foregone semesters and Defense of Master Thesis in front of the commission.

e) Conditions of the completion of the Programme:

- Brief description of the kind of Practical Training/ Project Study:
The Student must carry out practical training about one Problem related to the subjects of Harbor Construction and Coastal Engineering in one or more institution or incorporation, and he must present full study about this problem.

- In which phase or phases of the programme this Practical Training/ Project Study is carried out : This Study or Project must be carried out in the 3rd semester.

- Number of Credit / or semesters for this Practical Training/ Project Study: Offered in 3 rd semester with 10 cr. per week.

- Description of evaluation procedures: the evaluation should be done by a commission, which formed by the delegacy of faculty of civil engineering, the student must pass the module seminar and presentation in front of the commission.

- Brief description of the kind of Master Thesis:

The Student must carry out Master Thesis about one Problem relate to the subjects of Harbor Construction and Coastal Engineering in the 4th semester, and he must present full study about this problem in front of the commission.

- In which phase from the programme the Master Thesis with Defense should be carried out: This Master Thesis must be carried out in the 4th semester.

- Number of Credit / or semesters for this Master Thesis with Defense:
Offered in 4th semester with 30 cr. per week.

- Description of evaluation procedures: the evaluation should be done by a commission, which formed by the delegacy of the faculty of civil engineering, the student must pass the module and presentation in front of the commission.

1-3- The Programme description:

The programme of Master course Harbor Construction and Coastal Engineering based on theoretical lectures, laboratory meeting, Seminars scientific excursion approved in the study plan.

- Brief description of praxis experiences activity:

* Practical Project with report in Harbors and related Structures projects;
* Practical Project with report in Costal Engineering and related Structures projects;
* Practical Project with report in Marine Transportation and related laws.
* Scientific excursion to Harbors, Costal Projects, and Structures.

- In which phase or phases of programmes the field experience should be introduce:

* Summer training in Harbors and related Structures projects in 3rd Semester;
* Summer training in Costal Engineering and related Structures projects in 3rd Semester;
* Summer training in Marine Transportation and related laws in 3rd Semester;
* Scientific excursion to Harbors and Costal Engineering projects in 1,2,3 Semester.

2- Modules of Harbors Construction and Costal Engineering HCCE

		Actual		Goal	
Nr of Module		Credits	%	Credits	%
and symbol					
	Modules in Mathematics and Natural Sciences	15	13%	12	10%
	Modules in Engineering	10	8%	18	15%
	Modules in Hydro Sciences	10	8%		
	Modules with Specialization	30	25%	42	35%
	Elective Modules	10	8%		
	Modules for general Qualification	5	4%	6	5%
	Practical Training /Project	10	8%	12	10%
	Master Thesis plus Defense	30	25%	30	25%
	Total	**120**	**100%**	**120**	**100%**

	Module Semester	**1**	**2**	**3**	**4**	**Total/ECTS**
	Mathematics and Natural Sciences	10	5			**15**
	Engineering		10			**10**
	Hydro Sciences	10				**10**
	Specialization	10	10	10		**30**
	Elective Modules		5	5		**10**
	General Qualification			5		**5**
	Practical Training/ Project Study			10		**10**
	Master Thesis plus Defense				30	**30**
	Total	**30**	**30**	**30**	**30**	**120**

	Course Semester	**1**	**2**	**3**	**4**	**Total/ECTS**
	Mathematics and Natural Sciences	**10**	**5**			**15**
MHCCE 1	Advanced Mathematics	5				**5**
MHCCE 2	Mathematical and physical Modeling	5				**5**
MHCCE 3	Methods of scientific research		5			**5**
	Engineering		10			**10**
MHCCE 4	Construction and protection of shores		5			**5**
MHCCE 5	Planning of Harbors		5			**5**
	Hydro Sciences	**10**				**10**

MHCCE 6	Hydro Physic of Seas and Currents	5				**5**
MHCCE 7	Hydro Dynamic of shores	5				**5**
	Specialization	**10**	**10**	**10**		**30**
MHCCE 8	Sea and Shore Structures	5				**5**
MHCCE 9	Navigation and Sea Measurements Devices		5			**5**
MHCCE 10	Sediments Transport and Movement		5			**5**
MHCCE 11	Harbors Construction			5		**5**
MHCCE 12	Technology of Harbors Structures			5		**5**
MHCCE 13	Sea Navigation	5				**5**
	Elective Modules		**5**	**5**		**10**
MHCCE 14	Sea Geodesy					**5**
MHCCE 15	Dynamics of Sea Waters					**5**
MHCCE 16	Maintenance and Rehabilitation of Harbor Structures					**5**
MHCCE 17	Marine Ecology and Sea Environmental Protection					**5**
MHCCE 18	Economics of Sea Transportation					**5**
MHCCE 19	Naval Safety and assurance					**5**
	From these modules students must select one module for each of the 2nd .and 3rd. Semester					
	General Qualification			**5**		**5**
MHCCE 20	Rights and Sea Legislations			**5**		**5**
MHCCE 21	**Practical Training/Project study**			**10**		**10**
MHCCE 22	**Master Thesis plus Defense**				30	**30**
	Total	**30**	**30**	**30**	**30**	**120**
	Goal	**30**	**30**	**30**	**30**	**120**

3- Study Plan of Master Course Harbors Construction and Costal Engineering HCCE

Nr of Module and symbol	Courses	S. 1	S. 2	S. 3	S. 4	To-tal/ECTS
	Modules in Mathematics and Natural Sciences					
MHCCE 1	Advanced Mathematics	3/2/0/2				**5**
MHCCE 2	Mathematical and physical Modeling	3/2/0/2				**5**
MHCCE 3	Methods of scientific research		3/2/0/2			**5**
	Engineering					
MHCCE 4	Construction and protection of shores		3/2/0/2			**5**
MHCCE 5	Planning of Harbors		3/2/0/2			**5**
	Hydro Sciences					
MHCCE 6	Hydro Physic of Seas and Currents	3/2/0/2				**5**
MHCCE 7	Hydro Dynamic of shores	3/2/2/0				**5**
	Specialization					
MHCCE 8	Sea and Shore Structures	3/2/2/0				**5**
MHCCE 9	Navigation and Sea Measurements Devices		3/2/2/0			**5**
MHCCE 10	Sediments Transport and Movement		3/2/2/0			**5**
MHCCE 11	Harbors Construction			3/2/2/0		**5**
MHCCE 12	Technology of Harbors Structures			3/2/2/0		**5**
MHCCE 13	Sea Navigation	3/2/2/0				**5**
	Elective Modules					
MHCCE 14	Sea Geodesy		3/2/2/0	3/2/2/0		**5**
MHCCE 15	Dynamics of Sea Waters		0	0		**5**
MHCCE 16	Maintenance and Rehabilitation of Harbor Structures		0	0		**5**
MHCCE 17	Marine Ecology and Sea Environmental Protection		0	0		**5**
MHCCE 18	Economics of Sea Transportation		0	0		**5**
MHCCE 19	Naval Safety and assurance		0	0		**5**
	From these Courses students must select one course in each Semester 2 and 3					
	General Qualification					

MHCCE 20	Rights and Sea Legislations			3/2/2/0		**5**
	Practical Training/ Project Study					
MHCCE 21	Practical Training/ Project Study			**10**		**10**
	Master Thesis with Defense					
MHCCE 22	**Master Thesis with Defense**				**30**	**30**
	Total	**30**	**30**	**30**	**30**	**120**

A: Knowledge and Understanding

a1: Advanced Mathematic with practical applications, differential and integral equations, Statistics methods, numerical mathematics. Mathematical and physical Modeling different Engineering subjects of Harbors Construction and Costal Engineering and their application and Execution. Methods of scientific research. Tidy development his methods of scientific thought to continue his scientific stud and his professional works as civil engineer in field Harbors Construction and Costal Engineering.
a2: Engineering Principles in field of Harbors Construction and Costal Engineering.
a3: Engineering Principles in field of Harbors and related Structures, Costal Engineering and related Structures,, Sea and Shore Structures,, Maintenance and Rehabilitation of Harbor Structures, Technology of Harbors Structures, Marine Ecology and Sea Environmental Protection, Mathematical Modeling of different Harbors and Costal Engineering Structures. Ability of application these Engineering Principles and development them.
a4: Knowledge related to Informatics and exploitation of Computing Programs in Practical Projects , in Master Thesis, Harbors and Costal Engineering Structures and to solve different problems these fields and show the innovation ability.
a5: Principles of sustainable of Harbors and related Structures, Costal Engineering and related Structures, Sea and Shore Structures, Safe of Marine Ecology and Protection of shore and Sea. Ability of application these Engineering Principles and development them and principles of beautiful Nature in design.
a6: Knowledge related to technologies of execution methods of engineering contracts and projects taking into consideration the economical social and environmental input data.
a7: Ethics of exercises of professional and scientific work and their social and environmental reflections.
a8: Supply the graduate with required knowledge and understanding in accreditation principles and required common health and safety and other environmental subjects
a9: Supply the graduate with required knowledge in exercises of related professional systems and their criterions, cods, laws and legislation, especially Legislation of Water and Environment and stick to them.
a10: Supply the graduate with required ability knowledge to conflate the knowledge of civil engineering with all different fields, and execute an integral engineering project.
a11: Supply the graduate with related required scientific and practical strange terms.

ARS(Academic Reference Standard)

	ARS(Academic Reference Standard)											
Nr of Module and symbol	Module Name	National Academic Reference Standard NARS										Additional Standards
		a_1	a_2	a_4	a_5	a_6	a_7	a_8	a_9	a_{10}	a_{11}	a_3
	Modules in Mathematics and Natural Sciences											
MHCCE 1	Advanced Mathematics	+		+						+	+	
MHCCE 2	Mathematical and physical Modeling	+		+						+	+	+
MHCCE 3	Methods of scientific research	+		+			+			+	+	
	Engineering											
MHCCE 4	Construction and protection of shores		+		+	+				+	+	+
MHCCE 5	Planning of Harbors		+		+	+	+			+	+	+
	Hydro Sciences											
MHCCE 6	Hydro Physic of Seas and Currents									+	+	
MHCCE 7	Hydro Dynamic of shores									+	+	
	Specialization											
MHCCE 8	Sea and Shore Structures		+			+				+	+	+
MHCCE 9	Navigation and Sea Measurements Devices		+		+	+				+	+	+
MHCCE 10	Sediments Transport and Movement		+		+	+				+	+	+
MHCCE 11	Harbors Construction		+			+				+	+	+
MHCCE 12	Technology of Harbors Structures		+		+	+				+	+	+
MHCCE 13	Sea Navigation		+		+	+			+	+	+	+
	Elective Modules											
MHCCE 14	Sea Geodesy		+	+	+	+				+	+	+
MHCCE 15	Dynamics of Sea Waters		+	+		+			+	+	+	+
MHCCE 16	Maintenance and Rehabilitation of Harbor Structures		+		+	+			+	+	+	+
MHCCE 17	Marine Ecology and Sea Environmental Protection		+		+	+	+	+	+	+	+	+
MHCCE 18	Economics of Sea Transportation		+		+		+	+	+	+	+	+
MHCCE 19	Naval Safety and assurance		+	+	+	+	+	+	+	+	+	+

	From these Courses students must select one course in each Semester 2 and 3											
	General Qualification											
MHCCE 20	Rights and Sea Legislations				+	+	+		+	+	+	+
	Practical Training/ Project Study											
MHCCE 21	Practical Training/ Project Study	+	+	+	+	+	+	+	+	+	+	+
	Master Thesis with Defense											
MHCCE 22	**Master Thesis with Defense**	+	+	+	+	+	+	+	+	+	+	+

B- Intellectual Abilities

b1: Evaluation and choosing the suitable methods to solve the problems in field Harbors Construction and Costal Engineering and make optimum solution to design different civil engineering in these Fields using suitable tools based on analytical and structural thought.

b2: Evaluation and choosing the optimum planning of different Harbors Structures and Costal Engineering using suitable tools based on analytical thought.

b3: Evaluation and choosing the optimum solution for design of Harbors and all related Structures using suitable tools based on analytical thought.

b4: Evaluation and choosing the optimum solution for design of Costal Engineering and related Structures, Sea and Shore Structures using suitable tools based on analytical thought.

b5: Evaluation and choosing the optimum solution for Sediments Transport and Movement and their deposition outside the Harbors using suitable tools and software based on analytical thought.

b6: Implementation the acquired knowledge and the engineering principles to connect research, design and environment to protect and develop the nature.

b7: Integral application and connection of engineering knowledge's and understanding the other engineering competences requirements to get innovative engineering solutions.

b8: Offering the engineering solutions of civil engineering problems especially Harbors Structures and their Construction, Costal Engineering, Sea and Shore structures based on finite resources and incongruent information.

b9: Analysis of engineering systems and their components and evaluating their consequences.

b10: Self-learning for dealing with modern innovative problems of civil engineering, especially Harbors Structures and Construction, Costal Engineering, Sea and Shore Structures and technical new software.

b11: Abilities to introduce the engineering solution of several problems of Harbors Structures and Construction, Costal Engineering, Sea and Shore Structures based on international scientific references and journals and other resources.

ARS(Academic Reference Standard)

	ARS(Academic Reference Standard)											
Nr of Module and symbol	Module Name	National Academic Reference Standard NARS								Additional Standards		
		b_1	**b_5**	**b_6**	**b_7**	**b_8**	**b_9**	**b_{10}**	**b_{11}**	**b_2**	**b_3**	**b_4**
	Modules in Mathematics and Natural Sciences											
MHCCE 1	Advanced Mathematics	+	+	+	+	+		+	+	+		+
MHCCE 2	Mathematical and physical Modeling	+	+	+	+	+	+	+	+	+	+	+
MHCCE 3	Methods of scientific research	+	+	+	+	+	+	+	+	+		
	Engineering											
MHCCE 4	Construction and protection of shores	+			+			+	+	+		+
MHCCE 5	Planning of Harbors	+			+			+	+	+	+	
	Hydro Sciences											
MHCCE 6	Hydro Physic of Seas and Currents	+	+		+	+	+	+	+	+		+
MHCCE 7	Hydro Dynamic of shores	+	+		+	+	+	+	+	+		+
	Specialization											
MHCCE 8	Sea and Shore Structures	+			+	+		+	+	+		+
MHCCE 9	Navigation and Sea Measurements Devices	+	+		+	+		+	+	+		+
MHCCE 10	Sediments Transport and Movement	+	+		+	+		+	+	+	+	+
MHCCE 11	Harbors Construction	+			+	+		+	+	+	+	
MHCCE 12	Technology of Harbors Structures	+	+		+	+	+	+	+	+	+	
MHCCE 13	Sea Navigation	+	+	+	+	+		+	+			
	Elective Modules											
MHCCE 14	Sea Geodesy	+	+		+	+		+	+	+	+	+
MHCCE 15	Dynamics of Sea Waters	+	+	+	+	+		+	+	+	+	+
MHCCE 16	Maintenance and Rehabilitation of Harbor Structures	+			+	+	+	+	+	+		
MHCCE 17	Marine Ecology and Sea Environmental Protection	+	+	+	+	+	+	+	+	+		+
MHCCE 18	Economics of Sea Transportation	+	+	+	+	+		+	+	+	+	
MHCCE 19	Naval Safety and assurance	+	+	+	+	+	+	+	+	+		
	From these Courses students must select one course in each Semester 2 and 3											
	General Qualification											

MHCCE 20	Rights and Sea Legislations	+	+	+	+	+	+	+	+	+	+	+
	Practical Training/ Project Study											
MHCCE 21	Practical Training/ Project	+	+	+	+	+	+	+	+	+	+	+
	Study	**Master Thesis with Defense**										
MHCCE 22	**Master Thesis with Defense**	+	+	+	+	+	+	+	+	+	+	+

C- Professional and Practical Skills

C_1: The development of Ability of obligation and restraint of the Professional systems Basics,

C_2: Ability to work within team and regulating, moving and leading the collective team.

C_3: Ability to appoint the practical application of mathematical laws in other engineering modules, and enter them in continuing professional development.

C_4: Ability to expect hazards and develop, apply and improve the systems to manage and avoid their.

C_5: Ability to execute different engineering structures studies in fields Harbors Construction and Costal Engineering taking into consideration the economical social and environmental output.

C_6: Ability to evaluate the geological cartography and execute different geological studies to establish different Harbors Construction and Costal Engineering Projects taking into consideration their impact on the other engineering studies and the economical social and environmental output.

C_7: Ability to study and design Costal Engineering and related Structures, Sea and Shore Structures taking into consideration the economical social and environmental output.

C_8: Ability to execute profitable studies and make financial and time programs of engineering projects. In addition to preparing and executing work plan to achieve the goals of corporation.

C_9: Ability to appoint tools, software programs and different field engineering devices with obligation of professional safety basics.

C_{10}: Ability to use and appoint Navigation and Sea Measurements devices, and execute related laboratory and fields experiments and analyzing the results.

ARS(Academic Reference Standard)

	ARS(Academic Reference Standard)										
Nr of Module and symbol	Module Name	National Academic Reference Standard NARS							Additional Standards		
		C_1	**C_2**	**C_3**	**C_4**	**C_8**	**C_9**	**C_{10}**	**C5**	**C6**	**C_7**
	Modules in Mathematics and Natural Sciences										
MHCCE **1**	Advanced Mathematics			+	+			+	+		
MHCCE **2**	Mathematical and physical Modeling			+	+		+	+	+		
MHCCE **3**	Methods of scientific research	+	+	+	+		+	+	+		
	Engineering										
MHCCE 4	Construction and protection of shores		+	+	+			+	+	+	+
MHCCE 5	Planning of Harbors		+	+	+			+	+	+	+
	Hydro Sciences										
MHCCE 6	Hydro Physic of Seas and Currents				+	+		+	+		+
MHCCE 7	Hydro Dynamic of shores				+	+		+	+		+
	Specialization										
MHCCE 8	Sea and Shore Structures		+	+	+			+	+	+	+
MHCCE 9	Navigation and Sea Measurements Devices		+	+	+			+	+	+	
MHCCE 10	Sediments Transport and Movement		+	+	+			+	+	+	+
MHCCE 11	Harbors Construction		+		+			+		+	
MHCCE 12	Technology of Harbors Structures		+		+	+	+	+	+	+	+
MHCCE 13	Sea Navigation		+		+			+	+		

	Elective Modules										
MHCCE 14	Sea Geodesy		+	+	+	+		+	+		+
MHCCE 15	Dynamics of Sea Waters		+		+			+	+	+	+
MHCCE 16	Maintenance and Rehabilitation of Harbor Structures		+	+	+	+	+		+		
MHCCE 17	Marine Ecology and Sea Environmental Protection	+	+	+	+	+	+	+	+	+	+
MHCCE 18	Economics of Sea Transportation	+	+		+		+	+	+	+	+
MHCCE 19	Naval Safety and assurance	+	+	+	+	+		+	+		
	From these Courses students must select one course in each Semester 2 and 3										
	General Qualification										
MHCCE 20	Rights and Sea Le-gislations	+	+	+	+	+	+	+	+	+	+
	Practical Training/ Project Study										
MHCCE 21	Practical Training/ Project Study	+	+	+	+	+	+	+	+	+	+
	Master Thesis with Defense										
MHCCE 22	**Master Thesis with Defense**	+	+	+	+	+	+	+	+	+	+

d- General Transferable Skills

D1: Ability to work actively within team with several specializations.

D2: Ability to show active and personal skills in different work environments.

D3: Ability to develop self-learning and follow a continuing learning processes.

D4: Ability to work within hard business work environment to achieve the required businesses in time and in different limits.

D5: Ability to manage tasks and resources in active serious form.

D6: Ability to follow and use advanced technologies and software programs in field civil engineering especially in Harbors Construction and Costal Engineering.

D7: Ability to acquire skills of Projects management.

D8: Ability to expose the designs and proposals and writing the scientific reports.

D9: Ability to realize a relationship and discussion with other sides.

D10: Possession of skills of required strange languages to carry out the profession and follow-up the epistemic development.

ARS(Academic Reference Standard)

	ARS(Academic Reference Standard)										
Nr of Module and symbol	Module Name	National Academic Reference Standard NARS									Additional Standards
		D_1	**D_2**	**D_3**	**D_4**	**D_5**	**D_6**	**D_8**	**D9**	**D10**	**D_7**
	Modules in Mathematics and Natural Sciences										
MHCCE **1**	Advanced Mathematics			+		+	+		+	+	
MHCCE **2**	Mathematical and physical Modeling	+		+		+	+		+	+	
MHCCE **3**	Methods of scientific research	+		+		+	+	+	+	+	
	Engineering										
MHCCE 4	Construction and protection of shores	+	+	+	+	+			+	+	+
MHCCE 5	Planning of Harbors	+	+	+		+			+	+	+
	Hydro Sciences										
MHCCE 6	Hydro Physic of Seas and Currents			+		+	+		+	+	+
MHCCE 7	Hydro Dynamic of shores			+		+	+		+	+	+
	Specialization										
MHCCE 8	Sea and Shore Structures	+	+	+	+	+			+	+	+
MHCCE 9	Navigation and Sea Measurements Devices	+	+	+	+	+			+	+	+
MHCCE 10	Sediments Transport and Movement	+	+	+	+	+			+	+	+
MHCCE 11	Harbors Construction	+	+	+	+	+			+	+	+
MHCCE 12	Technology of Harbors Structures	+	+	+	+	+			+	+	+
MHCCE 13	Sea Navigation	+	+	+	+	+			+	+	+
	Elective Modules										
MHCCE 14	Sea Geodesy	+	+	+	+	+	+		+	+	+
MHCCE 15	Dynamics of Sea Waters		+	+	+	+			+	+	+
MHCCE 16	Maintenance and Rehabilitation of Harbor Structures	+	+	+	+	+	+		+	+	+
MHCCE 17	Marine Ecology and Sea Environmental Protection	+	+	+	+	+	+		+	+	+
MHCCE 18	Economics of Sea Transportation	+	+	+	+	+			+	+	+

MHCCE 19	Naval Safety and assurance	+		+		+	+	+	+	+	
	From these Courses students must select one course in each Semester 2 and 3										
	General Qualification										
MHCCE 20	Rights and Sea Legislations	+	+	+	+	+	+	+	+	+	+
	Practical Training/ Project Study										
MHCCE 21	Practical Training/ Project Study	+	+	+	+	+	+	+	+	+	+
	Master Thesis with Defense										
MHCCE 22	**Master Thesis with Defense**	+	+	+	+	+	+	+	+	+	+

4-Systems and special lists belong to the evaluation of students and check of standards

Input the programme standards which agreed upon, for min. time for success and for each rate				
Academic semester	1	2	3	4
Writing examination	Range between (60-70) of max. notes of modules (100%).			
Oral test (interview)	Max. 50 % of term paper note of modules (30-40%).			
several tests (tutorial – Laboratory)	Max. 50 % of term paper note of modules (30-40%).			

5- Evaluation of Education aimed output of programme

Evaluator	**tool**	**sample**
Student of final Semester.	questionnaire	all students
Absolvent	Form pages	all absolvent
Appointment sides	Form pages	25% business holders
External checks	-	-
External checks	questionnaire	Education Staff members, some members from the University Quality guarantee center
Others	-	-

6- Books and references

* Academic university Book.
* Printed Lectures.
* Arabic and strange available references in the Faculty library.
* Scientific periodically journals.
* Internet website

MODULE COMPENDIUM

Sanitary Engineering (MSE)

Master Programme

Tishreen University Lattakia

Department of Water Engineering and Irrigation
Faculty of Civil Engineering

2015

EDUWAT: 511251-TEMPUS-1-2010-1-DE-TEMPUS-SMHES
Development of a Modern Higher Education System for Water Engineering in Syria

Developed by
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1- Goals of the Master course of sanitary engineering MSE

The academic plan in the Master course of sanitary engineering program, aims at providing the students the following items:

22. High level information in science and computer techniques, and developing the skills in engineering sciences and its applications.
23. Developing the ability of the students to achieve various sanitary engineering studies check and use it according to the engineering codes.
24. Comparing between the sanitary engineering solutions, and choose the optimum ones.
25. Developing the works skills and regulate the relationship between the work team which the best and have many specialists.
26. Strengthening the research ability, developing and working with the modest soft-ware's, equipments… etc.
27. Developing the item of the scientific, social and cultural of the students characters.
28. Continuous developing to get the high quality of the research, teaching…...etc.

2- Modules of Master course of sanitary engineering MSE

	Credits	%
Modules in Mathematics and Natural Sciences	15	13%
Modules in Engineering	10	8%
Modules in Hydro Sciences	10	8%
Modules with Specialization	30	25%
Elective Modules	10	8%
Modules for general Qualification	5	4%
Practical Training /Project	10	8%
Master Thesis plus Defense	30	25%
Total	**120**	**100%**

Module Semester	**1**	**2**	**3**	**4**
Mathematics and Natural Sciences	10	5		
Engineering	5	5		
Hydro Sciences	10	0		
Specialization	5	15	10	
Elective Modules		5	5	
General Qualification			5	
Practical Training/ Project Study			10	
Master Thesis plus Defense				30
Total	**30**	**30**	**30**	**30**

	Modules in Natural Sciences 10% - 25%		Modules inTechnical Sciences 10 - 25%		Modules in Economic & Social Sciences 5% - 15%		Modules in Variable Sciences 55% - 70%

Nr of Module	Course Semester	1	2	3	4	Total/ECTS
	Mathematics and Natural Sciences	**10**	**5**			**15**
MSE 1	Advanced Mathematics	5				**5**
MSE 2	Mathematical and physical Mode-ling	5				**5**
MSE 3	Methods of scientific research		5			**5**
	Engineering	**5**	**5**			**10**
MSE 4	Water Supply and Waste Water treatment		5			5
MSE 5	Geotechnical Engineering of Sa-nitary Structures	5				**5**
	Hydro Sciences	**10**				**10**
MSE 6	Advanced Hydraulics	5				5
MSE 7	Advanced Water Chemistry	5				5
	Specialization	**10**	**15**	**5**		**30**
MSE 8	Solid Waste Management and Contamination Treatment		5			5
MSE 9	Environment Impacts Assess-ment	5				5
MSE 10	Water Supply and Waste Water Networks Advanced	5				5
MSE 11	Pumping stations Advanced		5			5
MSE 12	Sanitary Engineering Structures		5			
MSE 13	Technology of Environmental Structures			5		5
	Elective Modules		**5**	**5**		**10**
MSE 14	Advanced Geodesy		**+**	**+**		5
MSE 15	Ecology and Environment Protec-tion		**+**	**+**		5
MSE 16	Maintenance and Rehabilitation of Environmental Structures		**+**	**+**		
MSE 17	Municipal and Industrial Water Management		**+**	**+**		5
MSE 18	Integrated Water Resources Ma-nagement		**+**	**+**		5
MSE 19	Advanced Water Tanks		**+**	**+**		
	From these Courses students must select one module for each of the 2nd and 3rd Semester					
	General Qualification			**5**		**5**
MSE 20	Water Rights and Conflict Reso-lution			5		5
MSE 21	**Practical Training/Project study**			**10**		**10**
MSE 22	**Master Thesis plus Defense**				**30**	**30**
	Total	**30**	**30**	**30**	**30**	**120**

3- Study Plan of Master course of sanitary engineering MSE -

Nr of Module and symbol	**Courses**	**S. 1**	**S.** 2	**S.** 3	**S.** 4	**Total/ECTS**
	Modules in Mathematics and Natural Sciences					
MSE 1	Advanced Mathematics	3/2/0/2				5
MSE 2	Mathematical and physical Modeling	3/2/0/2				5
MSE 3	Methods of scientific research		3/2/0/2			5
	Engineering					
MSE 4	Water Supply and Waste Water treatment		3/2/0/2	3/2/0/2		5
MSE 5	Geotechnical Engineering of Sanitary Structures	3/2/2/0				
	Hydro Sciences					
MSE 6	Advanced Hydraulics	3/2/0/2				5
MSE 7	Advanced Water Chemistry	3/2/2/0				5
	Specialization					
MSE8	Solid Waste Management and Contamination Treatment		3/2/2/0			5
MSE 9	Environment Impacts Assessment		3/2/2/0			5
MSE 10	Water Supply and Waste Water Networks Advanced	3/2/2/0				5
MSE 11	Pumping stations Advanced		3/2/2/0			5
MSE 12	Sanitary Engineering Structures		3/2/2/0			5
MSE 13	Technology of Environmental Structures			3/2/2/0		5
	Elective Modules					
MSE 14	Advanced Geodesy		3/2/2/0	3/2/2/0		5
MSE 15	Ecology and Environment Protection		+	+		5
MSE 16	Maintenance and Rehabilitation of Environmental Structures		+	+		5
MSE 17	Municipal and Industrial Water Management		+	+		5
MSE 18	Integrated Water Resources Management		+	+		5
MSE 19	Advanced Water Tanks		+	+		5
	From these Courses students must select one course in each Semester 3 and 4					

	General Qualification					
MSE 20	Water Rights and Conflict Resolution			3/2/2/0		**5**
	Practical Training/ Project Study					
MSE 21	Practical Training/ Project Study			**10**		**10**
	Master Thesis with Defense					
MSE 22	**Master Thesis with Defense**				**30**	**30**
	Total	**30**	**30**	**30**	**30**	**120**

Lecture/Tutorial/Laboratory/Excursion (homework's)

4- Definition of the modules of Master course of Sanitary Engineering MSE

Basics in Mathematics and Natural Sciences		
Module Number	**Module Name**	**Professor in Charge**
MSE 1	**Advanced Mathematics**	Prof. Dr.
Contents and Qualification aims	The module deals with understanding the basics of statistics and probability which cover the module Principles of probabilities :(the probability, the random events, the conditional probability, autonomy of the events), Bays formula (the first and second, Random variable, distribution function, discrete and connected variable, expectation standard deviation. In addition to the Differential equations such as The normal Differential equations of first order(solved and not solved as for derivative) and The Differential equations of higher order, The partial Differential equations. The students' knowledge will be developed with probability distributions and finding the relationship between the variables and give the students enough knowledge's and ability in these fields.	
Module Character	Advanced Mathematics: 4 Hours of lectures per week, 2 hour of tutorial.	
Prerequisite of attendance	Basic Knowledge of Advanced Mathematics (Differential equations and statistics and probability) is Bachelor of Water engineering and environment.	
Applicability	The module is one of 3 mandatory compulsory of the Mathematics and Natural Sciences of the master course Sanitary Engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 1.	
Proposal references	1. Erwin Kreyszig: **Advanced Engineering Mathematics**, 10th Edition, John Wiley& Sons, INC.ISBN 978-0-470-45836-5, 2011 1283 pages. 2. Wolfgang Ertel: **Advanced Mathematics for Engineers**, translated by Elias Drotle and Richard Cubek, Hochschule Ravensburg- Weingarten University of Applied Sciences, October 1, 2012.	

MSE 2	**Mathematical and physical Modeling**	Prof. Dr
Contents and Qualification aims	The module deals with understanding the basics of the mathematical and physical modeling in the water engineering, the models types, covering equations, the boundaries conditions, model execution and the calibration process, sensitivity analysis, verification model, validation model, prediction model, post- audit model, documenting and reporting the modeling study. The students' knowledge will be developed during tutorials and specialist software's which give the students enough knowledge's and ability in these fields.	
Module Character	Mathematical and physical Modeling: 4Hours of lectures per week, 2 hour of tutorial and laboratory experiments.	
Prerequisite of attendance	Basic Knowledge of Mathematical and physical Modeling. Bachelor of Water engineering and environment..	
Applicability	The module is one of 3 mandatory compulsory of the Basics in mathematics of the master course Sanitary Engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 1.	
Proposal references	1. The physical, **mathematical and computational models**, University of Albetra. 2. Umut Hanoglu: **Mathematical and Physical Modeling,** University of Nova Gorica, 2009. 3. Masato Nakamura: **Mathematical and Physical Modeling of Mixing and Flow Phenomena of Municipal Solid Waste Particles on a Reverse Acting Grate**,Columbia University, 2008, 198 pages.	

MSE 3	**Methods of scientific research**	**Prof. Dr.**
Contents and Qualification aims	The module deals with general and basic information about understanding; importance of scientific research; skills of scientific research; ethics of scientific research; methodology; preparing of scientific research protocol; design of experiment in laboratory or in the field; collecting and analysis of data; searching in references; searching in web; writing of scientific paper, writing of thesis and dissertation. The students' knowledge will be developed during training to write the scientific paper and preparing his scientific research protocol.	
Module Character	Methods of scientific research: 4 Hours of lectures per week, 2 hours of training per week.	
Prerequisite of attendance	Basic Knowledge of Methods of scientific research is Language skills; Basic knowledge of informatics.	
Applicability	The module is one of 3 mandatory compulsory of the Mathematics and Natural Sciences of the master course Sanitary Engineering. The module is suitable for the research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 2.	
Proposal references	1. James E. Mauch and Namgi Park: **Guide to the Successful Thesis and Dissertation, A Handbook for Students and Faculty**. 2003. 5th ed. Copyright ©2003 by Marcel Dekker. ISBN: 0-8247-4288-5. 2. Louis Cohen; Lawrence Manion and Keith Morrison: **Research Methods in Education**, 2005, 5th ed. ISBN 0-203-22434-5 Master e-book ISBN. 3.Derek Swetnam: **Writing Your Dissertation, How to plan, prepare and present successful work**. 2007, 3rd ed. ISBN: 978 1 84803 126 5.	

Engineering		
MSE 4	**Water Supply and Waste Water treatment**	**Prof. Dr. Eng.**
Contents and Qualification aims	The module introduces the students the main principles and details of calculation and design of drinking water treatment stations and related structures and its equipment's. In the other part give the module students the basic knowledge's about the properties of waste water and the hazards resultant from pollution with it, after that the student should know the general treatment methods (how they calculate it hydraulically and how the student can design several waste water networks (simple, secondary and tertiary). In addition to the students will be introduce details the hydraulically calculations of the related structures each method and how can take out the sediments and sludge resultant from the several treatment phases.	
Module Character	Waste water system and Treatment: 4 Hours of lectures per week, 2 hour of tutorial and Laboratory experiments per week.	
Prerequisite of attendance	Basic Knowledge of Waste water system and Treatment is Advanced Hydraulics, Advanced of Water Chemistry, Water Supply and Waste Water Networks Advanced.	
Applicability	The module is the single main mandatory compulsory of the engineering of the master course of sanitary engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 10 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 2 and 3.	
Proposal references	1. Mark J. Hammer: **Water and Wastewater Technology**, 7th edition, 2008, Amazon Book. 2. D. Duncan Mara and Charles G. Gunnerson: **Appropriate Technology for Water Supply and Sanitation, A Planner's Guide**, By John M Kalbermatten, De Anne S. Julius, 1980. 3. Rang wala: **Water Supply and Sanitary Engineering[Environmental Engineering]**, 27th Edition,Charotar Publishing House Pvt. Ltd. 2013, ISBN 978-93-80358-81-9, Pages 888 + 16. 4. **Water Supply, Water Distribution** (Technical Manual), Headquarters, Department of the Army November 1986, Washington, D.C., TM 5-813.5/AFM 88-10, Vol 5.	

MWS 5	**Geotechnical Engineering of Sanitary Structures**	**Dr. Eng.**
Contents and Qualification aims	The module introduces Geotechnical investigations of foundation of water structures ; types of foundations of water structures, ; improve and sustainability of soils, Soil settlement and Foundation; design several types of foundation (surface foundations; deep foundations; piles; wells) ; improve of foundation ; the stabilization and equilibrium of slopes. Design of buried Constructions. The students' knowledge will be developed during tutorials and computer programmes and gives the students enough knowledge's and ability in these fields.	
Module Character	Foundation of Water Structures: 4 Hours of lectures per week, 2 hour of tutorial.	
Prerequisite of attendance	Geotechnical Engineering of Sanitary Structures is Bachelor of Water Engineering and Environment, and Environment Engineering, sanitary engineering and Civil Engineering.	
Applicability	The module is one of 2 mandatory compulsory of the Engineering of the Master Course of Water Structures. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 1.	
Proposal references	1. Evert C. Lawton, Ph.D., P.E. and Steven F. Bartlett, Ph.D., P.E.: **Introduction to Geotechnical Engineering**, The University of UTAH, 2. **Geotechnical Engineering Manual Geotechnical Engineering Section**, Minnesota University2013.	

Hydro Sciences		
Module Number	Module Name	Prof. in Charge
MSE 6	**Advanced Hydraulics**	**Prof. Dr.Eng.**
Contents and Qualification aims	The module deals with restrictive layer and disturbed theory; unsteady flow in open Canals, Weirs; Connection structures and energy depression; Laboratory experiments, computing programmes about this subjects. Boundary flow and its application in water engineering; similarity; principles of theoretical modeling of hydraulic phenomena; two-and three-dimensional flow and its application; and applications of electrical modeling in solving the flow equation. The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and Use some advanced software to give the students enough knowledge and ability in these fields.	
Module Character	Advanced Hydraulics: 3 Hours of lectures per week, 2 hour of tutorial per week. 2 hour of Laboratory test per week.	
Prerequisite of attendance	Basic Knowledge of Advanced Hydraulics is Bachelor of Water Engineering and Environment, and Environment Engineering, sanitary engineering and Civil Engineering.	
Applicability	The module is one of 2 mandatory compulsory of the Basics in Hydro Sciences of the Master course sanitary engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one terms starting in Semester 1.	
Proposal references	1. Alan Vardy: **Fluid Principles**, McGraw-Hill (1990). 2. Herman Schlichting: Boundary-layer theory, McGraw-Hill (1979). 3. James A. Liggett: **Basic equations of unsteady flow, In Unsteady flow of open channels**, Water Resources Publications (1975). 4. William A. Miller and Jean A. Cunge :**Simplified equations of unsteady flow, In Unsteady flow of open channels**, Water Resources Publications (1975). 5. **Hydraulics, Workbook Advanced Level, Learning System for Automation and Communications**, P502Festo Didactic OCKERIngenieurbüro, 1999, 162 Pages. 6. Suresh A. Kartha: **Advanced Hydraulics**, Department of Civil Engineering Indian Institute of Technology, Guwahati. 7. A. Osman Akan: Open Channel Hydraulics, Elsevier BH, 2006, reprinted 2008.	

MSE 7	**Advanced of Water Chemistry**	Prof. Dr. Eng.
Contents and Qualification aims	The module introduces the general information of water solution Chemistry and the important parameters indicated of water quality and the methods of chemical treatment. Chemical Equilibrium and Oxidation-Reduction Reactions; methods of sampling; methods of Chemical analysis of water; Chemical analysis processing. The students' knowledge will be developed during tutorials and necessary laboratory experiments and use some advanced software to give the students enough knowledge's and ability in this fields.	
Module Character	Advanced of Water Chemistry: 4 Hours of lectures per week, 2 hours of tutorial and Laboratory and experiments per week.	
Prerequisite of attendance	Basic Knowledge of Advanced of Water Chemistry is Bachelor of Water Engineering and Environment, and Environment Engineering, sanitary engineering and Civil Engineering.	
Applicability	The module is one of 2 mandatory compulsory of the Hydro Sciences of the Master Course Sanitary Engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 1.	
Proposal references	1. Frederick George Mann; Bernard Charles Saunders: Practical Organic **Chemistry**, Longman London and New York, Fourth Edition, 1960. 2. Paul Mc Sweeney; Patrick F. Fox : **Advanced Dairy Chemistry,** Volume 3" Lactose, Water, Salts and Minor Constituents", ISBN: 978-0-387-84864-8 (Print) 978-0-387-84865-5 (Online), 2009. 3. Erik Sogaard: **Chemistry of Advanced Environmental Purification Processes of Water**, **Fundamentals and Applications**, ISBN: 978-0-444-53178-0, Elsevier B.V,2014.	

Specialization

MSE 8	**Solid Waste Management and Contamination Treatment**	Prof. Dr.
Contents and Qualification aims	The module introduce the Solid Waste resultant from several human activity, its component, resources, types, properties, management system, the Management and optimum methods to calculate this waste, transporting, storage, burring, in addition to safety riddance methods of this waste and its rotation methods and treat it with purpose of using it and minimize its influences on human and environment. The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and use some advanced software to give the students enough knowledge and ability in these fields.	
Prerequisite of attendance	Solid Waste Management and Contamination Treatment: 4 Hours of lectures per week, 2 hour of tutorial and Laboratory and experiments per week.	

Applicability	Basic Knowledge of Solid Waste Management and Contamination Treatment is Advanced Hydraulics, Advanced of Water Chemistry, Municipal and Industrial Water Supply and Purification, Waste Water Systems and treatment.
Prerequisite to active credit points	The module is one of 6 mandatory compulsory of the Specialization of the master course of sanitary engineering. the module is suitable for the professional and research oriented studies in civil and environmental engineering.
Accredit points and grades	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.
Frequency of the module	The module is offered annually.
Worked load	The workload is 150 hours.
Duration of the module	The module takes one term starting in Semester 2.
Proposal references	• 1. Nicholas P. Cheremisinoff : **Handbook of Solid Waste Management and Waste Minimization Technologies**, ISBN: 978-0-7506-7507-9, Elsevier Inc, 2003. 2. **Solid Waste Managemen**t (Volume I), United Nations Environment programme, (2005), 72 Pages.

MSE 9	**Environment Impacts Assessment**	**Dr. eng.**
Contents and Qualification aims	The module introduces students Environment Impact Assessment and sustainable development, basics and principles of Environment Impact Assessment process, influence of Environment Impact Assessment on the environment, procedures of Environment Impacts Assessment (scoping and screening of Environment Impacts, study of Environment Impacts Assessment (primary Environment study, full Environment study), mitigation procedures, environment management plan, legal framework of study), integrated environmental management, knowing of using GIS system in Environment Impacts Assessment. The students' must know how can calculate the costs of the construction and the time plan. The students' knowledge will be developed during tutorials and use some software to gives the students enough knowledge and ability in these fields.	
Module Character	Environment Impacts Assessment: 4 Hours of lectures per week, 2 hour of tutorial and Laboratory and experiments per week.	
Prerequisite of attendance	Basic Knowledge of Environment Impacts Assessment is Advanced Hydraulics, Advanced of Water Chemistry, Municipal and Industrial Water Supply and Purification, Waste Water Systems and treatment.	
Applicability	The module is one of 6 elective modules of the Master course sanitary engineering. the module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one terms starting in Semester 2.	
Proposal references	1. Pacifica F. Achieng gola: **Environmental Impact Assessment,** General Procedures, Presented at Short Course II on Surface Exploration for Geothermal Resource s, organized by UNU - GTP and Ken Gen, at Lake Naivasha, Kenya, 2 17 November, 2007. 2. **A handbook on environmental impact assessment**, Scottish Natural Heritage Guidance for Competent Authorities, Consul tees and others involved in the Environmental Impact Assessment Process in Scotland, Natural Heritage Management, 4th Edition, 2013, Pages 246.	

MSE 10	**Water Supply and Waste Water Networks Advanced**	Prof.Dr.
Contents and Qualification aims	The module introduces the students the main principles and details of calculation and design of drinking water supply networks to cities, towns, industrial institution, related structures and equipment's. In the other part give the module students the basic knowledge's of waste water systems new methods of its design, hydraulically calculation of several waste water networks (separate, un separate, half separate) using modern computing programmes and models. In addition to the students will be introducing the related structures on these Networks and how can maintain these Networks.	
Module Character	Water Supply and Waste Water Networks Advanced: 4 Hours of lectures per week, 2 hour of tutorial and Laboratory and experiments per week.	
Prerequisite of attendance	Basic Knowledge of Water Supply and Waste Water Networks Advanced is Bachelor of Water Engineering and Environment, and Environment Engineering, sanitary engineering and Civil Engineering.	
Applicability	The module is one of 6 elective modules of the Master course sanitary engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40 % term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one terms starting in Semester 1.	
Proposal references	1. TruptiPatil; R.Anju Ranjani: **Design of Monitoring System for Water Supply for Metropolitan City Using Embedded Technology,** International Journal of Advanced Research in Computer Science and Software Engineering, Volume 3, Issue 7, July 2013, ISSN: 2277 128X. 2. **Drinking Water Distribution Systems, Assessing and Reducing Risks,** Committee on Public Water Supply Distribution Systems, Water Science and Technology Board, HE NATIONAL ACADEMIES PRESS, Washington, D.C. www.nap.edu, ISBN: 0-309-66432-2, 404 pages, 6 x 9, (2006). • 3. Prabhata K. Swamee, Ashok K. Sharma: **Design of Water Supply Pipe Networks,** John Wiley & Sons, Inc., 2008, Print ISBN: 9780470178522, Online ISBN: 9780470225059, DOI: 10.1002/9780470225059.	

MSE 11	**Pumping Stations Advanced**	Prof. Dr. Eng.
Contents and Qualification aims	The module deals with problems hydraulic machines; Potential energy; Basic Equation of pumps; types of pumps; parts of centrifugal pump; characteristic curves of pumps; working and connection of pumps; pumping pipes; Pumping stations; water hammer and cavitation; used measurement instruments; renewable energy; hydroelectric power plants; turbines; power generation and environment. The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and Use some advanced software to give the students enough knowledge and ability in these fields.	
Module Character	Pumping Stations Advanced: 4 Hours of lectures per week, 2 hour of tutorial and Laboratory and experiments per week.	
Prerequisite of attendance	Basic Knowledge of Pumping Stations Advanced: are Advanced Hydraulics, Advanced of Water Chemistry, Environment Impacts Assessment, Water Supply and Waste Water Networks Advanced.	
Applicability	The module is one of 6 mandatory compulsory of the Specialization of the master course of sanitary engineering. the module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 2.	
Proposal references	1. James B. Rishel, P.E : **Water Pumps and Pumping Systems**, Copyright 2002. 2. David Stephnson: **Pipe Line Design for Water Engineers**, Second Edition (Completely revised) Elsevier Scientific Publishing Company, 1981	

MSE 12	**Sanitary Engineering Structures**	**Prof. Dr. Eng.**
Contents and Qualification aims	The module deals with problems Classification of sanitary structures work and design; and focused on bases theoretical and practical drink water and hot water supply systems, sewage systems, and rain drainage in public and private buildings and methods of design and implementation. The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and Use some advanced software to give the students enough knowledge and ability in these fields.	
Module Character	Sanitary Engineering Structures: 4 Hours of lectures per week, 2 hour of tutorial and laboratory experiments per week.	
Prerequisite of attendance	Basic Knowledge of Sanitary Engineering Structures is Advanced Hydraulics, Advanced of Water Chemistry, Environment Impacts Assessment, Water Supply and Waste Water Networks Advanced.	
Applicability	The module is one of 6 mandatory compulsory of the Specialization of the master course of sanitary engineering. the module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes two terms starting in Semester 2.	
Proposal references	1. Ruth, F. Weiner; Robin A. Matthews: **Environmental Engineering**, Butter Worth Heinemann, 4th Edition, 2003, 484 page. 2. Marcos von Sperling: **Basic Principles of Wastewater Treatment, Biological Wastewater Treatment Series**, VOLUME TWO, Department of Sanitary and Environmental Engineering Federal University of Minas Gerais, Brazil, IWA Publishing London, New York, First published 2007, 208 Pages. 3.Paul Bizier: **Gravity Sanitary Sewer Design and Construction,** Second Edition, Manuals of Practice (MOP) MOP 60; WEF MOP FD-5, 2007 / 436 pp. 4. **Specifications Book**, CITY OF ST. JOHN'S – Department of Engineering 4th Edition, March 2010, Pages 513. 5. **Design of Reinforced Concrete Structures**: Dayaratnam P, Oxford&IBH. 6. Wang.C.K. Salmon.C.G.and Pincheirs, J.A: **Reinforced Concrete Design**:, 7th Edition, John Wiley, 2007.	

MSE 13	**Technology of environmental Structures.**	**Dr. eng.**
Contents and Qualification aims	The module introduces students to the construction process and plans of environmental structures in site. Through this module the students will be able to identify the steps to construct each structures element and the properties of construction process and used machinery. The students' must know how can calculate the costs of the construction and the time plan. The students' knowledge will be developed during tutorials and gives the students enough knowledge and ability in these fields.	
Module Character	Construction Technology of environmental Structure: 4 Hours of lectures per week, 2 hour of tutorial and Laboratory and experiments per week.	
Prerequisite of attendance	Basic Knowledge of Technology of environmental Structures is Advanced Hydraulics, Advanced of Water Chemistry, Environment Impacts Assessment, Water Supply and Waste Water Networks Advanced, Solid Waste Management, Contamination Treatment, Pumping stations, Sanitary Engineering Structures.	
Applicability	The module is one of 6 mandatory compulsory of the Specialization of the master course of sanitary engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes two terms starting in Semester 3.	
Proposal references	1. Specifications Volumes I - CPWD **construction technologies** cpwd.gov.in/Publication/Specs2009V1.pdf 2. **Concrete technology and durability design**, COWI company. 3. **XIV National Conference on Structural Engineering, Acapulco 2004,** Offshore Structures – A new challenge,	

Elective Modules		
Module Number	**Module Name**	**Prof. in Charge**
MSE 14	**Advanced Geodesy**	Dr.
Contents and Qualification aims	The module aims at giving the students new information about surveying methods in several parts, enables the students to read complex maps and topographic schemes, knowing some new surveying apparatus and doing measurements on it, using mathematical methods to handle these measurements, making topographic schemes to design several engineering projects. The students will be able to apply these projects. The student's knowledge will be developed during tutorials, using apparatus, and computer programmes and gives the students enough knowledge and ability in these fields.	
Module Character	Geodesy:4 Hours of lectures per week, 2 hour of tutorial.	
Prerequisite of attendance	Basic Knowledge of Geodesy is Bachelor of Water engineering and environment.	
Applicability	The module is one of 6 Elective Modules of the Engineering of the Master Course Sanitary Engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 1.	
Proposal references	• 1. Shepherd F. A.: **Advanced Engineering Surveying: Problems and Solutions (Paperback)**,Paperback 288 pages,1982, Hodder Arnold, ISBN 9780713134162. 2. Gershberg, M.A. :**Geodesy**, Moscow 1967.	

MSE 15	**Ecology and Environment Protection**	Prof. Dr. Eng.
Contents and Qualification aims	The module deals with understanding the actual environmental and water problems within drinking water, water resources and waste water. The module give the students the ability to evaluate and choose the best solution to protect the drinking and waste water nets and treatment station. In other hand the students can evaluate the quality of water resources using the possible and suitable equipment's based on analytical and structural thinking. In addition to provide students with practical steps and methodology to determine the environmental effects of direct and indirect project proposals, analyze, evaluate and prepare a report assessing the environmental impact of projects. The students' knowledge will be developed during the necessary laboratory experiments and practical computer training and use some advanced software to give the students enough knowledge and ability in this fields.	
Module Character	Ecology and water resources Protection: 4 Hours of lectures per week, 2 hour of tutorial and Laboratory experiments per week.	
Prerequisite of attendance	Basic Knowledge of Ecology and Environment Protection is Advanced Hydraulics, Advanced of Water Chemistry, Environment Impacts Assessment, Water Supply and Waste Water Networks Advanced.	
Applicability	The module is one of 6 elective modules of the Master course sanitary engineering. the module is suitable for the professional and research oriented studies in civil and environmental engineering	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one terms starting in Semester 2 or 3.	
Proposal references	1. Pratibha Singh, PiyushMalaviya and Anup Singh: Text book of Environment and Ecology,, A learning Pvt Ltd, New Delhi. 2. Wang Jianlong: Technologies for Water Pollution Control, Point Sources of Pollution: Local Effects and its Control – Vol. I Tsinghua University, Beijing, 100084, Poeples Republic of China. • 3. Helmut Meuser: Soil Remediation and Rehabilitation, Environmental Pollution Volume 23, 2013, Springer Link, ISBN: 978-94-007-5750-9 (Print) 978-94-007-5751-6 (Online). 4. Richard Helmer and IvanildoHespanho: Water Pollution Control - A Guide to the Use of Water Quality Management Principles, 1997, 526 pages. ISBN 0419229108, published on behalf of WHO by F & FNSpon 11 New Fetter Lane London EC4) 4E.	

MSE 16	**Maintenance and Rehabilitation of environmental structures**	Prof. Dr. Eng.
Contents and Qualification aims	The module introduce the management the working of environmental Structures and its exploitation, execute technical measurements and the required calibration of working of environmental Structures and its exploitation, measurements apparatus and observation of environmental structures phenomena, required maintenance working for environmental projects and structures according its component. Management of environmental structures, execute several programme of environmental structures projects and manage and exploit it. The students' will be developed during tutorials and practical computer training.	
Module Character	Maintenance and Rehabilitation of environmental structures: 4 Hours of lectures per week, 2 hour of tutorial and Laboratory and experiments per week.	
Prerequisite of attendance	Basic knowledge of Maintenance and Rehabilitation of environmental structures is Advanced Hydraulics, Advanced of Water Chemistry, Environment Impacts Assessment, Water Supply and Waste Water Networks Advanced.	
Applicability	The module is one of 6 elective modules of the master course of sanitary engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 3.	
Proposal references	1. Peter H. Emmons; Gajanan M. Sabnis: **Concrete Repair and Maintenance**, Galgotia Publication. 2. George Somerville: **Management of Deteriorating Concrete Structures**:, Taylor and Francis Publication. 3. Glenn Smock: **Guide to Concrete Repair**. US Department of the Interior Bureau of Reclamation, Technical Service. 4. John H. Bungrey; Stephen G. Millard and Michael G. Grantham: **Testing of Concrete in Structures**, Taylor & Francis Publication. 5. **Durability of Concrete and Cement composites**: C.L. Page & M.M. Page. Woodhead Publishing. 6. I. Hassan: **Irrigation Networks**, 2011, Tishreen University.	

MSE 17	**Municipal and Industrial Water Management**	Dr. eng.
Contents and Qualification aims	The module introduces student's methods of water supply for industrial structures and methods of waste water treatment resultant from this structures. this main the student must know resources, properties and quantity required for Municipal and industrial water supply, methods of water treatment required for using in industry, resources, properties and quantity of industrial waste water. Industrial waste water treatment (simple, chemical, physical-chemical, air- biological industry waste water, no air biological treatment, advanced treatment of industrial waste water and reuse the treated water; riddance of the sediments resultant from this treatment, the students must able to design technological planning for treatment station of waste water of some industries. The students' must know how calculate the costs of the construction and the time plan. The students' knowledge will be developed during tutorials and gives the students enough knowledge and ability in these fields.	
Module Character	Municipal and Industrial Water Management: 4 Hours of lectures per week, 2 hour of tutorial and Laboratory and experiments per week.	
Prerequisite of attendance	Basic Knowledge of Municipal and Industrial Water Management is Advanced Hydraulics, Advanced of Water Chemistry, Environment Impacts Assessment, Water Supply and Waste Water Networks Advanced.	
Applicability	The module is one of 6 Elective Modules of the Master Course Sanitary Engineering. the module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one terms starting in one Semester 2 or 3..	
Proposal references	1. W W Eckenfelder Jr.: **Industrial Water Pollution Control**, McGraw Hill. 2. E F Gurnham: **Industrial Water Management**, John Wiley.	

MSE 18	**Integrated Water Resources Management**	Prof. Dr. Eng.
Contents and Qualification aims	The module introduce the conditions of water Exploitation as sufficient water storage, required quantity, influence of climate change on water resources, integrated planning of water resources exploitation using suitable software as WEAP, several using of water (as drinking water, irrigation, industry, tourism, environment flow, flood protection, river transport). The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and use some advanced software to give the students enough knowledge and ability in these fields.	
Module Character	Integrated Water Resources Management: 4 Hours of lectures per week, 2 hour of tutorial and laboratory and experiments per week.	
Prerequisite of attendance	Basic knowledge of Integrated Water Resources Management is Advanced Hydraulics, Advanced of Water Chemistry, Environment Impacts Assessment, Water Supply and Waste Water Networks Advanced.	
Applicability	The module is one of 6 elective modules of the Master Course Sanitary Engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one terms starting in one Semester 2 or 3.	
Proposal references	1. Hiscock K.M.; Rivett M.O.; Davison R.M.: **Sustainable Groundwater Development**., 2002. Published by The Geological Society London. ISBN 1-86239-097-5. 2. William M. Alley; Thomas E. Reilly ;Franke O. Lehn: **Sustainability of Ground-Water Resources**, 1999, U.S. Government Printing Office, ISBN 0–607–93040–3. 3. Giupponi, C., Karssenberg D. A. J., and P. H. Matt P. Hare: **Sustainable Management of Water Resources**: An Integrated Approach.Edward Elgar Publishing, 2006. 4. Douglass Shaw W.: **Water Resource Economics and Policy An Introduction**. 2005, ISBN 1 84376 917 4 (cased). 5. **Resources of the World and their Use**, 2004. © UNESCO. ISBN 92-9220-007-0. 6. Warren Viessman Jr. and Timothy D. Feather: **Water Resources Planning in the United State,** American Society of Civil Engineers, Reston, VA, 2006.. 7. Loucks, D. P. and E. van Beek: **Water Resources Systems Planning and Management:** An Introduction to Methods, Models and Applications. UNESCO Publishing. 2005.	

MSE 19	**Advanced Water Tanks**	**Prof. Dr.**
Contents and Qualification aims	The module introduces the main principles of water tanks design, the constructive basics in the design of the holding elements in these tanks, design of the circular tanks, design of rectangular tanks and high tanks. Analysis and distribution of forces in the holding framework, analysis and design of circular slabs, analysis and design of circular beams, analysis and design of scurfy. The students' will be developed during tutorials and practical computer training.	
Module Character	Water Tanks: 4 Hours of lectures per week, 2 hour of tutorial and laboratory and experiments per week.	
Prerequisite of attendance	Basic Knowledge of Water Tanks is Geotechnical Engineering of Sanitary Structures and Sanitary structures.	
Applicability	The module is one of 6 Elective Modules of the Master Course Sanitary Engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one terms starting in Semester 2 or 3.	
Proposal references	1. Nibedita Sahoo: **Design of Water Tank**, DEPARTMENT OF CIVIL ENGINEERING NATIONAL INSTITUTE OF TECHNOLOGY ROURKELA MAY 2008. 2. **IITK- GSDMA GUIDELINES for SEISMIC DESIGN OF LIQUIDS STORAGE TANKS, Provisions with Commentary**, Indian Institute of Technology Kanpur Kanpur, 2007. 3. **DESIGN RECOMMENDATION FOR STORAGE TANKS AND THEIR SUPPORTS WITH EMPHASIS ON SEISMIC DESIGN**, 2010, ARCHITECTURAL INSTITUTE OF JAPAN.	
From these modules students must select one module for each of the 2nd and 3rd Semester.		

General Qualification		
Module Number	**Module Name**	**Prof. in Charge**
MWS 20	**Water Rights and Conflict Resoluti-on**	Dr.Eng.
Contents and Qualification aims	The module introduce the laws and legislation of water using and environment in Syria, Arab country and in the world. The changes of water necessity in Syria; The conflict reasons rela-ted to water demand in the MENA area; The national and international water rights; water resources as a factor for im-provement international relationship. The students' will be developed during seminars and repre-sentation.	
Module Character	Rights and Water Legislations: 4 Hours of lectures per week, 2 hour of tutorial per week.	
Prerequisite of attendance	Basic knowledge of Water Rights and Conflict Resolution is not necessary.	
Applicability	The module is the single mandatory general qualification of the Master course Sanitary Engineering. The module is suitable for the professional oriented studies in civil and environmental engi-neering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes).	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 3.	
Proposal references	1. **Water Rights in Montana**, Montana University System Water Center, April 2012. 2. Stephen Hodgson: **Modern Water Rights Theory and Prac-tice,** FAO Legislative Study.	

Practical Training/ Project Study		
Module Number	**Module Name**	**Prof. in Charge**
MWS 21	**Practical Training/ Project Study**	**Not definite**
Contents and Qualification aims	The Student must carry out practical training about one Problem belongs to subjects of the Master course of Sanitary Engineering in one or more institution or incorporation, and he must present full study about this problem.	
Module Character	Practical Training/ Project Study: 10 Hours tutorial per week	
Prerequisite of attendance	Basic Knowledge of Practical Training/ Project Study, the student must be in the 3rd Semester.	
Applicability	the module is suitable for the professional and research oriented studies in civil and environmental engineering	
Prerequisite to active credit points	Having passed the module seminar and presentation before a commission.	
Accredit points and grades	The module earns 10 Cr. The final Grade is generated with 100% as presentation in front of committee.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 300 hours.	
Duration of the module	The module takes one term starting in Semester 3.	
Proposal references	1. **Old Master, Bachelor thesis** and **Practical Training** reports which are available in the Libraries of the University. 2. James E. Mauch and Namgi Park: **Guide to the Successful Thesis and Dissertation, A Handbook for Students and Faculty**. 2003. 5th ed. Copyright ©2003 by Marcel Dekker. ISBN: 0-8247-4288-5.	

Master Thesis with Defense		
Module Number	**Module Name**	**Prof. in Charge**
MWS 22	**Master Thesis with Defense**	**Not definite**
Contents and Qualification aims	The Student must work Master Thesis with Defense about one Problem belongs to the subjects of the Master course of Sanitary Engineering in one or more institution or incorporation, and he must present full study about this problem.	
Module Character	Master Thesis with Defense: 30 Hours tutorial per week.	
Prerequisite of attendance	Basic Knowledge of Master Thesis with Defense, the student must be in 6 Semester.	
Applicability	the module is suitable for the professional and research oriented studies in civil and environmental engineering	
Prerequisite to active credit points	Having passed the module presentation before a commission.	
Accredit points and grades	The module earns 30 Cr. The final Grade is generated with 100% as presentation in front of committee.	
Frequency of the module	The module is offered in 4. semester	
Worked load	The work load is 900 hours.	
Duration of the module	The module takes one term starting in Semester 4.	
Proposal references	1. James E. Mauch and Namgi Park: **Guide to the Successful Thesis and Dissertation, A Handbook for Students and Faculty**. 2003. 5th ed. Copyright ©2003 by Marcel Dekker. ISBN: 0-8247-4288-5. 2. Derek Swetnam: **Writing Your Dissertation, How to plan, prepare and present successful work**.2007, 3rd ed. ISBN: 978 1 84803 126 5. 3. Louis Cohen; Lawrence Manion and Keith Morrison: **Research Methods in Education**, 2005, 5th ed. ISBN 0-203-22434-5 Master e-book ISBN. 4. **Old Master and Bachelor thesis**, which are available in the Libraries of the University.	

5- Training Course of Master Sanitary Engineering

1- Training course: Water supply networks

The course has been put to engineers working in field sanitary engineering, water structures and water resources management. The goal of course is giving the absolvent the experience in field Water supply networks.

Course contents:

- Required database to design of Water supply networks;
- Layout of water distribution networks;
- Structures of tanking of drinking water;
- Pumping stations of drinking water;
- Hydraulically design of distribution of drinking water;
- Principles and Structures of drinking water purification.
- Application some Computing programs and software in field Water purification and supply networks.

2- Training course: Wastewater treatment and networks

The course has been put to engineers working in field sanitary engineering, water structures and water resources management. The goal of course is giving the absolvent the experience in field wastewater treatment and networks.

Course contents:

- Resources of wastewater;
- Unsteady behavior of wastewater;
- Hydraulical design of wastewater networks;
- Layout of collection networks of wastewater;
- Structures of tanking of wastewater;
- Pumping stations of wastewater;
- Principles and Structures of wastewater treatment;
- Application some Computing programs and software in field wastewater treatment and collection networks.

3- Training course: Study of Environmental Impact Assessment

The course has been put to engineers working in field sanitary engineering, water structures , water resources management and in general engineering works. The goal of course is giving the absolvent the experience in field Environmental Impact Assessment

Course contents:

- Introduction to Environmental Impact Assessment;
- Standard Elements of an Environmental Impact Assessment;
- Overview of Environmental Impact Assessment Tools;
- Environmental Impacts and Mitigation Measures to Be Considered in an EIA Process;
- Guidance on Possible Mitigation;
- Case Studies.

Quality Management

Sanitary Engineering (MSE)

Master Programme

Tishreen University Lattakia

Department of Water Engineering and Irrigation
Faculty of Civil Engineering

2015

EDUWAT: 511251-TEMPUS-1-2010-1-DE-TEMPUS-SMHES
Development of a Modern Higher Education System for Water Engineering in Syria

Developed by
Prof. Dr. Eng. Izzeddin Hassan
Prof. Dr. Eng. Camille Bouras
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Quality management and accreditation

University: Tishreen University
Faculty: Faculty of Civil Engineering

2- Specification of the programme

2-1- Basics Data

- **Programme name (MWS): Master Course of Sanitary Engineering**
- **Type of the programme**: single include one specific.

- **Name of the participated Programmes**: (none).
- **Length of Programme (time):** 4 Semester
- **Qualification (Certificate), which the Student get at End of the programme:** Master of Science (specialist of **Sanitary Engineering).**
- **Language or the used Language in the Programme:** Arabic is the main language. English Language is used to explain the scientific terms.
- **Place of programme application**: University Campus, Building of Faculty of Civil Engineering.
- **External Check Person**:
- **Date the latest acceptance of Specification of the programme**:

3-3- Professional Dates

1-2-1- Message and Goal of the programme

- **Notification of Message and Goal of the programme:**

The Department Water Engineering and Irrigation and Department of Environment Engineering in the Faculty of Civil Engineering in the Tishreen University undertake the preparation an excellent absolvent in the fields of Sanitary Engineering, qualified to continue his qualification and his professional development, able to compete and cover the need of the labour market in these Engineering fields. In addition to, the both Departments give a very good study and research plan aims to develop the scientific research and participation in professional and research projects.

Which contribute in supporting and covering the needs of development plans of the country, during the cooperation with the related scientific, research and service sides.

- **Goals of the programme**

The academic plan in the Master course of sanitary engineering programme, aims at providing the students the following items:

29. High level information in science and computer techniques, and developing the skills in engineering sciences and its applications.
30. Developing the ability of the students to achieve various sanitary engineering studies check and use it according to the engineering codes.
31. Comparing between the sanitary engineering solutions, and choose the optimum ones.
32. Developing the works skills and regulate the relationship between the work team which the best and have many specialists.
33. Strengthening the research ability, developing and working with the modest software's, equipments etc.
34. Developing the item of the scientific, social and cultural of the students characters.
35. Continuous developing to get the high quality of the research, teaching…...etc.

1-2-2- Programme Composition and its Contents

a) **Admission condition in the programme**

a) Admission condition in the Programme: the admission will be done through the competition among the students, who have Bachelor in Fields: Environmental Engineering, sanitary engineering, Civil Engineering, Water Engineering, Water Engineering and Irrigation.

b) The conditions of success in the Programme:
Presence of theoretical, tutorial, and laboratory Lectures and present the required projects and scientific and laboratories reports.

c) Success from year to year: Success in all Modules in in 1st and 2nd Semester each studying year.

d) **Completion of programme:**

Condition of accomplish of studying years	
1st year	Success in modules of 1st and 2nd semesters, the student can hold max. 2 Modules.
2nd year	- Success in modules of 3rd semesters, the student can hold max. 2 Modules from all foregone semesters - Success in modules of foregone semesters and Defense of Master Thesis in front of the commission.

e) Conditions of the completion of the Programme:

- Brief description of the kind of Practical Training/ Project Study:

The Student must carry out practical training about one Problem related to the subjects of sanitary engineering in one or more institution or incorporation, and he must present full study about this problem.

- **In which phase or phases of the programme this Practical Training/ Project Study is carried out :** This Study or Project must be carried out in the 3rd semester.
- **Number of Credit / or semesters for this Practical Training/ Project Study**: Offered in 3 rd semester with 10 cr. per week.
- **Description of evaluation procedures:** the evaluation should be done by a commission, which formed by the delegacy of faculty of civil engineering, the student must pass the module seminar and presentation in front of the commission.

- **Brief description of the kind of Master Thesis**

  The Student must carry out Master Thesis with Defense about one Problem relate to the subjects of sanitary engineering in the 4th semester, and he must present full study about this problem in front of the commission.
- **In which phase from the programme the Master Thesis with Defense should be carried out:** This Master Thesis must be carried out in the 4th semester.
- **Number of Credit / or semesters for this Masster Thesis with Defense:** Offered in 4th semester with 30 cr. per week.
- **Description of evaluation procedures:** the evaluation should be done by a commission, which formed by the delegacy of the faculty of civil engineering, the student must pass the module and presentation in front of the commission.

1-3- The Programme description:

The programme of Master course sanitary engineering based on theoretical lectures, laboratory meeting, and Seminars scientific excursion approved in the study plan.

- Brief description of praxis experiences activity:

∗ Practical Project with report in Drinking water purification and related Structures and networks projects;

∗ Practical Project with report in wastewater treatment and related Structures and networks projects;

∗ Practical Project with report in Pumping Stations Projects;

* Scientific excursion to Water engineering projects.

- In which phase or phases of programmes the field experience should be introduce:

* Summer training in Drinking water purification and networks projects in 3rd Semester;
* Summer training in waste Water treatment and networks projects; in 3rd Semester;
* Summer training in Pumping Stations Projects in 3rd Semester;
* Scientific excursion to Water engineering projects in 1,2,3 Semester.

4- Modules of Master course of sanitary engineering
Faculty of Civil Engineering - Tishreen University (TIU)

		Actual		Goal	
Nr of Module and symbol		Credits	%	Credits	%
	Modules in Mathematics and Natural Sciences	15	13%	12	10%
	Modules in Engineering	10	8%	18	15%
	Modules in Hydro Sciences	10	8%		
	Modules with Specialization	30	25%	42	35%
	Elective Modules	10	8%		
	Modules for general Qualification	5	4%	6	5%
	Practical Training /Project	10	8%	12	10%
	Master Thesis plus Defense	30	25%	30	25%
	Total	**120**	**100%**	**120**	**100%**

	Module Semester	**1**	**2**	**3**	**4**	**Total/ECTS**
	Mathematics and Natural Sciences	10	5			**15**
	Engineering	5	5			**10**
	Hydro Sciences	10				**10**
	Specialization	5	15	10		**30**
	Elective Modules		5	5		**10**
	General Qualification			5		**5**
	Practical Training/ Project Study			10		**10**
	Master Thesis plus Defense				30	**30**
	Total	**30**	**30**	**30**	**30**	**120**

	Course Semester	**1**	**2**	**3**	**4**	**Total/ECTS**
	Mathematics and Natural Sciences	**10**	**5**			**15**
MSE 1	Advanced Mathematics	5				**5**
MSE 2	Mathematical and physical Modeling	5				**5**
MSE 3	Methods of scientific research		5			**5**
	Engineering	5	5			**10**
MSE 4	Water Supply and Waste Water treatment		5			**5**
MSE 5	Geotechnical Engineering of Sanitary Structures	5				**5**
	Hydro Sciences	**10**				**10**
MSE 6	Advanced Hydraulics	5				**5**
MSE 7	Advanced Water Chemistry	5				**5**

	Specialization	**5**	**15**	**10**		**30**
MSE 8	Solid Waste Management and Contamination Treatment		5			**5**
MSE 9	Environment Impacts Assessment		5			**5**
MSE 10	Water Supply and Waste Water Networks Advanced	5				**5**
MSE 11	Pumping stations Advanced			5		**5**
MSE 12	Sanitary Engineering Structures		5			
MSE 13	Technology of Environmental Structures			5		**5**
	Elective Modules		**5**	**5**		**10**
MSE 14	Advanced Geodesy		**+**	**+**		**5**
MSE 15	Ecology and Environment Protection		**+**	**+**		**5**
MSE 16	Maintenance and Rehabilitation of Environmental Structures		**+**	**+**		**5**
MSE 17	Municipal and Industrial Water Management		**+**	**+**		**5**
MSE 18	Integrated Water Resources Management		**+**	**+**		**5**
MSE 19	Advanced Water Tanks		**+**	**+**		
	From these Courses students must select one module for each of the 2nd and 3rd Semester					
	General Qualification			**5**		**5**
MSE 20	Water Rights and Conflict Resolution			**5**		**5**
MSE 21	**Practical Training/Project study**			**10**		**10**
MSE 22	**Master Thesis plus Defense**				30	**30**
	Total	**30**	**30**	**30**	**30**	**120**
	Goal	**30**	**30**	**30**	**30**	**120**

3- Study Plan of Master course of sanitary engineering Faculty of Civil Engineering - Tishreen University (TIU)

Nr of Module and symbol	Courses	S. 1	S. 2	S. 3	S. 4	Total/ECTS
	Modules in Mathematics and Natural Sciences					
MSE 1	Advanced Mathematics	3/2/0/2				5
MSE 2	Mathematical and physical Modeling	3/2/0/2				5
MSE 3	Methods of scientific research		3/2/0/2			5
	Engineering					
MSE 4	Water Supply and Waste Water treatment		3/2/0/2			5
MSE 5	Geotechnical Engineering of Sanitary Structures	3/2/2/0				
	Hydro Sciences					
MSE 6	Advanced Hydraulics	3/2/0/2				5
MSE 7	Advanced Water Chemistry	3/2/2/0				5
	Specialization					
MSE8	Solid Waste Management and Contamination Treatment		3/2/2/0			5
MSE 9	Environment Impacts Assessment		3/2/2/0			5
MSE 10	Water Supply and Waste Water Networks Advanced	3/2/2/0				5
MSE 11	Pumping stations Advanced			3/2/2/0		5
MSE 12	Sanitary Engineering Structures		3/2/2/0			5
MSE 13	Technology of Environmental Structures			3/2/2/0		5
	Elective Modules					
MSE 14	Advanced Geodesy		3/2/2/0	3/2/2/0		5
MSE 15	Ecology and Environment Protection		+	+		5
MSE 16	Maintenance and Rehabilitation of Environmental Structures		+	+		5
MSE 17	Municipal and Industrial Water Management		+	+		5
MSE 18	Integrated Water Resources Management		+	+		5
MSE 19	Advanced Water Tanks		+	+		5

	From these Courses students must select one course in each Semester 3 and 4					
	General Qualification					
MSE 20	Water Rights and Conflict Resolution			3/2/2/0		**5**
	Practical Training/ Project Study					
MSE 21	Practical Training/ Project Study			**10**		**10**
	Master Thesis with Defense					
MSE 22	**Master Thesis with Defense**				**30**	**30**
	Total	**30**	**30**	**30**	**30**	**120**

Lecture/Tutorial/Laboratory/Excursion (homework's)

A: Knowledge and Understanding

a1: Advanced Mathematic with practical applications, differential and Integral equations, Statistics methods, numerical mathematics. Mathematical and physical Modeling several Engineering subjects of sanitary engineering and their application and Execution. Methods of scientific research. Tidy development his methods of scientific thought to continue his scientific studying and his professional works as civil engineer in field Sanitary Engineering and Environmental Engineering.

a2: Engineering Principles in field of sanitary engineering and Environment.

a3: Engineering Principles in field of sanitary engineering: Drinking water purification and related Structures and networks, waste Water treatment and related Structures and networks, Pumping Stations and related Structures, Maintenance and Rehabilitation of these Structures, Municipal and Industrial Water Management, Solid Waste Management and Contamination Treatment, Environment Impacts Assessment, Integrated Water Resources Management and Protection and Conservation of sustainability of Water resources. Mathematical Modeling of several sanitary_engineering Structures. Ability of application these Engineering Principles and development them.

a4: Knowledge related to Informatics and exploitation of Computing programs in Practical Projects , in Master Thesis , sanitary engineering Structures and to solve several Engineering problems in these fields and show the innovation ability.

a5: Principles of sustainable environmental Engineering of water resources, Drinking water purification, waste Water treatment, Pumping Stations, Municipal and Industrial Water Management, Solid Waste Management and Contamination Treatment, Environment Impacts Assessment, Integrated Water Resources Management and Maintenance and Rehabilitation of these Structures, and principles of beautiful Nature in design.

a6: Knowledge related to technologies of execution methods of engineering contracts and projects taking into consideration of economical Social and environmental input data.

a7: Ethics of exercises of professional and scientific work and their social and environmental reflections.

a8: Supply the graduate with required knowledge and understanding in accreditation principles and required common health and safety and other environmental subjects

a9: Supply the graduate with required knowledge in exercises of related professional systems and their criterions, cods, laws and legislation, especially Legislation of Water and Environment and stick to them.
a10: Supply the graduate with required ability knowledge to conflate the knowledge of civil engineering with all different fields, and execute an integral engineering project.
a11: Supply the graduate with related required scientific and practical strange terms.

ARS(Academic Reference Standard)

	ARS(Academic Reference Standard)											
Nr of Module and symbol	Module Name	National Academic Reference Standard NARS										Additional Standards
		a_1	a_2	a_4	a_5	a_6	a_7	a_8	a_9	a_{10}	a_{11}	a_3
	Modules in Mathematics and Natural Sciences											
MSE 1	Advanced Mathematics	+		+						+	+	
MSE 2	Mathematical and physical Modeling	+		+						+	+	+
MSE 3	Methods of scientific research	+		+			+			+	+	
	Engineering											
MSE 4	Water Supply and Waste Water treatment	+	+		+	+				+	+	+
MSE 5	Geotechnical Engineering of Sanitary Structures	+	+		+	+				+	+	+
	Hydro Sciences											
MSE 6	Advanced Hydraulics			+	+					+	+	
MSE 7	Advanced Water Chemistry									+	+	
	Specialization											
MSE 8	Solid Waste Management and Contamination Treatment		+		+	+				+	+	+
MSE 9	Environment Impacts Assessment		+		+	+	+	+	+	+	+	+
MSE 10	Water Supply and Waste Water Networks Advanced		+		+	+				+	+	+
MSE 11	Pumping stations Advanced		+		+	+				+	+	+
MSE 12	Sanitary Engineering Structures		+		+	+				+	+	+
MSE 13	Technology of Environmental Structures		+		+	+		+	+	+	+	+
	Elective Modules											
MSE 14	Advanced Geodesy		+	+	+					+	+	+
MSE 15	Ecology and Environment Protection		+	+		+			+	+	+	+
MSE 16	Maintenance and Rehabilitation of Environmental Structures		+		+	+	+	+	+	+	+	+
MSE 17	Municipal and Industrial Water Management		+		+	+				+	+	+
MSE 18	Integrated Water Resources Management		+		+	+	+	+	+	+	+	+

MSE 19	Advanced Water Tanks		+	+	+		+			+	+	+
	From these Courses students must select one course in each Semester 2 and 3											
	General Qualification											
MSE 20	Water Rights and Conflict Resolution					+	+	+	+	+	+	+
	Practical Training/ Project Study											
MSE 21	Practical Training/ Project Study		+	+	+	+	+	+	+	+	+	+
	Master Thesis with Defense											
MSE 22	**Master Thesis with Defense**		+	+	+	+	+	+	+	+	+	+

B- Intellectual Abilities

b_1**:** Evaluation and choosing the suitable methods to solve the problems in field Sanitary Engineering and make optimum solution to design different civil engineering in these Fields using suitable tools based on analytical and structural thought.

b_2: Evaluation and choosing the optimum planning of different Sanitary Engineering and using suitable tools based on analytical thought.

b_3: Evaluation and choosing the optimum solution for design of drinking water purification and related networks and their related structures, in addition to the required pumping Stations using suitable tools based on analytical thought.

b_4**:** Evaluation and choosing the optimum solution for design of wastewater treatment structures, and related networks using suitable tools based on analytical thought.

b_5: Evaluation and choosing the optimum solution for water resources management and development using suitable tools and software based on analytical thought.

b6: Implementation the acquired knowledge and the engineering principles to connect research, design and environment to protect and develop the water resources and the nature.

b7: Integral application and connection the engineering knowledge and understanding the other engineering competences requirements, to get innovative engineering solutions.

b8: Offering the engineering solutions of civil engineering problems especially Sanitary Engineering and networks ,related Structures and water resources management and development based on finite resources and incongruent information.

b9: Analysis of engineering systems and their components and evaluating their consequences.

b10: Self-learning for dealing with modern innovative problems of civil engineering, especially Sanitary Engineering and networks ,related Structures and water resources management and development and technical new software.

b11: Abilities to introduce the engineering solution of several problems of Sanitary Engineering and Water resources management and development based on international scientific references and journals and other resources.

ARS(Academic Reference Standard)

	ARS(Academic Reference Standard)											
Nr of Module and symbol	Module Name	National Academic Reference Standard NARS								Additional Standards		
		b1	**b5**	**b6**	**b7**	**b8**	**b9**	**b10**	**b11**	**b2**	**b3**	**b4**
	Modules in Mathematics and Natural Sciences											
MSE 1	Advanced Mathematics	+	+	+	+	+		+	+	+		
MSE 2	Mathematical and physical Modeling	+	+	+	+	+	+	+	+	+		
MSE 3	Methods of scientific research	+	+	+	+	+	+	+	+	+		
	Engineering											
MSE 4	Water Supply and Waste Water treatment	+			+			+	+	+	+	+
MSE 5	Geotechnical Engineering of Sanitary Structures	+			+			+	+	+	+	+
	Hydro Sciences											
MSE 6	Advanced Hydraulics	+			+	+	+	+	+	+	+	+
MSE 7	Advanced Water Chemistry	+			+	+	+	+	+	+	+	+
	Specialization											
MSE 8	Solid Waste Management and Contamination Treatment	+			+	+		+	+	+		+
MSE 9	Environment Impacts Assessment	+			+	+		+	+	+		+
MSE 10	Water Supply and Waste Water Networks Advanced	+			+	+		+	+	+	+	+
MSE 11	Pumping stations Advanced	+			+	+		+	+	+	+	+
MSE 12	Sanitary Engineering Structures	+			+	+	+	+	+	+	+	+
MSE 13	Technology of Environmental Structures	+	+	+	+	+		+	+	+	+	+
	Elective Modules											
MSE 14	Advanced Geodesy	+			+	+		+	+	+		
MSE 15	Ecology and Environment Protection	+	+	+	+	+		+	+	+	+	+
MSE 16	Maintenance and Rehabilitation of Environmental Structures	+			+	+	+	+	+	+	+	+
MSE 17	Municipal and Industrial Water Ma-	+	+	+	+	+	+	+	+	+	+	+

	nagement											
MSE 18	Integrated Water Resources Mana-gement	+	+	+	+	+		+	+	+	+	+
MSE 19	Advanced Water Tanks	+	+		+	+	+	+	+	+	+	+
	From these modules students must select one module in each Semester 2 and 3											
	General Qualification											
MSE 20	Water Rights and Conflict Resolution	+	+	+	+	+	+	+	+	+	+	+
	Practical Training/ Project Study											
MSE 21	Practical Training/ Project Study	+	+	+	+	+	+	+	+	+	+	+
	Master Thesis with Defense											
MSE 22	**Master Thesis with Defense**	+	+	+	+	+	+	+	+	+	+	+

C- Professional and Practical Skills

C_1: The development of Ability of obligation and restraint of the Professional systems Basics,

C_2: Ability to work within team and regulating, moving and leading the collective team.

C_3: Ability to appoint the practical application of mathematical laws in other engineering modules, and enter them in continuing professional development.

C_4: Ability to expect hazards and develop, apply and improve the systems to manage and avoid them.

C_5: Ability to execute several engineering structures study in fields sanitary engineering as Drinking water purification and related Structures and networks, waste Water treatment and related Structures and networks, Pumping Stations and related Structures, Maintenance and Rehabilitation of these Structures, Municipal and Industrial Water Management, Integrated Water Resources Management and Protection and Conservation of sustainability of Water resources taking into consideration the economical social and environmental output.

C_6: Ability to evaluate the geological cartography and execute different geological, hydrological and hydrogeological studies to establish several sanitary engineering Projects taking into consideration their impact on the other engineering studies and the economical social and environmental output.

C_7: Ability to study and design Solid Waste Management and Contamination Treatment and Environment Impacts Assessment taking into consideration the economical social and environmental output.

C_8: Ability to execute profitable studies and make financial and time programs of engineering projects. In addition to preparing and executing work plan to achieve the goals of corporation.

C9: Ability to appoint tools, software programs and different field engineering devices with obligation of professional safety basics.

C10: Ability to use and appoint measurement devices, and execute related laboratory and fields experiments and analyzing the results.

ARS(Academic reference Standard)

Nr of Module and symbol	**ARS**(Academic Reference Standard)										
	Module Name	National Academic Reference Standard NARS							Additional Standards		
		C_1	C_2	C_3	C_4	C_8	C_9	C_{10}	C5	C6	C_7
	Modules in Mathematics and Natural Sciences										
MSE 1	Advanced Mathematics			+	+	+		+	+		
MSE 2	Mathematical and physical Modeling			+	+	+	+	+	+	+	
MSE 3	Methods of scientific research	+	+	+	+	+	+	+	+		
	Engineering										
MSE 4	Water Supply and Waste Water treatment		+		+			+	+		
MSE 5	Geotechnical Engineering of Sanitary Structures		+		+			+	+		
	Hydro Sciences										
MSE 6	Advanced Hydraulics				+	+	+	+	+		
MSE 7	Advanced Water Chemistry				+	+	+	+	+	+	+
	Specialization										
MSE 8	Solid Waste Management and Contamination Treatment		+		+			+	+	+	+
MSE 9	Environment Impacts Assessment		+		+			+	+		+
MSE 10	Water Supply and Waste Water Networks Advanced		+		+			+	+	+	
MSE 11	Pumping stations Advanced		+		+	+		+	+	+	
MSE 12	Sanitary Engineering Structures		+		+	+	+	+	+	+	
MSE 13	Technology of Environmental Structures	+	+		+	+		+	+	+	
	Elective Modules										
MSE 14	Advanced Geodesy		+		+			+	+		
MSE 15	Ecology and Environment Protection		+		+			+	+		+
MSE 16	Maintenance and Rehabilitation of Environmental Structures	+	+		+	+	+	+	+	+	
MSE 17	Municipal and Industrial Water Management		+	+	+	+	+	+	+	+	+
MSE	Integrated Water		+	+	+	+	+	+	+		+

18	Resources Management										
MSE 19	Advanced Water Tanks		+		+		+	+	+	+	+
	From these Courses students must select one course in each Semester 2 and 3										
	General Qualification										
MSE 20	Water Rights and Conflict Resolution	+	+	+	+	+	+	+	+	+	+
	Practical Training/ Project Study										
MSE 21	Practical Training/ Project Study	+	+	+	+	+	+	+	+	+	+
	Master Thesis with Defense										
MSE 22	**Master Thesis with Defense**	+	+	+	+	+	+	+	+	+	+

d- General Transferable Skills

D1: Ability to work actively within team with several specializations.

D2: Ability to show active and personal skills in different work environments.

D3: Ability to develop self-learning and follow a continuing learning processes.

D4: Ability to work within hard business work environment to achieve the required businesses in time and in different limits.

D5: Ability to manage tasks and resources in active serious form.

D6: Ability to follow and use advanced technologies and software programs in field of civil engineering especially sanitary engineering and environmental engineering.

D7: Ability to acquire skills of Projects management.

D8: Ability to expose the designs and proposals and writing the scientific reports.

D9: Ability to realize a relationship and discussion with other sides.

D10: Possession of skills of required strange languages to carry out the profession and follow-up the epistemic development.

ARS(Academic Reference Standard)

	ARS(Academic Reference Standard)										
Nr of Module and symbol	Module Name	National Academic Reference Standard NARS									Additional Standards
		D_1	**D_2**	**D_3**	**D_4**	**D_5**	**D_6**	**D_8**	**D9**	**D10**	**D_7**
	Modules in Mathematics and Natural Sciences										
MSE 1	Advanced Mathematics	+		+		+	+		+	+	+
MSE 2	Mathematical and physical Modeling	+		+		+	+		+	+	+
MSE 3	Methods of scientific research	+		+		+	+	+	+	+	+
	Engineering										
MSE 4	Water Supply and Waste Water treatment	+	+	+	+				+	+	+
MSE 5	Geotechnical Engineering of Sanitary Structures	+	+	+	+				+	+	+
	Hydro Sciences										
MSE 6	Advanced Hydraulics			+		+	+		+	+	+
MSE 7	Advanced Water Chemistry			+		+	+		+	+	+
	Specialization										
MSE 8	Solid Waste Management and Contamination Treatment	+	+	+	+	+			+	+	+
MSE 9	Environment Impacts Assessment	+	+	+	+	+			+	+	+
MSE 10	Water Supply and Waste Water Networks Advanced	+	+	+	+		+		+	+	+
MSE 11	Pumping stations Advanced	+	+	+	+		+		+	+	+
MSE 12	Sanitary Engineering Structures	+	+	+	+	+	+		+	+	+
MSE 13	Technology of Environmental Structures	+	+	+	+		+		+	+	+
	Elective Modules										
MSE 14	Advanced Geodesy	+	+	+	+		+		+	+	+
MSE 15	Ecology and Environment Protection		+	+	+	+			+	+	+
MSE 16	Maintenance and Rehabilitation of Environmental Structures	+	+	+	+		+		+	+	+
MSE 17	Municipal and Industrial Water Management	+	+	+	+	+	+		+	+	+
MSE 18	Integrated Water	+	+	+	+	+	+		+	+	+

	Resources Management										
MSE 19	Advanced Water Tanks	+		+			+		+	+	+
	From these Courses students must select one course in each Semester 2 and 3										
	General Qualification										
MSE 20	Water Rights and Conflict Resolution	+	+	+	+	+	+	+	+	+	+
	Practical Training/ Project Study										
MSE 21	Practical Training/ Project Study	+	+	+	+	+	+	+	+	+	+
	Master Thesis with Defense										
MSE 22	**Master Thesis with Defense**	+	+	+	+	+	+	+	+	+	+

4-Systems and special lists belong to the evaluation of students and check of standards

Input the programme standards which agreed upon, for min. time for success and for each range (rate)				
Academic semester	1	2	3	4
Writing examination	Range between (60-70) of max. notes of modules (100%).			
Oral test (interview)	Max. 50 % of term paper note of modules (30-40%).			
several tests (tutorial – Laboratory)	Max. 50 % of term paper note of modules (30-40%).			

5- Evaluation of Education aimed output of Programme

Evaluator	tool	sample
Student of final Semester.	questionnaire	all students
Absolvent	Form pages	all absolvent's
Appointment sides	Form pages	25% business holders
External checks	-	-
External checks	questionnaire	Education Staff members, some members from the University Quality guarantee center
Others	-	-

6- Books and references

* Academic university Book.
* Printed Lectures.
* Arabic and strange available references in the Faculty library.
* Scientific periodically journals.
* Internet websites.

MODULE COMPENDIUM

Water Resources Management (MWRM)

Master Programme

Tishreen University Lattakia

Department of Water Engineering and Irrigation
Faculty of Civil Engineering

2015

EDUWAT: 511251-TEMPUS-1-2010-1-DE-TEMPUS-SMHES
Development of a Modern Higher Education System for Water Engineering in Syria

Developed by
Prof.Dr. Eng. Izzeddin Hassan
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This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein	Tempus

1. Goals of Master course of water resources management MWRM

The academic plan in the Master course of water resources management program, aims at providing the students the following items:

36. High level information in science and computer techniques, and developing the skills in engineering sciences and its applications.

37. Developing the ability of the students to achieve various water problems and water engineering studies, check and use it according to the engineering codes.
38. Comparing between the water engineering solutions, and choose the optimum one.
39. Developing the works skills and regulate the relationship between the work team which the best and have many specialists.
40. Strengthening the research ability and developing and working with the modest software's, equipment… etc.
41. Developing the item of the scientific, social and cultural of the student's characters.
42. Continuous developing to get the high quality of the research, teaching…...etc.

2-Modules of Master Water Resources Management MWRM

	Credits	**%**
Modules in Mathematics and Natural Sciences	15	13%
Modules in Rural Water management	10	8%
Modules in Hydro Sciences	10	8%
Modules with Specialization	30	25%
Elective Modules	10	8%
Modules for general Qualification	5	4%
Practical Training /Project	10	8%
Master Thesis plus Defense	30	25%
Total	**120**	**100%**

Module Semester	**1**	**2**	**3**	**4**	**Total/ECTS**
Mathematics and Natural Sciences	10	5			**15**
Rural Water management		5	5		**10**
Hydro Sciences	10				**10**
Specialization	10	15	5		**30**
Elective Modules		5	5		**10**
General Qualification			5		**5**
Practical Training/ Project Study			10		**10**
Master Thesis plus Defense				30	**30**
Total	**30**	**30**	**30**	**30**	**120**

	Modules in Natural Sciences 10% - 25%		Modules inTechnical Sciences 10 - 25%		Modules in Economic & Social Sciences 5% - 15%		Modules in Variable Sciences 55% - 70%

	Course Semester	1	2	3	4	Total/ECTS
	Mathematics and Natural Sciences	**10**	**5**			**15**
MWRM 1	Advanced Mathematics	5				**5**
MWRM 2	Mathematical and physical Modeling	5				**5**
MWRM 3	Methods of scientific research		5			**5**
	Rural Water management		5	5		**10**
MWRM 4	Irrigation and Land Use		5			**5**
MWRM 5	Drainage Engineering and Land Reclamation			5		**5**
	Hydro Sciences	**10**				**10**
MWRM 6	Advanced Hydraulics	5				**5**
MWRM 7	Groundwater Hydraulics	5				**5**
	Specialization	**10**	**15**	**5**		**30**
MWRM 8	Engineering Hydrology	5				**5**
MWRM 9	Engineering Hydrogeology		5			**5**
MWRM 10	Agricultural Soil and Water Chemistry	5				**5**
MWRM 11	Protection and Conserving of Groundwater			5		**5**
MWRM 12	Migration of contaminants		5			**5**
MWRM 13	Integrated Water Resources Management		5			**5**
	Elective Modules		**5**	**5**		**10**
MWRM 14	Ecology and Environment Protection					**5**
MWRM 15	Maintenance and Rehabilitation of Well structures					**5**
MWRM 16	pumping test					**5**
MWRM 17	Municipal and Industrial Water Management					**5**
MWRM 18	Drinking water system Modeling					**5**
	From these Courses students must select one module for each of the 2nd and 3rd Semester					
	General Qualification			**5**		**5**
MWRM 19	Water Rights and Conflict Resolution			**5**		**5**
MWRM 20	**Practical Training/Project study**			**10**		**10**
MWRM 21	**Master Thesis plus Defense**				**30**	**30**
	Total	**30**	**30**	**30**	**30**	**120**

1- Study Plan of Master Course Water Resources Management MWRM

2-

Nr of Module and symbol	Courses	S. 1	S. 2	S. 3	S. 4	Total/ECTS
	Modules in Mathematics and Natural Sciences					
MWRM 1	Advanced Mathematics	3/2/0/2				**5**
MWRM 2	Mathematical and physical Modeling	3/2/0/2				**5**
MWRM 3	Methods of scientific research		3/2/0/2			**5**
	Rural Water management					
MWRM 4	Irrigation and Land Use		3/2/0/2			**5**
MWRM 5	Drainage Engineering and Land Reclamation			3/2/0/2		
	Hydro Sciences					
MWRM 6	Advanced Hydraulics	3/2/0/2				**5**
MWRM 7	Groundwater Hydraulics	3/2/2/0				**5**
	Specialization					
MWRM 8	Engineering Hydrology	3/2/2/0				**5**
MWRM 9	Engineering Hydrogeology		3/2/2/0			**5**
MWRM 10	Agricultural Soil and Water Chemistry	3/2/2/0				**5**
MWRM 11	Protection and Conservation of Groundwater			3/2/2/0		**5**
MWRM 12	Migration of contaminants		3/2/2/0			**5**
MWRM 13	Integrated Water Resources Management		3/2/2/0			**5**
	Elective Modules					
MWRM 14	Ecology and Environment Protection		3/2/2/0	3/2/2/0		**5**
MWRM 15	Maintenance and Rehabilitation of Well structures		0	0		**5**
MWRM 16	Pumping test		0	0		**5**
MWRM 17	Municipal and Industrial Water Management		0	0		**5**

MWRM 18	Drinking water system Modeling		0	0		**5**
	From these Courses students must select one course in each Semester 2 and 3					
	General Qualification					
MWRM 19	Water Rights and Conflict Resolution			3/2/2/0		**5**
	Practical Training/ Project Study					
MWRM 20	Practical Training/ Project Study			**10**		**10**
	Master Thesis with Defense					
MWRM 21	**Master Thesis with Defense**				**30**	**30**
	Total	**30**	**30**	**30**	**30**	**120**

Lecture/Tutorial/Laboratory/Excursion (homework's)

4- Definition OF modules of Master Course Water Resources Management MWRM

Basics in Mathematics and Natural Sciences		
Module Number	**Module Name**	**Professor in Charge**
MWRM 1	**Advanced Mathematics**	Prof. Dr
Contents and Qualification aims	The module deals with understanding the basics of statistics and probability which cover the module Principles of probabilities:(the probability, the random events, the conditional probability, autonomy of the events), Bays formula (the first and second, Random variable, distribution function, discrete and connected variable, expectation standard deviation. In addition to the Differential equations such as The normal Differential equations of first order(solved and not solved as for derivative) and The Differential equations of higher order, The partial Differential equations. The students' knowledge will be developed with probability distributions and finding the relationship between the variables and give the students enough knowledge's and ability in these fields.	
Module Character	Advanced Mathematics: 4 Hours of lectures per week, 2 hour of tutorial.	
Prerequisite of attendance	Basic Knowledge of Advanced Mathematics (Differential equations and statistics and probability) are Water Engineering, Water Engineering and Irrigation, Civil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences .	
Applicability	The module is one of 3 mandatory compulsory of the Mathematics and Natural Sciences of the master course of water resources management the module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 1.	
Proposal references	1. Erwin Kreyszig: Advanced Engineering Mathematics, 10th Edition, John Wiley& Sons, INC.ISBN 978-0-470-45836-5, 2011 1283 pages. 2. Wolfgang Ertel: Advanced Mathematics for Engineers, translated by Elias Drotle and Richard Cubek, Hochschule Ravensburg- Weingarten University of Applied Sciences, October 1, 2012	

MWRM 2	**Mathematical and physical Modeling**	Prof. Dr
Contents and Qualification aims	The module deals with understanding the basics of the mathematical and physical modeling in the water engineering, the models types, covering equations, the boundaries conditions, model execution and the calibration process, sensitivity analysis, verification model, validation model, prediction model, post- audit model, documenting and reporting the modeling study. The students' knowledge will be developed during tutorials and specialist software which give the students enough knowledge's and ability in these fields.	
Module Character	Mathematical and physical Modeling: 4 Hours of lectures per week, 2 hour of tutorial and laboratory experiments.	
Prerequisite of attendance	Basic Knowledge of Mathematical and physical Modeling are Water Engineering, Water Engineering and Irrigation, Civil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in mathematics of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	1. The physical, **mathematical and computational models**, University of Albetra. .1.1. 2. Umut Hanoglu: **Mathematical and Physical Modeling**, University of Nova Gorica, 2009. 3. Masato Nakamura: **Mathematical and Physical Modeling of Mixing and Flow Phenomena of Municipal Solid Waste Particles on a Reverse Acting Grate**, Columbia University, 2008, 198 pages.	

MWRM 3	**Methods of scientific research**	Prof. Dr.
Contents and Qualification aims	The module deals with general and basic information about understanding; importance of scientific research; skills of scientific research; ethics of scientific research; methodology; preparing of scientific research protocol; design of experiment in laboratory or in the field; collecting and analysis of data; searching in references; searching in web; writing of scientific paper, writing of thesis and dissertation. The students' knowledge will be developed during training to write the scientific paper and preparing his scientific research protocol.	
Module Character	Methods of scientific research: 4 Hours of lectures per week, 2 hours of training per week.	
Prerequisite of attendance	Basic Knowledge of Methods of scientific research is Language skills; Basic knowledge of informatics.	
Applicability	The module is one of 3 mandatory compulsory of the Mathematics and Natural Sciences of the master course of water resources management The module is suitable for the research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 2.	
Proposal references	1. James E. Mauch and Namgi Park: **Guide to the Successful Thesis and Dissertation, A Handbook for Students and Faculty**. 2003. 5th ed. Copyright ©2003 by Marcel Dekker. ISBN: 0-8247-4288-5. 2. Louis Cohen; Lawrence Manion and Keith Morrison: **Research Methods in Education**, 2005, 5th ed. ISBN 0-203-22434-5 Master e-book ISBN. 3.Derek Swetnam: **Writing Your Dissertation, How to plan, prepare and present successful work**. 2007, 3rd ed. ISBN: 978 1 84803 126 5.	

Rural Water management		
Module Number	Module Name	Professor in Charge
MWRM 4	**Irrigation and Land Use**	Prof. Dr.
Contents and Qualification aims	The module introduce the students the several soil properties and its determination; relationship between soil types, water and plants, water demands of agriculture crops; irrigation systems, methods of irrigation; calculation of irrigation system; maintenance of irrigation networks and related structures; in the other part the module gives a general concepts of drainage and land reclamation; saline soils remediation methods; drainage methods of land; drainage systems and networks, regulation of drainage collectors and rivers. The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and use some advanced software to give the students enough knowledge's and ability in these fields.	
Module Character	**Irrigation and Land Use:** 4 Hours of lectures per week, 2 hour of tutorial per week.	
Prerequisite of attendance	Basic Knowledge of **Irrigation and Land Use** are Engineering Hydrology, Engineering Hydrogeology, Advanced Hydraulics, Groundwater Hydraulics.	
Applicability	The module is one of 2 mandatory compulsory of the **Rural Water management** of the Master Course Water Resources Management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 2.	
Proposal references	1. Frederick Haynes Newell: Principles of Irrigation Engineering, McGraw-Hill Publication (2010). 2. Etcheverry: Irrigation Practice and Irrigation Engineering. Mc Graw-Hill Publisher (2010). 3. Larry G. James: Principles of Farming Irrigation System Design Washington State University (Wiley) (2004).	
MWRM 5	**Drainage Engineering and Land Reclamation**	**Dr. Eng.**
Contents and Qualification aims	The module introduces students General Concepts of drainage and land reclamation; salinity in agricultural soils; saline soils remediation methods; calculation of water demand for washing the saltines, design of drainage networks (horizontal drainage of irrigated land; Vertical drainage of irrigated land); evaluation of the drainage method and land reclamation, and prepare the related researches. The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and use some advanced software to give the students enough knowledge's and ability in these fields.	
Module Character	Drainage Engineering and Land Reclamation: 4 Hours of lectures per week, 2 hour of tutorial and Laboratory and experiments per week.	
Prerequisite of attendance	Basic Knowledge of Drainage Engineering and Land Reclamation are Engineering Hydrogeology, irrigation and drainage engineering Advanced Hydraulics, Groundwater Hydraulics.	

Applicability	The module is one of 2 mandatory compulsory of the Rural Water management of the master course of water resources management. the module is suitable for the professional and research oriented studies in civil and environmental engineering.
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.
Frequency of the module	The module is offered annually.
Worked load	The workload is 150 hours.
Duration of the module	The module takes one term starting in Semester 3.
Proposal references	1. H. P. Ritzema: **Drainage principles and applications**, (Editor-in-Chief) 1994. ILRI. ISBN: 90 70754 3 39. 2. Larry G. James**: Principles of Farming Irrigation System Design,** Washington State University (Wiley) (2004). 3. Ahmad, Nisar: **Participatory Irrigation Management**. Higher Education Commission, Islamabad, 2008. 4. Mc Comas, Murray R.: **Geology and Land Reclamation,** The Ohio Journal of Science. v72 n2 (March, 1972), 65-75. 3. **Land Reclamation and Planning**. 5. **Guidance for Planning Authorities on Drainage and Reclamation of wetlands**, consultation draft, 2011, Environment, Community and Local Government.

Basics in Hydro Sciences		
Module Number	Module Name	Professor in Charge
MWRM 6	**Advanced Hydraulics**	**Prof. Dr.**
Contents and Qualification aims	The module deals with restrictive layer and disturbed theory; unsteady flow in open Canals, Weirs; Connection structures and energy depression; Laboratory experiments, computing programmes about this subjects. Boundary flow and its application in water engineering; similarity; principles of theoretical modeling of hydraulic phenomena; two-and three-dimensional flow and its application; and applications of electrical modeling in solving the flow equation. The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and Use some advanced software to give the students enough knowledge's and ability in these fields.	
Module Character	Advanced Hydraulics: 3 Hours of lectures per week, 2 hour of tutorial per week. 2 hour of Laboratory test per week.	
Prerequisite of attendance	Basic Knowledge of Advanced Hydraulics are Water Engineering, Water Engineering and Irrigation, Civil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences.	
Applicability	The module is one of 2 mandatory compulsory of the Basics in Hydro Sciences of the Master course of water resources management. the module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one terms starting in Semester 1.	

Proposal references	1. **Hydraulics, Workbook Advanced Level, Learning System for Automation and Communications**, P502 Festo Didactic OCKER Ingenieurbüro, 1999, 162 Pages. 2. Suresh A. Kartha: **Advanced Hydraulics**, Department of Civil Engineering Indian Institute of Technology, Guwahati. 3. A. Osman Akan: **Open Channel Hydraulics**, Elsevier BH, 2006, reprinted 2008.

MWRM 7	**Groundwater Hydraulics**	Prof. Dr.
Contents and Qualification aims	The module introduces students the Groundwater flow laws; steady groundwater flow into homogeneous and no homogeneous aquifers; groundwater flow in saturated and in unsaturated media; hydraulic of wells; artificial recharge of groundwater; dynamic of groundwater around of hydraulic structures. The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and use some advanced software to give the students enough knowledge and ability in these fields.	
Module Character	Groundwater Hydraulics: 4 Hours of lectures per week, 2 hours of tutorial and laboratory and experiments per week.	
Prerequisite of attendance	Basic knowledge of Groundwater Hydraulics are Water Engineering, Water Engineering and Irrigation, Civil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 2 mandatory compulsory of the Hydro Sciences of the Master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 1.	
Proposal references	1. National Academy Press Washington: **Rock Fractures and Fluid Flow**, D.C. 1996. ISBN: 0-309-56348-8. 2. Wen- Hsing Chiang: **3 D-Groundwater Modeling with PMWIN, A Simulation System for Modeling Groundwater Flow and Transport processes**, 2005, ISBN-10 3-540-27590-8 Springer Berlin Heidelberg New York. 3. K. SATO; Y. IWASSA: **Groundwater Hydraulics**. Springer. JAPAN, 2003. ISBN 4-431-20039-8 4. Jacques W. Delleur: The handbook of groundwater engineering, 2007, 2nd ed. Taylor & Francis Group, LLC. ISBN-13: 978-0-8493-4316-2 (alk. paper). ISBN-10: 0-8493-4316-X (alk. paper). 5. David K. TODD; Larry W. MAYS: Groundwater Hydrology, 2005, 3rd ed. John Wiley & Sons, Inc.	

Specialization		
MWRM 8	**Advanced Engineering Hydrology**	Prof. Dr.

Contents and Qualification aims	The module deals with Air and climatic phenomena; rainfall; Evaporation; runoff and Floods; Watershed; Hydrograph analysis; Statistics and probability in hydrology; urban and small watershed hydrology; hydrological design of urban and rural drainage; hydrological design of control structures of flood; watershed modeling; and flood management. The students' knowledge will be deepened during tutorials and necessary laboratory experiments and practical computer training and Use some advanced software to give the students enough knowledge's and ability in these fields.
Prerequisite of attendance	Engineering Hydrology**:** 4 Hours of lectures per week, 2 hours of tutorial Laboratory experiments per week.
Applicability	Basic knowledge of Engineering Hydrology are Water Engineering, Water Engineering and Irrigation, Civil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences.
Prerequisite to active credit points	The module is one of 6 mandatory compulsory of the Specialization of the Master Course Water Resources Management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.
Frequency of the module	The module is offered annually.
Worked load	The workload is 150 hours.
Duration of the module	The module takes one term starting in Semester 1.
Proposal references	1. E. M. WILSON: **Engineering Hydrology**, 1984, 3rd ed. Hong Kong. 2. Ian WATSON; Alister D. B: **Hydrology**, 1995. 3. Victor Miguel Ponce, **Engineering Hydrology**, **Principles and practices**, ISBN 0-13-277831-9. 4. Elizabeth M. Shaw: **Hydrology in Practice**, 1994, 3rd ed ISBN 0-203-01325-5 Master e-book ISBN. 5. ALASAAD, A.M.; AMMAR, Gh. A. **Engineering Hydrology**. 2014, Tishreen University, 506 pgs.

MWRM 9	**Advanced Engineering Hydrogeology**	Prof.Dr..
Contents and Qualification aims	The module gives the students the ability to calculate the discharge of wells; design the drainage system of many engineering structures at any construction stage; design the drainage system of tunnels and other underground buildings; groundwater flow in the saturated and unsaturated media; hydraulic and design of wells; artificial recharge of groundwater; principles of groundwater modeling;. The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and use some advanced software to give the students more knowledge and ability in these field.	
Module Character	Engineering Hydrogeology: 4 Hours of lectures per week, 2 hours of tutorial and Laboratory and experiments per week.	

Prerequisite of attendance	Basic Knowledge's of Engineering Hydrogeology are Groundwater Hydraulics, Advanced Hydraulics, Mathematical and physical Modeling, Advanced Mathematics.
Applicability	The module is one of 6 mandatory compulsory of the Specialization modules of the Master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.
Frequency of the module	The module is offered annually.
Worked load	The work load is 150 hours.
Duration of the module	The module takes one term starting in Semester 2.
Proposal references	1.HISCOCK, Keven: **Hydrogeology Principles and Practice**, 2005, Blackwell Publishing. UK. 2.KovalevskyV. S.; Kruseman;G. P., RushtonK. R.: An International guide for hydro geological investigations, UNESCO 2004. ISBN 92-9220-005-4. 3. Neven Kresic: **Hydrogeology and Groundwater Modeling**, 2007, 2. d- Ed. Taylor & Francis Group, London New York. 4. Rushton, K. R.: **Groundwater Hydrology Conceptual and Computational Models**, 2003. John Wiley & Sons Ltd. ISBN 0-470-85004-3. 5. Willis D. Weight: **Manual of Applied Field Hydrogeology.** 2004, McGraw-Hill (www. digital engineering library.com). 6. ALASAAD, A.M**. Hydrogeology**. 2010, Tishreen University, 600 pgs.

MWRM 10	**Agricultural Soil and Water Chemistry**	**Dr. eng.**
Contents and Qualification aims	The module deals with understanding the General Principles of chemistry, Chemical Arithmetic, Atomic Structure and The Periodic Table of elements, Chemical Bonding and Molecular Structure, State of Material, dissolution, Thermo chemistry, Chemical Kinetics, Chemical Equilibrium and Oxidation-Reduction Reactions. In addition to the chemical properties of the water and soil and related it to the concrete. The students' knowledge will be developed during the laboratory experiments and necessary laboratory experiments and practical computer training and use some advanced software to give the students enough knowledge and ability in these fields.	
Module Character	Agricultural Soil and Water Chemistry: 4 Hours of lectures per week, 2 hour of tutorial and laboratory experiments.	
Prerequisite of attendance	Basic Knowledge of Agricultural Soil and Water Chemistry are Engineering Hydrology, Groundwater Hydraulics, Advanced Hydraulics, Mathematical and physical Modeling and Advanced Mathematics.	
Applicability	The module is one of 5 elective modules of the Master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one terms starting in one Semester 2	
Proposal references	1. Michael E. Essington: **Soil and Water Chemistry: An Integrative Approac**h, 2004, University of Tennessee, [CRC Press]. 2. Broder J. Merkel; Britta Planer- Friederich and Darrell Kirk Nordstrom: **Groundwater Geochemistry**, **A Practical Guide to Modeling of Natural and Contaminated Aquatic Systems**, 2005. ISBN 3-540-24195-7, Springer Berlin Heidelberg, New York.	

MWRM 11	**Protection and Conserving of Groundwater**	**Prof. Dr.**
Contents and Qualification aims	The module introduces students the Physical and chemical properties of groundwater; origin of groundwater and its forms in the earth crust؛ Groundwater flow laws ;steady groundwater flow into homogeneous aquifers ; steady groundwater flow into no homogeneous aquifers ; groundwater flow in the unsaturated media; groundwater investigation; field infiltration tests; pumping tests and analyzing it's data; hydraulic and design of wells; artificial recharge of groundwater; Protect the groundwater from pollution und depletion; principles of groundwater modeling;. The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and use some advanced software to give the students enough knowledge's and ability in these fields.	
Module Character	Protection and Conserving of Groundwater: 4 Hours of lectures per week, 2 hour of tutorial and Laboratory and experiments per week.	
Prerequisite of attendance	Basic Knowledge of Protection and Conserving of Groundwater are Engineering Hydrogeology, Engineering Hydrology, Groundwater	

	Hydraulics, Advanced Hydraulics, Mathematical and physical Modeling and Advanced Mathematics.
Applicability	The module is one of 5 mandatory compulsory of the Specialization of the Master course of water resources management. the module is suitable for the professional and research oriented studies in civil and environmental engineering.
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.
Accredit points and grades	The module earns Cr. The final Grade is generated with 60% written exam and 40% term paper.
Frequency of the module	The module is offered annually.
Worked load	The workload is 150 hours.
Duration of the module	The module takes one term starting in Semester 3.
Proposal references	1. **Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action**, United States Environmental Protection, Agency, EPA530-R-04-030, 2004, 120 Pages. 2.Chevalking, S., Knoop, L. and Van Steenbergen, F.: **Ideas for Groundwater Management**, Wageningen, The Netherlands, Meta Meta and IUCN, 2008, ISBN: 978-90-79658-01-5, Pages 144. 3. **Protection the Groundwater from Contamination and Depletion**, National Academy Press Washington, D.C. 1984. http://www.nap.edu/catalog/1770.html. 4. Stephen Foster; Ricardo Hirata; Daniel Gomes; Monica D'Elia& Marta Paris: **Groundwater Quality Protection. a guide for water utilities**, municipal authorities, and environment agencies, 2002, ISBN 0-8213-4951-1.

MWRM 12	**Migration of contaminants** — Prof. Dr.
Contents and Qualification aims	The module introduces students the General description of processes of groundwater contamination; dispersion theory in porose media; technical methods in groundwater contamination study; experimental definition of contamination parameters; mathematical models; examples of groundwater contamination; numerical analysis of groundwater contamination problems; balance of contaminated blocks. The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and use some advanced software to give the students enough knowledge and ability in these fields.
Module Character	Basic Knowledge of Migration of contaminants are Engineering Hydrology, Groundwater Hydraulics, Advanced Hydraulics, Mathematical and physical Modeling and Advanced Mathematics.
Prerequisite of attendance	The module is one of 5 mandatory compulsory of the Specialization of the Master Course Water Resources Management. the module is suitable for the professional and research oriented studies in civil and environmental engineering.
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.
Frequency of the module	The module is offered annually.
Worked load	The work load is 150 hours.
Duration of the module	The module takes one term starting in Semester 2.
Proposal references	1. Dance J.T.; Reardon E.J. : **Migration of contaminants in groundwater at a landfill**: A case study: 5. Cation migration in the dispersion test, Journal of Hydrology Volume 63, Issues 1–2, May 1983, Pages 109–130. 2. Mather J.; Banks D.; Dumpleton; Fermor M.: **Groundwater Contaminants and their Migration**, Geological Society Special Publication No. 128, 1998, Published by The Geological Society, London, Pages 361.

MWRM 13	**Integrated Water Resources Management** — Prof. Dr
Contents and Qualification aims	The module introduce the conditions of water Exploitation as sufficient water storage, required quantity, influence of climate change on water resources, integrated planning of water resources exploitation using suitable software as WEAP, several using of water (as drinking water, irrigation, industry, tourism, environment flow, flood protection, river transport). The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and use some advanced software to give the students enough knowledge and ability in these fields.
Module Character	Integrated Water Resources Management: 4 Hours of lectures per week, 2 hour of tutorial and laboratory and experiments per week.
Prerequisite of attendance	Basic knowledge of Integrated Water Resources Management are Engineering Hydrology, Groundwater Hydraulics, Advanced Hydraulics, Mathematical and physical Modeling and Advanced Mathematics

Applicability	The module is one of 5 mandatory compulsory of the Specialization modules of the Master Course Water Resources Management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.
Frequency of the module	The module is offered annually
Worked load	The work load is 150 hours
Duration of the module	The module takes one term starting in Semester 2.
Proposal references	1. Hiscock K.M.; Rivett M.O.; Davison R.M.: **Sustainable Groundwater Development**., 2002. Published by The Geological Society London. ISBN 1-86239-097-5. 2. William M. Alley; Thomas E. Reilly ;Franke O. Lehn: **Sustainability of Ground-Water Resources**, 1999, U.S. Government Printing Office, ISBN 0–607–93040–3. 3. Giupponi, C., Karssenberg D. A. J., and P. H. Matt P. Hare: **Sustainable Management of Water Resources**: An Integrated Approach. Edward Elgar Publishing, 2006. 4. Douglass Shaw W.: **Water Resource Economics and Policy An Introduction**. 2005, ISBN 1 84376 917 4 (cased). 5. **Resources of the World and their Use**, 2004. © UNESCO. ISBN 92-9220-007-0.

Elective Modules		
Module Number	**Module Name**	Professor in Charge
MWRM 14	**Ecology and Environment Protection**	Prof. Dr. Eng.
Contents and Qualification aims	The module deals with understanding the actual environmental problems within drinking water, surface water resources and waste water. The module gives the students the ability to evaluate and choose the best solution to design the drinking and waste water nets and treatment station. In other hand the students can evaluate the quality of water resources using the possible and suitable equipment's based on analytical and structural thinking. In addition to provide students with practical steps and methodology to determine the environmental effects of direct and indirect project proposals, analyze, evaluate and prepare a report assessing the environmental impact of projects. The students' knowledge will be developed during the necessary laboratory experiments and practical computer training and use some advanced software to give the students enough knowledge's and ability in these fields.	
Module Character	Ecology and Environment Protection: 4 Hours of lectures per week, 2 hour of tutorial and Laboratory experiments per week.	
Prerequisite of attendance	Basic Knowledge of Ecology and Environment Protection are Engineering Hydrology, Groundwater Hydraulics, Advanced Hydraulics, Mathematical and physical Modeling and Advanced Mathematics	
Applicability	The module is one of 5 elective modules of the Master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 2 or 3.	
Proposal references	1. Pratibha Singh, Piyush Malaviya and Anup Singh: Text **book of Environment and Ecology**,, A learning Pvt Ltd, New Delhi. 2. Joseph A. Salvato; P.E., Dee; Nelson L. Nemerow and Franklin J. Agardy, 2003. **Environmental Engineering**. JOHN WILEY & SONS, INC. ISBN 0-471-41813-7 (cloth).	

MWRM 15	**Maintenance and Rehabilitation of Well structures**	Prof. Dr.

Contents and Qualification aims	The module introduce the conditions of water Exploitation as sufficient water storage, required quantity, influence of climatic change, required water legislation, integrated planning, water exploitation, several using of water (as drinking water, irrigation, industry, tourism, environment flow, flood protection, river transport). The students' knowledge will be developed during tutorials and necessary laboratory experiments and Use some advanced software to give the students enough knowledge and ability in these fields.
Module Character	Maintenance and Rehabilitation of Well structures: 4 Hours of lectures per week, 2 hour of tutorial and Laboratory and experiments per week.
Prerequisite of attendance	Basic Knowledge of Maintenance and Rehabilitation of Well structures are Engineering Hydrology, Groundwater Hydraulics, Advanced Hydraulics, Mathematical and physical Modeling and Advanced Mathematics
Applicability	The module is one of 5 elective modules of the Master course of water resources management.. the module is suitable for the professional and research oriented studies in civil and environmental engineering.
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.
Frequency of the module	The module is offered annually.
Worked load	The work load is 150 hours.
Duration of the module	The module takes one terms starting in Semester 2 or 3.
Proposal references	1.Peter H. Emmons; Gajanan M. Sabnis: **Concrete Repair and Maintenance**, Galgotia Publication. 2. **Water Well Handbook**, State of Utah, Based on the Administrative Rules for Water Wells (R655-4 UAC),2011, KENT L. JONES, P.E. State Engineer. 3. **Ground Water- Manual**, Technical Publication, United States, Bureau of Reclamation, SECOND EDITION 1995.

MWRM 16	**Pumping Test**	Dr. Eng.
Contents and Qualification aims	The module introduces students the Analysis and Evaluation of Pumping Test Data; Aquifer types; Physical properties of rocks; Pumping tests; Selecting the site for the well; The measurements to be taken; Duration of the pumping test; Processing the data; Interpretation of the data..; Confined and leaky aquifers: Thiem’s method; Theis’s method; Jacob’s method; De Glee’s method; Hantush-Jacob’s method; Neuman’s curve-fitting method; Thiem-Dupuit’s method. Bounded aquifers: De Glee’s method; Walton’s method; Neuman-Witherspoon’s method…; Unconfined aquifers: Neuman’s curve-fitting method; Thiem-Dupuit’s method. The students’ knowledge will be developed during tutorials and necessary laboratory experiments and practical training to give the students enough knowledge’s and ability in these fields.	
Module Character	Pumping test: 4 hours of lectures per week, 2 hours of tutorial and Laboratory and experiments per week.	
Prerequisite of attendance	Basic Knowledge of Pumping test are Engineering Hydrology, Groundwater Hydraulics, Advanced Hydraulics, Mathematical and physical Modeling and Advanced Mathematics.	

Applicability	The module is one of 5 elective modules of the Master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.
Frequency of the module	The module is offered annually.
Worked load	The work load is 150 hours.
Duration of the module	The module takes one terms starting in Semester 2 or 3.
Proposal references	1. Kruseman G.P. and de Ridder N.A.: **Analysis and Evaluation of Pumping Test** Data, 2000, 2^{nd} ed. ISBN 90 70754 207. 2. KrusemanG.P. ; de Ridder N.A.: **Analysis and Evaluation of Pumping Test Data,** 2^{nd} ed., International Institute for Land Reclamation and Improvement, P.O. Box 45,6700 AA Wageningen, The Netherlands,1994. 3. Abdel Ghafour Deeb: **Pumping Test for Groundwater Aquifers Analysis and Evaluation**, Ramallah 12, 2005.

MWRM 17	**Municipal and Industrial Water Management**	**Dr. eng**
Contents and Qualification aims	The module introduces students methods of water supply for industrial structures and methods of waste water treatment resultant from this structures. This main the student must know resources, properties and quantity required for industrial water supply, methods of water treatment required for using in industry, resources, properties and quantity of industry wastewater. Industry waste water treatment (simple, chemical, physical-chemical, air- biological industry waste water, no air biological, treatment, advanced treatment of industry waste water and ruse this water. riddance from the sediments resultant from this treatment, the students must able to put technological planning for treatment station of waste water some industries. The students' must know how can calculate the costs of the construction and the time plan. The students' knowledge will be developed during tutorials and necessary laboratory experiments to give the students enough knowledge and ability in these fields.	
Module Character	Municipal and Industrial Water Management: 4 Hours of lectures per week, 2 hour of tutorial and Laboratory and experiments per week.	
Prerequisite of attendance	Basic Knowledge of Municipal and Industrial Water Management are Engineering Hydrology, Groundwater Hydraulics, Advanced Hydraulics, Mathematical and physical Modeling and Advanced Mathematics.	
Applicability	The module is one of 5 elective modules of the Master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one terms starting in one Semester 2 or 3.	
Proposal references	1. W W Eckenfelder Jr.: **Industrial Water Pollution Control**, McGraw Hill. 2. E F Gurnham: **Industrial Water Management**, John Wiley.	

MWRM 18	**Drinking water system Modeling**	Prof. Dr.

Contents and Qualification aims	The module introduces the students the main principles and details of calculation and design of drinking water supply networks to cities and towns and related structures and equipment's. In the other part give the module students the basic knowledge of the main and advanced treatment of the drinking water system and design the related structures. After that the student know how they calculate it hydraulically and how the student can design several waste water networks (separate, un separate, half separate). In addition to the students will be introduce the related structures on these Networks and how can man maintain these Networks. Design required models for several problems with possible simulation methods. The students' knowledge will be developed during the practical computer training and Use some advanced software to give the students enough knowledge and ability in these fields.
Module Character	Drinking water system Modeling: 4 Hours of lectures per week, 2 hour of tutorial and Laboratory experiments per week
Prerequisite of attendance	Basic Knowledge of Drinking water system Modeling is Engineering Hydrology, Advanced Hydraulics, Mathematical and physical Modeling and Advanced Mathematics.
Applicability	The module is one of 5 elective modules of the Master course of water resources management. the module is suitable for the professional and research oriented studies in civil and environmental engineering
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.
Frequency of the module	The module is offered annually.
Worked load	The work load is 150 hours.
Duration of the module	The module takes one term starting in Semester 2 or 3.
Proposal references	1. **Drinking Water Distribution Systems**, Assessing and Reducing Risks, Committee on Public Water Supply Distribution Systems, Water Science and Technology Board, HE NATIONAL ACADEMIES PRESS, Washington, D.C. www.nap.edu, ISBN: 0-309-66432-2, 404 pages, 6 x 9, (2006). 2. Blokker E. J. M. ;Vreeburg J. H. G.; Buchberger S. G.; van Dijk J. C.: **Importance of demand modeling in network water quality models: a review, Drink. Water Eng.** Sci., 1, 27–38, 2008www.drink-water-eng-sci.net/1/27/2008/©Author(s) 2008. This work is distributed under the Creative Commons Attribution 3.0 License. 3.Jegatheesan V.; Kastl, G.; Fisher I. ;Chandy J. ; Angles M.: **Water Quality Modeling for Drinking Water Distribution Systems, School of Engineering**, James Cook University, Townsville, QLD 4811, email: Jega.Jegatheesan@jcu.edu.auSydney Water Corporation, PO Box 73, West Ryde, NSW 2114
From these modules students must select one module for each of the 2nd and 3rd Semester.	

General Qualification		
Module Number	**Module Name**	Professor in Charge
MWRM 19	**Water Rights and Conflict Resolution**	
Contents and Qualification aims	The module introduce the laws and legislation of water using and environment in Syria, Arab country and in the world. The changes of water necessity in Syria; The conflict reasons related to water demand in the MENA area; The national and international water rights; water resources as a factor for improvement international relationship. The students' will be developed during seminars and representation.	
Module Character	Rights and Water Legislations: 4 Hours of lectures per week, 2 hour of tutorial per week.	
Prerequisite of attendance	Basic knowledge of Water Rights and Conflict Resolution is not necessary.	
Applicability	The module is the single mandatory general qualification of the Master course of water resources management. The module is suitable for the professional oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes).	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 3.	
Proposal references	1. Water Rights in Montana, Montana University System Water Center, April 2012. 2. Stephen Hodgson: Modern Water Rights Theory and AO Legislative Study.	

Practical Training/ Project Study		
Module Number	**Module Name**	**Professor in Charge**
MWRM 20	**Practical Training/ Project Study**	**Not definite**
Contents and Qualification aims	The Student must carry out practical training about one Problem belongs to subjects of the Master course of water resources management in one or more institution or incorporation, and he must present full study about this problem.	
Module Character	Practical Training/ Project Study: 10 Hours tutorial per week	
Prerequisite of attendance	Basic Knowledge of Practical Training/ Project Study, the student must be in the 3rd Semester.	
Applicability	the module is suitable for the professional and research oriented studies in civil and environmental engineering	
Prerequisite to active credit points	Having passed the module seminar and presentation before a commission.	
Accredit points and grades	The module earns 10 Cr. The final Grade is generated with 100% as presentation in front of committee.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 300 hours.	
Duration of the module	The module takes one term starting in Semester 3.	
Proposal references	1. **Old Master, Bachelor thesis** and **Practical Training** reports which are available in the Libraries of the University. 2. James E. Mauch and Namgi Park: **Guide to the Successful Thesis and Dissertation, A Handbook for Students and Faculty**. 2003. 5th ed. Copyright ©2003 by Marcel Dekker. ISBN: 0-8247-4288-5.	

Master Thesis with Defense		
Module Number	**Module Name**	**Professor in Charge**
MWRM 21	**Master Thesis with Defense**	**Not definite**
Contents and Qualification aims	The Student must work Master Thesis with Defense about one Problem belongs to the subjects of the Master course of water resources management in one or more institution or incorporation, and he must present full study about this problem.	
Module Character	Master Thesis with Defense: 30 Hours tutorial per week.	
Prerequisite of attendance	Basic Knowledge of Master Thesis with Defense, the student must be in 6th Semester.	
Applicability	the module is suitable for the professional and research oriented studies in civil and environmental engineering	
Prerequisite to active credit points	Having passed the module presentation before a commission.	
Accredit points and grades	The module earns 30 Cr. The final Grade is generated with 100% as presentation in front of committee.	
Frequency of the module	The module is offered in 4th semester	
Worked load	The work load is 900 hours	
Duration of the module	The module takes one term starting in Semester 4.	
Proposal references	1. James E. Mauch and Namgi Park: **Guide to the Successful Thesis and Dissertation, A Handbook for Students and Faculty**. 2003. 5th ed. Copyright ©2003 by Marcel Dekker. ISBN: 0-8247-4288-5. 2. Derek Swetnam: **Writing Your Dissertation, How to plan, prepare and present successful work**.2007, 3rd ed. ISBN: 978 1 84803 126 5. 3. Louis Cohen; Lawrence Manion and Keith Morrison: **Research Methods in Education**, 2005, 5th ed. ISBN 0-203-22434-5 Master e-book ISBN. 4. **Old Master and Bachelor thesis**, which are available in the Libraries of the University.	

5- Training Course Master Water Resources Management

1- Training Course: Integrated water resources management

The course has been put to engineers working in field of sanitary engineering, irrigation engineering, water structures and water resources management. The goal of course is giving the absolvent the experience in field **Integrated water resources management**.

Course contents:

- Concept and principles of integrated water resources management;
- Management of water demand;
- System of evaluating and planning of water resources using program WEAP;
- Basics of water resources and components of water balance- practical examples;
- Water managements and evaluating of water resources- practical case;
- Construction of water data bases in GIS Environment;
- Construction of mathematical standard model ;
- Systems of coordinate and system of abortion and adaptation of work places of mathematical model;
- Connection between GIS and mathematical model.

2- Training Course: Water harvesting

The course has been put to engineers working in field of irrigation engineering, water structures and water resources management. The goal of course is giving the absolvent the experience in field Water harvesting.

Course contents:

- Components of water harvesting system;
- Affecting Technical coefficients on using competence of water harvesting technologies;
- Technologies of water harvesting;
- Technical Evaluating of methods of water harvesting;
- Formation of rain storms and affecting coefficients on them;
- Methods of calculation of discharges in temporary streams;
- Mechanism of choosing the construction places of small dams;
- Engineering technologies of construction of water traps.

3- Training Course: Development of Water resources

The course has been put to engineers working in field of irrigation engineering, water structures and water resources management. The goal of course is giving the absolvent the experience in field Development of water resources.

Course contents:

- Importance of hydrological studies and water measurements in estimating and exploiting of water resources;
- Study of Sedimentation in dams reservoirs;
- Methods of Exploitation of marine springs;
- Methods of sweetening of sea- and saltwater;

- Reuse of wastewater in Irrigation and other use;
- Increase of using efficiency in irrigation , drinking water and industry;
- Importance of understanding of concept of virtual water e and soft water path;
- Application some computing programs and software in field of water resources management and saving it from pollution

Quality Management

Water Resources Management (MWRM)

Master Programme

Tishreen University Lattakia

Department of Water Engineering and Irrigation
Faculty of Civil Engineering

2015

EDUWAT: 511251-TEMPUS-1-2010-1-DE-TEMPUS-SMHES
Development of a Modern Higher Education System for Water Engineering in Syria

Developed by
Prof.Dr. Eng. Izzeddin Hassan
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This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein	Tempus

Quality management and accreditation

University: Tishreen University
Faculty: Faculty of Civil Engineering

2- Specification of the programme

2-1- Basics Data

- Programme name (MWRM): Master course Water Resources Management

- **Type of the programme**: single: include one specific.

- **Name of the participated programmes**: (none).
- **Length of programme (time):** 4 Semesters.
- **Qualification (Certificate), which the Student get at End of the programme:** Master of Science (specialist of Water Resources Management).
- **Language or the used Language in the programme**: Arabic is the main language. English Language is used to explain the scientific terms.
- **Place of programme application:** University Campus, Building of Faculty of Civil Engineering.
- **External Check Person:**
- **Date the latest acceptance of Specification of the programme**:

4-2- Professional Data

1-2-1- Message and Goal of the programme

- Notification of message and Goal of the Programme:

The Department Water Engineering and Irrigation and Department of Environment Engineering in the Faculty of Civil Engineering in the Tishreen University undertake the preparation an excellent absolvent in the fields of Water Resources Management, qualified to continue his qualification and his professional development, able to compete and cover the need of the labour market in these Engineering fields. In addition to, the both Departments give a very good study and research plan aims to develop the scientific research and participation in professional and research projects.
Which contribute in supporting and covering the needs of development plans of the country, during the cooperation with the related scientific, research and service sides.**-**

Goals of the programme

The academic plan in the Master Course of Water Resources Management programme, aims at providing the students the following items:

43. High level information in science and computer techniques, and developing the skills in engineering sciences and its applications.
44. Developing the ability of the students to achieve various water problems and water engineering studies, check and use it according to the engineering codes.
45. Comparing between the water engineering solutions, and choose the optimum one.
46. Developing the works skills and regulate the relationship between the work team which the best and have many specialists.
47. Strengthening the research ability and developing and working with the modest software's, equipment etc.
48. Developing the item of the scientific, social and cultural of the student's characters.
49. Continuous developing to get the high quality of the research, teaching../etc.

1-2-2- Programme Composition and its Contents

a) Admission condition in the programme: the admission will be done through competition among the students, who have Bachelor in Fields: **Water Engineering, Water Engineering and Irrigation, Civil Engineering, Environmental Engineering, Agriculture Engineering and Bachelor of Sciences.**

b) **The conditions of success in the Programme:**:
Presence of theoretical, tutorial, and laboratory Lectures and present the required projects and scientific and laboratories reports.

c) **Success from year to year**: Success in all Modules in 1st and 2nd Semester each studying year.

d) Completion of programme:

Condition of accomplish of studying years	
1st year	Success in modules of 1st and 2nd semesters, the student can hold max. 2 Modules.
2nd year	- Success in modules of 3rd semesters, the student can hold max. 2 Modules from all foregone semesters - Success in modules of foregone semesters and Defense of Master Thesis in front of the commission.

e) Condition of the complete of the programme:

- Brief description of kind of Practical Training/ Project Study:

The Student must carry out practical training about one Problem related to the subjects of Water resources management in one or more institution or incorporation, and he must present full study about this problem.

- In which phase or phases of from the programme this Practical Training/ Project Study is carried out : This Study or Project must be carried out in the 3rd semester.

- Number of Credit / or semesters for this Practical Training/ Project Study:

Offered in 3 rd semester with 10 cr. per week.

- Description of evaluation procedures: the evaluation should be done by a commission, which formed by the delegacy of faculty of civil engineering, the student must pass the module seminar and presentation in front of commission.

- **Brief description of the kind of Master Thesis:**

  The Student must carry out Master Thesis about one Problem relate to the subjects of Water Resources management in the 4th semester, and he must present full study about this problem in front of the commission.
- **In which phase from the programme the Master Thesis with Defense should be carried out:** This Master Thesis must be carried out in the 4th semester.
- **Number of Credit / or semesters for this Master Thesis with Defense:**

  Offered in 4th semester with 30 cr. per week.
- **Description of evaluation procedures:** the evaluation should be done by a commission, which formed by the delegacy of the faculty of civil engineering, the student must pass the module and presentation in front of the commission.

1-3- The programme description:

The programme of Master course Water Structures based on theoretical lectures, laboratory meeting, Seminars and scientific excursion approved in the study plan.

- Brief description of praxis experiences activity:

∗ Practical Project with report Rural and Integrated Water management projects;

∗ Practical Project with report in Irrigation and Land Use projects;

∗ Practical Project with report in Well Structures and Pumping test projects;

∗ ∗ Scientific excursion to Water engineering and sanitary projects in 1,2,3 Semester.

- In which phase or phases of programmes will be introduce the field experience:

∗ Summer training in Rural and Integrated Water management in 3rd Semester;

∗ Summer training in Irrigation and Land Use in 3rd Semester;

∗ Summer training in Well Structures and Pumping test in 3rd Semester;

∗ Scientific excursion to Water engineering and sanitary projects in 1,2,3 Semester.

2-Modules of Master course Water Resources Management MWRM

		Actual		Goal		
Nr of Module and symbol		Credits	%	Credits	%	
	Modules in Mathematics and Natural Sciences	15	13%	12	10%	
	Modules in Rural Water management	10	8%	18	15%	
	Modules in Hydro Sciences	10	8%			
	Modules with Specialization	30	25%	42	35%	
	Elective Modules	10	8%			
	Modules for general Qualification	5	4%	6	5%	
	Practical Training /Project	10	8%	12	10%	
	Master Thesis plus Defense	30	25%	30	25%	
	Total	**120**	**100%**	**120**	**100%**	
	Module Semester	**1**	**2**	**3**	**4**	**Total/ECTS**
	Mathematics and Natural Sciences	10	5			**15**
	Rural Water management		5	5		**10**
	Hydro Sciences	10				**10**
	Specialization	10	15	5		**30**
	Elective Modules		5	5		**10**
	General Qualification			5		**5**
	Practical Training/ Project Study			10		**10**
	Master Thesis plus Defense				30	**30**
	Total	**30**	**30**	**30**	**30**	**120**
	Course Semester	**1**	**2**	**3**	**4**	**Total/ECTS**
	Mathematics and Natural Sciences	**10**	**5**			**15**
MWRM 1	Advanced Mathematics	5				**5**
MWRM 2	Mathematical and physical Modeling	5				**5**
MWRM 3	Methods of scientific research		5			**5**
	Rural Water management		5	5		**10**
MWRM 4	Irrigation and Land Use		5			**5**
MWRM 5	Drainage Engineering and Land Reclamation			5		**5**
	Hydro Sciences	**10**				**10**
MWRM 6	Advanced Hydraulics	5				**5**
MWRM 7	Groundwater Hydraulics	5				**5**
	Specialization	**10**	**15**	**5**		**30**
MWRM 8	Engineering Hydrology	5				**5**
MWRM 9	Engineering Hydrogeology		5			**5**
MWRM 10	Agricultural Soil and Water Chemistry	5				**5**
MWRM 11	Protection and Conserving of Groundwater			5		**5**

MWRM 12	Migration of contaminants		5			**5**
MWRM 13	Integrated Water Resources Management		5			**5**
	Elective Modules		**5**	**5**		**10**
MWRM 14	Ecology and Environment Protection					**5**
MWRM 15	Maintenance and Rehabilitation of Well structures					**5**
MWRM 16	pumping test					**5**
MWRM 17	Municipal and Industrial Water Management					**5**
MWRM 18	Drinking water system Modeling					**5**
	From these Courses students must select one module for each of the 2nd and 3rd Semester					
	General Qualification			**5**		**5**
MWRM 19	Water Rights and Conflict Resolution			**5**		**5**
MWRM 20	**Practical Training/Project study**			**10**		**10**
MWRM 21	**Master Thesis plus Defense**				**30**	**30**
	Total	**30**	**30**	**30**	**30**	**120**
	Goal	**30**	**30**	**30**	**30**	**120**

3- Study Plan of Master Course Water Resources Management MWRM

Nr of Module and symbol	Courses	S. 1	S. 2	S. 3	S. 4	Total/ECTS
	Modules in Mathematics and Natural Sciences					
MWRM 1	Advanced Mathematics	3/2/0/2				**5**
MWRM 2	Mathematical and physical Modeling	3/2/0/2				**5**
MWRM 3	Methods of scientific research		3/2/0/2			**5**
	Rural Water management					
MWRM 4	Irrigation and Land Use		3/2/0/2			**5**
MWRM 5	Drainage Engineering and Land Reclamation			3/2/0/2		
	Hydro Sciences					
MWRM 6	Advanced Hydraulics	3/2/0/2				**5**
MWRM 7	Groundwater Hydraulics	3/2/2/0				**5**
	Specialization					
MWRM 8	Engineering Hydrology	3/2/2/0				**5**
MWRM 9	Engineering Hydrogeology		3/2/2/0			**5**
MWRM 10	Agricultural Soil and Water Chemistry	3/2/2/0				**5**
MWRM 11	Protection and Conservation of Groundwater			3/2/2/0		**5**
MWRM 12	Migration of contaminants		3/2/2/0			**5**
MWRM 13	Integrated Water Resources Management		3/2/2/0			**5**
	Elective Modules					
MWRM 14	Ecology and Environment Protection		3/2/2/0	3/2/2/0		**5**
MWRM 15	Maintenance and Rehabilitation of Well structures		0	0		**5**
MWRM 16	Pumping test		0	0		**5**
MWRM 17	Municipal and Industrial Water Management		0	0		**5**

MWRM 18	Drinking water system Modeling		0	0		**5**
	From these Courses students must select one course in each Semester 2 and 3					
	General Qualification					
MWRM 19	Water Rights and Conflict Resolution			3/2/2/0		**5**
	Practical Training/ Project Study					
MWRM 20	Practical Training/ Project Study			**10**		**10**
	Master Thesis with Defense					
MWRM 21	**Master Thesis with Defense**				**30**	**30**
	Total	**30**	**30**	**30**	**30**	**120**

Lecture/Tutorial/Laboratory/Excursion (homework's)

A: Knowledge and Understanding

a1: Advanced Mathematic with practical applications, differential and Integral equations, Statistics methods, numerical mathematics. Mathematical and physical Modeling several Engineering subjects of Water resources and their management Methods of scientific research. Tidy development his methods of scientific thought to continue his scientific study and his professional works as civil engineer in field Water Resources Management and Environment.

a2: Engineering Principles in field of Water Resources Management and rural Engineering and Environment.

a3: Engineering Principles in field of Water Resources Management:
Irrigation and Land Use, Drainage Engineering and Land Reclamation, Advanced Hydraulics, Groundwater Hydraulics, Engineering Hydrology, Engineering Hydrogeology, Agricultural Soil and Water Chemistry, Protection and Conservation of Groundwater, Migration of contaminants, Ecology and Environment Protection, Maintenance and Rehabilitation of Well structures, Pumping test, Municipal and Industrial Water Management, Drinking water system modeling. Ability of application these Engineering Principles and development them.

a4: **Knowledge** related to Informatics and exploitation of Computing programmes in Practical Projects and in Master Thesis and Water Resources development and to solve several Engineering problems and show the innovation ability.

a5: Principles of sustainable environmental Engineering of water resources, Irrigation and Land Use, Drainage Engineering and Land Reclamation, Wastewater and air pollution and principles of beautiful Nature in design.

a6: Knowledge related to technologies of execution methods of engineering contracts and projects taking into consideration the economical Social and environmental input data.

a7: Ethics of exercises of professional and scientific work and their social and environmental reflections.

a8: Supply of graduate with required knowledge and understanding in accreditation principles and required common health and safety and other environmental subjects

a9: Supply the graduate with required knowledge in exercises of related professional systems and their criterions, cods, laws and legislation, especially Legislation of Water and Environment and stick to them.

a10: Supply the graduate with required ability knowledge to conflate the knowledge of civil engineering with all different fields, and execute an integral engineering project.

a11 Supply the graduate with related required scientific and practical strange terms.

ARS (Academic Reference Standard)

	ARS (Academic Reference Standard)											
Nr of Module and symbol	Module Name	National Academic Reference Standard NARS										Additional Standards
		a_1	**a_2**	**a_4**	**a_5**	**a_6**	**a_7**	**a_8**	**a_9**	**a_{10}**	**a_{11}**	**a_3**
	Modules in Mathematics and Natural Sciences											
MWRM 1	Advanced Mathematics	+		+							+	+
MWRM 2	Mathematical and physical Modeling	+		+							+	+
MWRM 3	Methods of scientific research	+									+	+
	Rural Water management											
MWRM 4	Irrigation and Land Use	+	+		+			+	+	+	+	+
MWRM 5	Drainage Engineering and Land Reclamation	+	+		+			+	+	+	+	+
	Hydro Sciences											
MWRM 6	Advanced Hydraulics		+							+	+	+
MWRM 7	Groundwater Hydraulics		+							+	+	+
	Specialization											
MWRM 8	Engineering Hydrology				+					+	+	+
MWRM 9	Engineering Hydrogeology				+					+	+	+
MWRM 10	Agricultural Soil and Water Chemistry	+			+						+	+
MWRM 11	Protection and Conservation of Groundwater	+			+					+	+	+
MWRM 12	Migration of contaminants	+			+					+	+	+
MWRM 13	Integrated Water Resources Management	+			+					+	+	+
	Elective Modules											
MWRM 14	Ecology and Environment Protection				+						+	+
MWRM 15	Maintenance and Rehabilitation of Well structures								+	+	+	+
MWRM 16	Pumping test						+			+	+	+
MWRM 17	Municipal and Industrial Water Management				+			+	+	+	+	+

MWRM 18	Drinking water system Modeling			+	+			+	+	+	+	+
	From these Courses students must select one course in each Semester 2 and 3											
	General Qualification											
MWRM 19	Water Rights and Conflict Resolution						+		+		+	+
	Practical Training/ Project Study											
MWRM 20	Practical Training/ Project Study		+	+	+	+	+	+	+	+	+	+
	Master Thesis with Defense											
MWRM 21	**Master Thesis with Defense**		+	+	+	+	+	+	+	+	+	+

B- Intellectual Abilities

b_1: Evaluation and choosing the suitable methods to solve the problems in field Water resources Management and make optimum solution to design several civil engineering in these Fields using suitable tools based on analytical and structural thought.

b_2: Evaluation and choosing the optimum solution of different geological, hydrological and hydro geological problems using suitable tools based on analytical thought.

b_3: Evaluation and choosing the optimum solution for design of irrigation and drainage networking and their related structures, in addition to the required pumping test using suitable tools based on analytical thought.

b_4: Evaluation and choosing the optimum solution for design of drinking and wastewater networks of and their related structures, in addition to the drinking water purification and wastewater treatment stations using suitable tools based on analytical thought.

b_5: Evaluation and choosing the optimum solution for water resources management and development using suitable tools and software based on analytical thought.

b_6**:** Implementation the acquired knowledge and the engineering principles to connect research, design and environment to develop water resources.

b_7: Integral application and connection the engineering knowledge and understanding the other engineering competences requirements to get innovative engineering solutions.

b_8: Offering the engineering solutions of civil engineering problems especially Water resources management, Irrigation, Drainage and sanitary engineering, based on finite resources and incongruent information.

b_9: Analysis of engineering systems and their components and evaluation their consequences.

b_{10}: Self-learning for dealing with modern innovative problems of civil engineering, especially water resources management, Irrigation, and sanitary engineering and technical new software.

b_{11}: Abilities to introduce the engineering solution of different problems of Water resources Management and development based on international scientific references and journals and other resources.

ARS(Academic Reference Standard)

	ARS(Academic Reference Standard)											
Nr of Module and symbol	Module Name	National Academic Reference Standard NARS								Additional Standards		
		b_1	**b_5**	**b_6**	**b_7**	**b_8**	**b_9**	**b_{10}**	**b_{11}**	**b_2**	**b_3**	**b_4**
	Modules in Mathematics and Natural Sciences											
MWRM 1	Advanced Mathematics			+		+	+	+	+			
MWRM 2	Mathematical and physical Modeling			+		+	+	+	+			
MWRM 3	Methods of scientific research			+		+	+	+	+			
	Rural Water management											
MWRM 4	Irrigation and Land Use	+			+	+	+	+	+		+	
MWRM 5	Drainage Engineering and Land Reclamation	+			+	+	+	+	+		+	
	Hydro Sciences											
MWRM 6	Advanced Hydraulics		+			+	+	+			+	+
MWRM 7	Groundwater Hydraulics					+	+	+			+	
	Specialization											
MWRM 8	Engineering Hydrology				+		+			+		
MWRM 9	Engineering Hydrogeology				+		+			+		
MWRM 10	Agricultural Soil and Water Chemistry	+			+	+	+	+				
MWRM 11	Protection and Conservation of Groundwater	+			+		+	+		+		
MWRM 12	Migration of contaminants	+			+		+	+		+		
MWRM 13	Integrated Water Resources Management	+	+	+	+	+	+	+	+	+	+	+
	Elective Modules											
MWRM 14	Ecology and Environment Protection				+		+		+			
MWRM 15	Maintenance and Rehabilitation of Well structures				+		+					
MWRM 16	Pumping test				+		+				+	+
MWRM 17	Municipal and	+			+	+	+	+				+

	Industrial Water Management											
MWRM 18	Drinking water system Modeling	+		+	+	+	+	+				+
	From these Courses students must select one course in each Semester 2 and 3											
	General Qualification											
MWRM 19	Water Rights and Conflict Resolution			+	+		+	+	+			+
	Practical Training/ Project Study											
MWRM 20	Practical Training/ Project Study	+	+	+	+	+	+	+	+	+	+	+
	Master Thesis with Defense											
MWRM 21	**Master Thesis with Defense**	+	+	+	+	+	+	+	+	+	+	+

C- Professional and Practical Skills

C_1: The development of Ability of obligation and restraint of the Professional systems Basics.

C_2: Ability to work within team and regulating, moving and leading the collective team.

C_3: Ability to appoint the practical application of mathematical laws in other engineering modules, and enter them in continuing professional development.

C_4: Ability to expect hazards and development, apply and improve the systems to manage and avoid them.

C_5: Ability to execute different engineering structures studies in fields Water, Irrigation, Water Resources Management and sanitary engineering taking into consideration the economical social and environmental output.

C_6: Ability to evaluate the geological cartography and execute different geological, hydrological and hydrological studies, and estimation the water resources and their management taking into consideration their impact on the other engineering studies and the economical social and environmental output.

C_7: Ability to study and design irrigation and drainage networks, land reclamation taking into consideration the economical social and environmental output.

C_8: Ability to execute profitable studies and making financial and time programmes of engineering projects. In addition to preparing and executing works plan to achieve the goals of corporation.

C_9: Ability to appoint of tools, software programs and different field engineering devices with obligation of professional safety basics.

C_{10}: Ability to use and appoint measurement devices, and execute related laboratory and fields experiments and analyzing the results.

ARS(Academic Reference Standard)

Nr of Module and symbol	**ARS**(Academic Reference Standard)										
	Module Name	National Academic Reference Standard NARS							Additional Standards		
		C_1	C_2	C_3	C_4	C_8	C_9	C_{10}	**C5**	**C6**	C_7
	Modules in Mathematics and Natural Sciences										
MWRM 1	Advanced Mathematics				+	+	+		+		
MWRM 2	Mathematical and physical Modeling		+	+	+	+	+	+	+	+	
MWRM 3	Methods of scientific research		+	+	+	+	+	+	+	+	
	Rural Water management										
MWRM 4	Irrigation and Land Use	+		+		+		+	+		+
MWRM 5	Drainage Engineering and Land Reclamation	+		+		+		+	+		+
	Hydro Sciences										
MWRM 6	Advanced Hydraulics					+	+	+	+	+	
MWRM 7	Groundwater Hydraulics					+	+	+	+	+	
	Specialization										
MWRM 8	Engineering Hydrology				+	+		+	+	+	
MWRM 9	Engineering Hydrogeology				+	+		+	+	+	
MWRM 10	Agricultural Soil and Water Chemistry	+		+		+		+	+	+	
MWRM 11	Protection and Conservation of Groundwater	+		+	+	+	+	+	+	+	
MWRM 12	Migration of contaminants	+		+	+	+	+	+	+	+	
MWRM 13	Integrated Water Resources Management	+	+	+	+	+	+	+	+	+	+
	Elective Modules										
MWRM 14	Ecology and Environment Protection		+		+	+	+	+	+	+	+
MWRM 15	Maintenance and Rehabilitation of Well structures	+	+	+	+	+		+	+		
MWRM 16	Pumping test	+	+	+		+	+	+	+	+	
MWRM 17	Municipal and	+	+	+	+	+	+	+	+		

	Industrial Water Management										
MWRM 18	Drinking water system Modeling	+	+	+	+	+	+	+	+		
	From these Courses students must select one course in each Semester 2 and 3										
	General Qualification										
MWRM 19	Water Rights and Conflict Resolution		+			+	+	+	+		
	Practical Training/ Project Study										
MWRM 20	Practical Training/ Project Study	+	+	+	+	+	+	+	+	+	+
	Master Thesis with Defense										
MWRM 21	**Master Thesis with Defense**	+	+	+	+	+	+	+	+	+	+

d- General Transferable Skills

D1: Ability to work active within team with several specializations.

D2: Ability to show active and personal skills in different work environments.

D3: Ability to development self-learning and follow of continuing learning processes.

D4: Ability to work within hard business work environment to achieve the required businesses in time, and in different limits.

D5: Ability to manage tasks and resources in active serious form.

D6: Ability to follow and use advanced technologies and software programs in field of civil engineering especially in water and environmental engineering.

D7: Ability to acquire skills of Projects management.

D8: Ability to expose the designs and proposals and writing the scientific reports.

D9: Ability to realize a relationship and discussion with other sides.

D10: Possession of skills of required strange languages to carry out the profession and follow-up the epistemic development.

ARS(Academic Reference Standard)

	ARS(Academic Reference Standard)										
Nr of Module and symbol	Module Name	National Academic Reference Standard NARS									Additional Standards
		D_1	**D_2**	**D_3**	**D_4**	**D_5**	**D_7**	**D_8**	**D9**	**D10**	**D_6**
	Modules in Mathematics and Natural Sciences										
MWRM 1	Advanced Mathematics			+						+	
MWRM 2	Mathematical and physical Modeling		+	+		+		+	+	+	+
MWRM 3	Methods of scientific research		+	+		+		+	+	+	+
	Rural Water management										
MWRM 4	Irrigation and Land Use	+		+	+	+	+	+	+		+
MWRM 5	Drainage Engineering and Land Reclamation	+		+	+	+	+	+	+		+
	Hydro Sciences										
MWRM 6	Advanced Hydraulics		+	+						+	
MWRM 7	Groundwater Hydraulics		+	+						+	
	Specialization										
MWRM 8	Engineering Hydrology	+		+	+	+		+	+		+
MWRM 9	Engineering Hydrogeology	+		+	+	+		+	+		+
MWRM 10	Agricultural Soil and Water Chemistry	+		+	+	+		+	+		+
MWRM 11	Protection and Conservation of Groundwater	+		+	+	+	+	+	+		+
MWRM 12	Migration of contaminants	+		+	+	+	+	+	+		+
MWRM 13	Integrated Water Resources Management	+	+	+	+	+	+	+	+	+	+
	Elective Modules										
MWRM 14	Ecology and Environment Protection	+	+	+	+	+	+	+	+	+	+
MWRM 15	Maintenance and Rehabilitation of Well structures	+	+	+	+	+	+	+	+		+
MWRM 16	Pumping test	+	+	+		+	+	+	+	+	+

MWRM 17	Municipal and Industrial Water Management	+	+	+	+	+	+	+	+		+
MWRM 18	Drinking water system Modeling	+	+	+	+	+	+	+	+		+
	From these Courses students must select one course in each Semester 2 and 3										
	General Qualification										
MWRM 19	Water Rights and Conflict Resolution	+	+	+	+	+	+	+	+	+	
	Practical Training/ Project Study										
MWRM 20	Practical Training/ Project Study	+	+	+	+	+	+	+	+	+	+
	Master Thesis with Defense										
MWRM 21	**Master Thesis with Defense**	+	+	+	+	+	+	+	+	+	+

4-Systems and special lists belong the evaluation of students and check of standards

Input the programme standards which agreed upon, for min. time for success and for each range (rate)				
Academic semester	1	2	3	4
Writing examination	Range between (60-70) of max. Notes of modules (100%).			
Oral test (interview)	Max. 50 % of term paper note of modules (30-40%).			
several tests (tutorial – Laboratory)	Max. 50 % of term paper note of modules (30-40%).			

5- Evaluation of Education aimed output of programme

Evaluator	tool	sample
Student of final Semester.	questionnaire	all students
Absolvent	Form pages	all absolvent
Appointment sides	Form pages	25% business holders
External checks	-	-
External checks	questionnaire	Education Staff members, some members from the University Quality guarantee center
Others	-	-

6- Books and references

* Academic university Book.
* Printed Lectures.
* Arabic and strange available references in the Faculty library.
* Scientific periodically journals.
* Internet website.

MODULE COMPENDIUM

Water Structures (MWS)

Master Programme

Tishreen University Lattakia

Department of Water Engineering and Irrigation

Faculty of Civil Engineering

2015

Developed by
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Goals of the program Master Course of Water Structures MWS

The academic plan in the Master course of water structures program, aims at providing the students the following items:

50. High level information in science and computer techniques, and developing the skills in engineering sciences and its applications.
51. Developing the ability of the students to achieve various water structures engineering studies, check and use it according to the engineering codes.
52. Comparing between the engineering solutions, and choose the optimum one.
53. Developing the works skills and regulate the relationship between the work team which the best and have many specialists.
54. Strengthening the research ability and developing and working with the modest software's, equipments… etc.
55. Developing the item of the scientific, social and cultural of the student's characters.
56. Continuous developing to get the high quality of the research, teaching…...etc.

2- Modules of Master Water Structures MWS

	Credits	**%**
Modules in Mathematics and Natural Sciences	15	13
Modules in Engineering	10	8%
Modules in Hydro Sciences	10	8%
Modules with Specialization	30	25%
Elective Modules	10	8%
Modules for general Qualification	5	4%
Practical Training /Project	10	8%
Master Thesis plus Defense	30	25%
Total	**120**	**100%**

Module Semester	**1**	**2**	**3**	**4**	**Total/ECTS**
Mathematics and Natural Sciences	10	5			**15**
Engineering	10	5	5		**20**
Hydro Sciences	10				**10**
Specialization		15	5		**20**
Elective Modules		5	5		**10**
General Qualification			5		**5**
Practical Training/ Project Study			10		**10**
Master Thesis plus Defense				30	**30**
Total	**30**	**30**	**30**	**30**	**120**

	Modules in Natural Sciences 10% - 25%		Modules inTechnical Sciences 10 - 25%		Modules in Economic & Social Sciences 5% - 15%		Modules in Variable Sciences 55% - 70%

Module Nr.	Course Semester	1	2	3	4	Total/ECTS
	Mathematics and Natural Sciences	**10**	**5**			**15**
MWS 1	Advanced Mathematics	5				**5**
MWS 2	Mathematical and physical Modeling	5				**5**
MWS 3	Methods of scientific research		5			**5**
	Engineering		5	5		**10**
MWS 4	Concrete of Water Structures			5		**5**
MWS 5	Geotechnical Engineering of Water Structures		5			**5**
	Hydro Sciences	**10**				**10**
MWS 6	Advanced Hydraulics	5				**5**
MWS 7	Hydro Dynamic of Water Structures	5				**5**
	Specialization	**10**	**15**	**5**		**30**
MWS 8	Water Structures and River Engineering		5			**5**
MWS 9	Advanced Engineering Hydrology	5				**5**
MWS 10	Dams and related Water Structures		5			**5**
MWS 11	Pumping and Hydro power Stations		5			**5**
MWS 12	Technology of Water Structures			5		**5**
MWS 13	Irrigation and Drainage Advanced	5				**5**
	Elective Modules		**5**	**5**		**10**
MWS 14	Advanced Geodesy					**5**
MWS 15	Drainage Engineering and Land Reclamation					**5**
MWS 16	Maintenance and Rehabilitation of Water Structures					**5**
MWS 17	Ecology and Environment Protection					**5**
MWS 18	Agricultural Soil and Water Chemistry					**5**
MWS 19	Integrated Water Resources Management					**5**
From these modules students must select one module for each of the 2nd and 3rd Semester						
	General Qualification			**5**		**5**
MWS 20	Water Rights and Conflict Resolution			**5**		**5**
MWS 21	**Practical Training/Project study**			**10**		**10**
MWS 22	**Master Thesis plus Defense**				30	**30**
	Total	**30**	**30**	**30**	**30**	**120**

3- Study Plan of Master Course Water Structures MWS

Nr of Module and symbol	Courses	S. 1	S. 2	S. 3	S. 4	Total/ECTS
	Modules in Mathematics and Natural Sciences					
MWS 1	Advanced Mathematics	3/2/0/2				**5**
MWS 2	Mathematical and physical Modeling	3/2/0/2				**5**
MWS 3	Methods of scientific research		3/2/0/2			**5**
	Engineering					
MWS 4	Concrete of Water Structures			3/2/0/2		**5**
MWS 5	Geotechnical Engineering of Water Structures		3/2/0/2			**5**
	Hydro Sciences					
MWS 6	Advanced Hydraulics	3/2/0/2				**5**
MWS 7	Hydro Dynamic of Water Structures	3/2/2/0				**5**
	Specialization					
MWS 8	Water Structures and River Engineering		3/2/2/0			**5**
MWS 9	Advanced Engineering Hydrology	3/2/2/0				**5**
MWS 10	Dams and related Structures		3/2/2/0			**5**
MWS 11	Pumping and Hydro power Stations		3/2/2/0			**5**
MWS 12	Technology of Water Structures			3/2/2/0		**5**
MWS 13	Irrigation and Drainage Advanced	3/2/2/0				**5**
	Elective Modules					
MWS 14	Advanced Geodesy		3/2/2/0	3/2/2/0		**5**
MWS 15	Drainage Engineering and Land Reclamation		0	0		**5**
MWS 16	Maintenance and Rehabilitation of Water Structures		0	0		**5**
MWS 17	Ecology and Environment Protection		0	0		**5**
MWS 18	Agricultural Soil and Water Chemistry		0	0		**5**
MWS 19	Integrated Water Resources Management		0	0		**5**
	From these modules students must select one module in each Semester 2 and 3					
	General Qualification					
MWS 20	Water Rights and Conflict Resolution			3/2/2/0		**5**
	Practical Training/ Project Study					

MWS 21	Practical Training/ Project Study			**10**		**10**
	Master Thesis with Defense					
MWS 22	**Master Thesis with Defense**				**30**	**30**
	Total	**30**	**30**	**30**	**30**	**120**

Lecture/Tutorial/Laboratory/Excursion (homework's)

4- Definition of the modules of Master Course Water Structures MWS

Mathematics and Natural Sciences		
Module Number	**Module Name**	**Prof. in Charge**
MWS 1	**Advanced Mathematics**	Prof. Dr.
Contents and Qualification aims	The module deals with understanding the basics of statistics and probability which cover the module Principles of probabilities:(the probability, the random events, the conditional probability, autonomy of the events), Bays formula (the first and second, Random variable, distribution function, discrete and connected variable, expectation standard deviation. In addition to the Differential equations such as The normal Differential equations of first order(solved and not solved as for derivative) and The Differential equations of higher order, The partial Differential equations. The students' knowledge will be developed with probability distributions and finding the relationship between the variables which give the students enough knowledge's and ability in these fields.	
Module Character	Advanced Mathematics: 4 Hours of lectures per week, 2 hour of tutorial.	
Prerequisite of attendance	Basic Knowledge of Advanced Mathematics (Differential equations and statistics and probability) is Water Engineering, Water Engineering and Irrigation, Civil Engineering, Environmental Engineering.	
Applicability	The module is one of 3 mandatory compulsory of the Mathematics and Natural Sciences of the master course of Water Structures. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 1.	
Proposal references	1. Erwin Kreyszig: **Advanced Engineering Mathematics**, 10^{th} ed., John Wiley& Sons, INC.ISBN 978-0-470-45836-5, 2011 1283 pages. 2. Wolfgang Ertel: **Advanced Mathematics for Engineers**, translated by Elias Drotle and Richard Cubek, Hochschule Ravensburg- Weingarten University of Applied Sciences, October 1, 2012.	

MWS 2	**Mathematical and physical Modeling**	**Prof. Dr**
Contents and Qualification aims	The module deals with understanding the basics of the mathematical and physical modeling in the water engineering, the models types, covering equations, the boundaries conditions, model execution and the calibration process, sensitivity analysis, verification model, validation model, prediction model, post- audit model, documenting and reporting the modeling study. The students' knowledge will be developed during tutorials and specialist software's which give the students enough knowledge's and ability in these fields.	
Module Character	Mathematical and physical Modeling: 4 hours of lectures per week, 2 hour of tutorial and laboratory experiments.	
Prerequisite of attendance	Basic Knowledge of Mathematical and physical Modeling are Water Engineering, Water Engineering and Irrigation, Civil Engineering, Environmental Engineering.	
Applicability	The module is one of 3 mandatory compulsory of the Mathematics and Natural Sciences of the Master Course of Water Structures and Coastal Engineering. The module is suitable for **the** professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 1.	
Proposal references	1. The physical, **mathematical and computational models**, University of Albetra. **.1.2.** 2. Umut Hanoglu: **Mathematical and Physical Modeling,** University of Nova Gorica, 2009. 3. Masato Nakamura: **Mathematical and Physical Modeling of Mixing and Flow Phenomena of Municipal Solid Waste Particles on a Reverse Acting Grate**, Columbia University, 2008, 198 pages.	

MWS 3	**Methods of scientific research**	**Prof. Dr.**
Contents and Qualification aims	The module deals with general and basic information about understanding; importance of scientific research; skills of scientific research; ethics of scientific research; methodology; preparing of scientific research protocol; design of experiment in laboratory or I the field; collecting and analysis of data; searching in references; searching in web; writing of scientific paper, writing of thesis and dissertation. The students' knowledge will be developed during training to write the scientific paper and preparing his scientific research protocol.	
Module Character	Methods of scientific research: 4 Hours of lectures per week, 2 hours of training per week.	
Prerequisite of attendance	Basic Knowledge of Methods of scientific research is Water Engineering, Water Engineering and Irrigation, Civil Engineering, Environmental Engineering.	
Applicability	The module is one of 3 mandatory compulsory of the Mathematics and Natural Sciences of the Master Course of Water Structures. The module is suitable for the research oriented studies in civil and environmental engineering	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 1.	
Proposal references	1. James E. Mauch and Namgi Park: **Guide to the Successful Thesis and Dissertation, A Handbook for Students and Faculty**. 2003. 5th ed. Copyright ©2003 by Marcel Dekker. 2. Louis Cohen; Lawrence Manion and Keith Morrison: **Research Methods in Education**, 2005, 5th ed. ISBN 0-203-22434-5 Master e-book ISBN. 3.Derek Swetnam: **Writing Your Dissertation, How to plan, prepare and present successful work**. 2007, 3rd ed. ISBN: 978 1 84803 126 5.	

Engineering		
Module Number	**Module Name**	**Prof. in Charge**
MWS 4	**Concrete of Water Structures**	Prof. Dr. Eng.
Contents and Qualification aims	The module introduces principles of Reinforced concrete, deformations stress situation, allow strains, critical situation, loads and safety factors, standard resistances, resistances Characteristics and Safety factors; elements subjected under central pressure items; elements subjected under central tension items; central controlled tensioning elements; elements subjected under Moment; ; elements subjected under Shear; continuing Beams; Slabs, which operate in two directions; Pipes from reinforced concrete, water reservoirs; canals from reinforced concrete (opened, hanged, flume, chute, crossing structures, bridges, culverts, conversed siphons, buried canals), supporting walls. The students' knowledge will be developed during tutorials and laboratory experiments to give the students enough knowledge and ability in these fields.	
Module Character	Concrete of Water Structures: 4 Hours of lectures per week, 2 hour of tutorial.	
Prerequisite of attendance	Basic Knowledge of Concrete of Water Structures are Water Structures and River Engineering, Irrigation and Drainage Networks, Advanced Hydraulics, Technology of Water Structures.	
Applicability	The module is one of 2 mandatory compulsory of the Engineering of the Master Course of Water Structures. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 3.	
Proposal references	1. **Manager Engineering: Reinforced Concrete Instruction for Liquid Retaining structures and/or Aggressive Environments**, Technical Standard, South Australian Water Corporation, May 2010. 2. **Concrete Storage Structures Use of the VSL Special Construction Methods**. VSL International LTD. Berne / Switzerland, MAY 1983. 3. Jeff Barenberg, P.E., Jeff Quaratino, P.E., and Don Allison, P.E.: **Design and Construction of Liquid- Tight Concrete Structures,Improving Performance**,TECH Briefs 2003 No 4.	

MWS 5	**Geotechnical Engineering of Water Structures**	**Dr. Eng.**
Contents and Qualification aims	The module introduces Geotechnical investigations of foundation of water structures; types of foundations of water structures, ; improve and sustainability of soils, Soil settlement and Foundation; design several types of foundation (surface foundations; deep foundations; piles; wells) ; improve of foundation; the stabilization and equilibrium of slopes. Design of buried Constructions. The students' knowledge will be developed during tutorials and computer programs and gives the students enough knowledge's and ability in these fields.	
Module Character	Foundation of Water Structures: 4 Hours of lectures per week, 2 hour of tutorial.	
Prerequisite of attendance	Basic Knowledge of Foundation of Water Structures are Water Structures and River Engineering, Irrigation and Drainage Networks, Advanced Hydraulics, Technology of Water Structures	
Applicability	The module is one of 2 mandatory compulsory of the Engineering of the Master Course of Water Structures. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 2.	
Proposal references	1. Evert C. Lawton, Ph.D., P.E. and Steven F. Bartlett, Ph.D., P.E.: **Introduction to Geotechnical Engineering**, The University of UTAH, 2. **Geotechnical Engineering Manual Geotechnical Engineering Section**, Minnesota University 2013.	

Hydro Sciences		
Module Number	Module Name	Prof. in Charge
MWS 6	**Advanced Hydraulics**	**Prof. Dr.**
Contents and Qualification aims	The module deals with restrictive layer and disturbed theory; unsteady flow in open Canals, Weirs; Connection structures and energy depression; Laboratory experiments, computing programs about these subjects. Boundary flow and its application in water engineering; similarity; principles of theoretical modeling of hydraulic phenomena; two-and three-dimensional flow and its application; and applications of electrical modeling in solving the flow equation. The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and Use some advanced software to give the students enough knowledge's and ability in these fields.	
Module Character	Advanced Hydraulics: 3 Hours of lectures per week, 2 hour of tutorial per week. 2 hour of Laboratory test per week	
Prerequisite of attendance	Basic Knowledge of Advanced Hydraulics is Bachelors of Water Engineering or Water Engineering and Irrigation or Civil Engineering or Environmental Engineering.	
Applicability	The module is one of 2 mandatory compulsory of the Hydro Sciences of the Master course of Water Structures. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one terms starting in Semester 1.	
Proposal references	1. Alan Vardy: **Fluid Principles**, McGraw-Hill (1990). 2. Herman Schlichting: **Boundary-layer theory**, McGraw-Hill (1979). 3. James A. Liggett: **Basic equations of unsteady flow, In Unsteady flow of open channels**, Water Resources Publications (1975). 4. William A. Miller and Jean A. Cunge: **Simplified equations of unsteady flow, In Unsteady flow of open channels**, Water Resources Publications (1975).	

MWS 7	**Hydro Dynamic of Water Structures**	**Prof. Dr. Eng.**
Contents and Qualification aims	The module deals with study the hydrodynamic structure flow around a vertical axis water turbine, in pump suction basins, in distribution structures zones, in spillway, stilling basins, weirs structures. The students' knowledge will be developed during tutorials and practical computer training and Use some advanced software to give the students enough knowledge and ability in these fields.	
Module Character	Hydro Dynamic of Water Structures:4 Hours of lectures per week, 2 hour of tutorial per week.	
Prerequisite of attendance	Basic Knowledge of Hydro Dynamic of Water Structures is Bachelor Water Engineering or Water Engineering and Irrigation or Civil Engineering or Environmental Engineering.	
Applicability	The module is one of 2 mandatory compulsory of the Hydro Sciences of Master Course of Water Structures. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 1.	
Proposal references	1. Zied Driss, Mohamed Ali Jemni, Amin helly, Mohamed Salah Abid: **Modeling and Analysis of the Hydrodynamic Structure around a Vertical Axis Water Turbine, Lecture Notes in Mechanical Engineering,** 2013, pp 245-252, springer verlag. 2. Harry Edmar Schulz, André Luiz Andrade Simões and Raquel Jahara Loboscom: **Hydrodynamics Optimizing Methods and Tools**, Published by intechweb, Copyright © 2011, ISBN 978-953-307-712-3,Printed in Croatia,434 pages. 3.Zhen-Gang Ji: **Hydrodynamics and Water Quality Modeling Rivers, Lakes and Estuaries**, a john wiley & sons, inc., publication, 2007	

Specialization		
MWS 8	**Water Structures and River Engineering**	Prof. Dr. Eng.
Contents and Qualification aims	The module deals with flood development and characteristic and mathematical modeling and simulation, river regulation and related structures such wears, spillway, culvert construction, crossing structures, aqueducts, siphons, Studying the relationship between this structures and natural catastrophes such huge floods and earthquakes. Use some advanced software to give the students enough knowledge's and skill (ability) in this fields. The students' knowledge will be developed during tutorials and practical computer training.	
Module Character	Water Structures and River Engineering: 4 Hours of lectures per week, 2 hour of tutorial per week.	
Prerequisite of attendance	Basic Knowledge of Water Structures and River Engineering is Bachelor of Water Engineering, Water Engineering and Irrigation, Civil Engineering, Environmental Engineering.	
Applicability	The module is one of the 6 mandatory compulsory of Specialization of the master course water structures. the module is suitable for the professional and research oriented studies in civil and environmental engineering	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60 % written exam and 40 % term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one terms starting in Semester 1.	
Proposal references	1. Pierre Y. Julien: River mechanics, Published in the United States of America by Cambridge University Press, New York, Cambridge University Press 2002. 2. Montanes J.L.: Hydraulic Canals " Design, construction, Regulation and Maintenances", Taylor and Frances, 2006. 3.Weiming Wu: **Computational River Dynamics, National Center for Computational Hydroscience and Engineering, University of Mississippi**, MS, USA, LONDON / LEIDEN / NEW YORK / PHILADELPHIA / SINGAPORE,, 2008 Taylor & Francis Group, London, UK. 4. P. Novak, A.I.B. Moffat and C. Nalluri ; R. Narayanan: **Hydraulic Structures**, Fourth edition published 2007 by Taylor & Francis 2 Park Square, Milton Park, Abingdon, Oxon OX144RN.	

MWS 9	**Advanced Engineering Hydrology**	Prof. Dr.
Contents and Qualification aims	The module deals with Air and climatic phenomena; rainfall; Evaporation; runoff and Floods; Watershed; Hydrograph analysis; Statistics and probability in hydrology; urban and small watershed hydrology; hydrological design of urban and rural drainage; hydrological design of control structures of flood; watershed modeling; and flood management. The students' knowledge will be deepened during tutorials and necessary laboratory experiments and practical computer training and Use some advanced software to give the students enough knowledge's and ability in these fields.	
Prerequisite of attendance	Engineering Hydrology: 4 Hours of lectures per week, 2 hours of tutorial Laboratory experiments per week.	
Applicability	Basic knowledge of Engineering Hydrology is Bachelor of Water engineering and environment or Water Engineering, Water Engineering and Irrigation or Civil Engineering or Environmental Engineering..	
Prerequisite to active credit points	The module is one of 6 mandatory compulsory of the Specialization of the Master Course Water Resources Management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 1.	
Proposal references	1. E. M. WILSON: **Engineering Hydrology**, 1984, 3rd ed. Hong Kong. 2. Ian WATSON; Alister D. B: **Hydrology**, 1995. 3. Victor Miguel Ponce, **Engineering Hydrology**, **Principles and practices**, ISBN 0-13-277831-9. 4. Elizabeth M. Shaw: **Hydrology in Practice**, 1994, 3rd edition. ISBN 0-203-01325-5 Master e-book ISBN. 5. ALASAAD, A.M.; AMMAR, GH. A. **Engineering Hydrology.** 2014, Tishreen university, 506 pgs.	

MWS 10	**Dams related Hydraulic Structures**	**Prof. Dr. Eng.**
Contents and Qualification aims	The module deals with modern design of the under cascade; design of Concrete dams provided with weirs; design of spillway, water intakes; spillway. Stilling basins, type of gates, execution of stability and monitoring equipment, other actual design methods. Use some advanced software to give the students enough knowledge and ability in these fields. The students' knowledge will be developed during tutorials and practical computer training.	
Module Character	Dams related Structures: 4Hours of lectures per week, 2 hour of tutorial per week.	
Prerequisite of attendance	Basic Knowledge of Dams related Structures are Water Structures and River Engineering, Irrigation and Drainage Networks, Technology of Water Structures	
Applicability	The module is one of the 6 mandatory compulsory of Specialization of the master course water structures. the module is suitable for the professional and research oriented studies in civil and environmental engineering	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Proposal references	1. Robin,Fill; Patrick Mac Greoger; David Stapledion: **Geotechnical engineering of Embankment Dams**, A.A. Balkema, P.o.B 1675,3000 BR, Roterdam, Neatherland, 1992. 2^{nd} ed.671 page. 2. **Design of Small Dams**, A Water Resources Technical Publication, Third Edition, 1987. United States Department of the Interior, Bureau of Reclamation,860 page. 3. Justin and Hinds: **Engineering for Dams**, Vol. 1 to III: by Crager, John Willy. 4. **Design of Small Dams**: USBR. 5. R.S. Varshney: **Concrete Dams**, Oxford and IBH Publishing Co.	

MWS 11	**Pumping and Hydro power Stations**	**Prof. Dr. Eng.**
Contents and Qualification aims	The module deals with problems hydraulic machines ; Potential energy; Basic Equation of pumps; types of pumps; working and connection of pumps; Pumping stations; water hammer and cavitation; used measurement instruments; renewable energy; type of hydroelectric power plants; type of turbines; power generation and environment. The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and Use some advanced software to give the students enough knowledge’s and ability in this fields.	
Module Character	Pumping and Hydro power Stations: 4 Hours of lectures per week, 2 hour of tutorial and Laboratory and experiments per week.	
Prerequisite of attendance	Basic Knowledge of Pumping and Hydro power Stations are Water Structures and River Engineering, Irrigation and Drainage Networks, Advanced Hydraulics, Hydro Dynamic of Water Structures.	
Applicability	The module is one of the 6 mandatory compulsory of Specialization of the master course water structures. the module is suitable for the professional and research oriented studies in civil and environmental engineering	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 2.	
Proposal references	1. James B. Rishel, P.E: **Water Pumps and Pumping Systems**, Copyright 2002. 2. David Stephnson: **Pipe Line Design for Water Engineers**, Second Edition (Completely revised) Elsevier Scientific Publishing Company, 1981. 3. R. S. Varshney, Nem Chand and Bross: **Hydro Power Structures.**	

MWS 12	**Technology of Water Structures**	**Dr. Eng.**
Contents and Qualification aims	The module introduces students to the construction process of Water structures in site. Through this module the students will be able to identify the steps to construct each structures element and the properties of construction process and used machinery. The students' must know how can calculate the costs of the construction and the time plan. The students' knowledge will be developed during tutorials and necessary laboratory experiments and Use some advanced software to give the students enough knowledge and ability in these fields.	
Module Character	Construction Technology of Harbors Structures: 4 Hours of lectures per week, 2 hour of tutorial and Laboratory, 2 hour of experiments per week.	
Prerequisite of attendance	Basic Knowledge of Construction Technology of Water Structure are Soil Mechanics and buried Construction, Water Structures and River Engineering, Irrigation and Drainage Networks.	
Applicability	The module is one of 6 mandatory compulsory of the Specialization of the master course of Water Structures. The module is suitable for the professional and research oriented studies in civil and environmental engineering	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 120 hours.	
Duration of the module	The module takes one term starting in Semester 3.	
Proposal references	• Specifications Volumes I - CPWD construction technologies cpwd.gov.in/Publication/Specs2009V1.pdf • Concrete technology and durability design, COWI company. • XIV National Conference on Structural Engineering, • Acapulco 2004, Offshore Structures – A new challenge,	

MWS 13	**Irrigation and Drainage Advanced**	**Prof. Dr. Eng.**
Contents and Qualification aims	The module deals with general and basic information about planning and design of the open and closed Irrigation and drainage networks, drop and drizzle Networks, Choose the regular and distribution elements, choose the most active methods to distribute and regulate the flow in the irrigation networks, Calculation of irrigation water lost, planning an active drainage network, and putting necessary exploitation and maintenance plans. Use some advanced software to give the students enough knowledge and ability in these fields.	
Module Character	Irrigation and Drainage Advanced: 4 Hours of lectures per week, 2 hour of tutorial per week.	
Prerequisite of attendance	Basic Knowledge of Irrigation and Drainage Advanced is Bachelor of Water engineering and environment or Water Engineering, Water Engineering and Irrigation or Civil Engineering or Environmental Engineering.. .	
Applicability	The module is one of 6 mandatory compulsory of the Specialization of the master course of Water Structures. The module is suitable for the professional and research oriented studies in civil and environmental engineering	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually	
Worked load	The work load is 150 hours	
Duration of the module	The module takes one terms starting in Semester 1.	
Proposal references	1. Frederick Haynes Newell: **Principles of Irrigation Engineering**. McGraw-Hill Publication (2010). 2. Etcheverry: **Irrigation Practice and Irrigation Engineering**. McGraw-Hill Publisher (2010). 3. Larry G. James: **Principles of Farming Irrigation System Design,** Washington State University (Wiley) (2004).	

Elective Modules		
Module Number	**Module Name**	**Prof. in Charge**
MWS 14	**Advanced Geodesy**	Dr. Eng.
Contents and Qualification aims	The module aims at giving the students new information about surveying methods in several parts, enables the students to read complex maps and topographic schemes, knowing some new surveying apparatus and doing measurements on it, using mathematical methods to handle these measurements, making topographic schemes to design several engineering projects. The students will be able to apply these projects. The student's knowledge will be developed during tutorials, using apparatus, and Use some advanced software to give the students enough knowledge and ability in these fields.	
Module Character	Advanced Geodesy: 4 Hours of lectures per week, 2 hour of tutorial.	
Prerequisite of attendance	Basic Knowledge of Geodesy is Bachelor Water Engineering or Water Engineering and Irrigation or Civil Engineering or Environmental Engineering.	
Applicability	The module is one of 6 Elective Modules of the Engineering of the Master Course Water Structures. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours	
Duration of the module	The module takes one term starting in Semester 2 or 3.	
Proposal references	1. Shepherd F.A.: **Advanced Engineering Surveying: Problems and Solutions (Paperback)**, Paperback 288 pages, 1982, Hodder Arnold, ISBN 9780713134162. 2. Gershberg, M.A.: **Geodesy**, Moscow 1967.	

MWS 15	**Drainage Engineering and Land Reclamation**	Prof. Dr.
Contents and Qualification aims	The module introduces students General Concepts of drainage and land reclamation; salinity in agricultural soils; saline soils remediation methods; calculation of water demand for washing the saltines, design of drainage networks (horizontal drainage of irrigated land; Vertical drainage of irrigated land); evaluation of the drainage method and land reclamation, and prepare the related researches. The students' knowledge will be developed during tutorials and tutorials and necessary laboratory experiments and Use some advanced software to give the students enough knowledge and ability in these fields.	
Module Character	Drainage Engineering and Land Reclamation: 4 Hours of lectures per week, 2 hour of tutorial and Laboratory and experiments per week.	
Prerequisite of attendance	Basic Knowledge of Drainage Engineering and Land Reclamation are Irrigation and Drainage Networks, Water Structures and River Engineering, Advanced Hydraulics, Mathematical and physical Modeling and Advanced Mathematics.	
Applicability	The module is one of 6 Elective Modules of the Engineering of the Master Course Water Structures. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one terms starting in Semester 2 or 3.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one terms starting in one Semester 2 or 3..	
Proposal references	1. H. P. Ritzema: **Drainage principles and applications**, (Editor-in-Chief) 1994. ILRI. ISBN: 90 70754 3 39. 2. Larry G. James**: Principles of Farming Irrigation System Design,** Washington State University (Wiley) (2004). 3. Ahmad, Nisar: **Participatory Irrigation Management**. Higher Education Commission, Islamabad, 2008. 4. Mc Comas, Murray R.: **Geology and Land Reclamation,** The Ohio Journal of Science. v72 n2 (March, 1972), 65-75. 5. **Land Reclamation and Planning**. 6. **Guidance for Planning Authorities on Drainage and Reclamation of wetlands**, consultation draft, 2011, Environment, Community and Local Government.	

MWS 16	**Maintenance and Rehabilitation of Water Structures**	**Dr. Eng.**
Contents and Qualification aims	The module introduces general introduction about the Water Structures, basics of safety, safety mettle in Water Structures parts, planning and management of Maintenance , principles of observation, apparatus and exchange pieces and its pick up, introduce the properties of characteristic of equipments of Water Structures, electrical nets in Water Structures, new informatics systems, advanced technical equipment of exploration and repair of damages, knowing of environment pollution reasons and methods of its protection, safe and rehabilitate the old Water Structures, Rehabilitation and consolidation of Water Structures in its environment, creation and instruction the required human skills and exporters, creation the required budget, priority of Maintenance workings, The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and Use some advanced software to give the students enough knowledge and ability in this fields.	
Module Character	Maintenance and Rehabilitation of Water Structures: 4 Hours of lectures per week, 2 hour of tutorial and Laboratory and experiments per week.	
Prerequisite of attendance	Maintenance and Rehabilitation of Water Structures are Water Structures and River Engineering, Irrigation and Drainage Networks.	
Applicability	The module is one of 6 mandatory elective modules of Master Course of Water Structures. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 2 or 3.	
Proposal references	1.Peter H. Emmons; Gajanan M. Sabnis: **Concrete Repair and Maintenance**, Galgotia Publication. 2. George Somerville: **Management of Deteriorating Concrete Structures**:, Taylor and Francis Publication. 3. Glenn Smock: **Guide to Concrete Repair**. US Department of the Interior Bureau of Reclamation, Technical Service. 4. John H. Bungrey; Stephen G. Millard and Michael G. Grantham: **Testing of Concrete in Structures**, Taylor & Francis Publication. 5. **Durability of Concrete and Cement composites**: C.L. Page & M.M. Page. Wood head Publishing. 6. I. Hassan: **Irrigation Networks**, 2011, Tishreen University.	

MWS 17	**Ecology and Environment Protection**	Prof. Dr.
Contents and Qualification aims	The module deals with understanding the actual environmental problems within drinking water, surface water resources and waste water. The module gives the students the ability to evaluate and choose the best solution to design the drinking and waste water nets and treatment station. In other hand the students can evaluate the quality of water resources using the possible and suitable equipment's based on analytical and structural thinking. In addition to provide students with practical steps and methodology to determine the environmental effects of direct and indirect project proposals, analyze, evaluate and prepare a report assessing the environmental impact of projects. The students' knowledge will be developed during the necessary laboratory experiments and practical computer training and use some advanced software to give the students enough knowledge's and ability in these fields.	
Module Character	Ecology and Environment Protection: 4 Hours of lectures per week, 2 hour of tutorial and Laboratory experiments per week.	
Prerequisite of attendance	Basic Knowledge of Ecology and Environment Protection are Water Structures and River Engineering, Irrigation and Drainage Networks, Advanced Hydraulics, Mathematical and physical Modeling and Advanced Mathematics.	
Applicability	The module is one of 6 elective modules of the Master course of Water Structures. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 2, or 3.	
Proposal references	1. Pratibha Singh, Piyush Malaviya and Anup Singh:Text **book of Environment and Ecology**,, A learning Pvt Ltd, New Delhi. 2. Joseph A. Salvato; P.E., Dee; Nelson L. Nemerow and Franklin J. Agardy, 2003. **Environmental Engineering**. JOHN WILEY & SONS, INC. ISBN 0-471-41813-7 (cloth).	

MWS 18	**Agricultural Soil and Water Chemistry**	Dr.
Contents and Qualification aims	The module deals with understanding the General Principles of chemistry, Chemical Arithmetic, Atomic Structure and The Periodic Table of elements, Chemical Bonding and Molecular Structure, State of Material, dissolution, Thermo chemistry, Chemical Kinetics, Chemical Equilibrium and Oxidation-Reduction Reactions. In addition to the chemical properties of the water and soil and related it to the concrete. The students' knowledge will be developed during the laboratory experiments and tutorial to give the students enough knowledge and ability in these fields.	
Module Character	Agricultural Soil and Water Chemistry: 4 Hours of lectures per week, 2 hour of tutorial and laboratory experiments.	
Prerequisite of attendance	Basic Knowledge of Agricultural Soil and Water Chemistry is Water Structures and River Engineering, Irrigation and Drainage Networks, Advanced Hydraulics, Mathematical and physical Modeling and Advanced Mathematics.	
Applicability	The module is one of 6 elective modules of the Master course of Water Structures. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 150 hours.	
Duration of the module	The module takes one term starting in Semester 2 or 3.	
Proposal references	1. Michael E. Essington: **Soil and Water Chemistry: An Integrative Approac**h, 2004, University of Tennessee, [CRC Press]. 2. Broder J. Merkel; Britta Planer- Friederich and Darrell Kirk Nordstrom: **Groundwater Geochemistry**, **A Practical Guide to Modeling of Natural and Contaminated Aquatic Systems**, 2005. ISBN 3-540-24195-7,Springer Berlin Heidelberg New York.	

MWS 19	**Integrated Water Resources Management**	Prof. Dr. Eng.
Contents and Qualification aims	The module introduce the conditions of water Exploitation as sufficient water storage, required quantity, influence of climate change on water resources, integrated planning of water resources exploitation using suitable software as WEAP, several using of water (as drinking water, irrigation, industry, tourism, environment flow, flood protection, river transport). The students' knowledge will be developed during tutorials and necessary laboratory experiments and practical computer training and use some advanced software to give the students enough knowledge and ability in these fields.	
Module Character	Integrated Water Resources Management: 4 Hours of lectures per week, 2 hour of tutorial and laboratory and experiments per week.	
Prerequisite of attendance	Basic knowledge of Integrated Water Resources Management are Water Structures and River Engineering, Irrigation and Drainage Networks, Advanced Hydraulics, Mathematical and physical Modeling and Advanced Mathematics.	
Applicability	The module is one of 6 mandatory compulsory of the Specialization modules of the Master Course Water Structures. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 2 or 3.	
Proposal references	1. Giupponi, C., D. A. J. Karssenberg, and P. H. Matt P. Hare: **Sustainable Management of Water Resources**: **An Integrated Approach**. Edward Elgar Publishing, 2006. 2. Warren Viessman Jr. and Timothy D. Feather: **Water Resources Planning in the United State**, American Society of Civil Engineers, Reston, VA, 2006.. 3. Loucks, D. P. and E. van Beek: Water Resources **Systems Planning and Management: An Introduction to Methods, Models and Applications**. UNESCO Publishing. 2005.	
From these modules, students must select one module for each of the 2nd and 3rd Semester.		

General Qualification		
Module Number	**Module Name**	Prof. in Charge
MWS 20	**Water Rights and Conflict Resolution**	Dr. Eng.
Contents and Qualification aims	The module introduces the laws and legislation of water use and environment in Syria, Arab country and in the world. The changes of water necessity in Syria; The conflict reasons related to water demand in the MENA area; The national and international water rights; water resources as a factor for improvement international relationship. The students' will be developed during seminars and representation.	
Module Character	Water Rights and Conflict Resolution: 4 hours of lectures per week. 2 hours of seminars and presentation.	
Prerequisite of attendance	Basic knowledge of Water Rights and Conflict Resolution is not necessary.	
Applicability	The module is the single mandatory general qualification of the Master Course Water Structures. The module is suitable for the professional oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes).	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 3.	
Proposal references	1. **Water Rights in Montana**, Montana University System Water Center, April 2012. 2. Stephen Hodgson: **Modern Water Rights Theory and Practice,** FAO Legislative Study.	

Practical Training/ Project Study		
Module Number	**Module Name**	**Prof. in Charge**
MWS 21	**Practical Training/ Project Study**	**Not definite**
Contents and Qualification aims	The Student must carry out practical training about one Problem belongs to subjects of Master Course of Water Structures in one or more institution or incorporation, and he must present full study about this problem.	
Module Character	Practical Training/ Project Study: 10 Hours tutorial per week	
Prerequisite of attendance	Basic Knowledge of Practical Training/ Project Study, the student must be in the 3rd Semester.	
Applicability	the module is suitable for the professional and research oriented studies in civil and environmental engineering	
Prerequisite to active credit points	Having passed the module seminar and presentation before a commission.	
Accredit points and grades	The module earns 10 Cr. The final Grade is generated with 100% as presentation in front of committee.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 300 hours.	
Duration of the module	The module takes one term starting in Semester 3.	
Proposal references	1. **Old Master, Bachelor thesis** and **Practical Training** reports which are available in the Libraries of the University. 2. James E. Mauch and Namgi Park: **Guide to the Successful Thesis and Dissertation, A Handbook for Students and Faculty**. 2003. 5th ed. Copyright ©2003 by Marcel Dekker. ISBN: 0-8247-4288-5.	

Master Thesis with Defense		
Module Number	**Module Name**	**Prof. in Charge**
MWS 22	**Master Thesis with Defense**	**Not definite**
Contents and Qualification aims	The Student must work Master Thesis with Defense about one Problem belongs to the subjects of Master Course of Water Structures in one or more institution or incorporation, and he must present full study about this problem.	
Module Character	Master Thesis with Defense: 30 Hours tutorial per week.	
Prerequisite of attendance	Basic Knowledge of Master Thesis with Defense, the student must be in 6th Semester.	
Applicability	the module is suitable for the professional and research oriented studies in civil and environmental engineering	
Prerequisite to active credit points	Having passed the module presentation before a omission.	
Accredit points and grades	The module earns 30 Cr. The final Grade is generated with 100% as presentation in front of committee.	
Frequency of the module	The module is offered in 4th semester	
Worked load	The work load is 900 hours	
Duration of the module	The module takes one term starting in Semester 4.	
Proposal references	1. James E. Mauch and Namgi Park: **Guide to the Successful Thesis and Dissertation, A Handbook for Students and Faculty**. 2003. 5th ed. Copyright ©2003 by Marcel Dekker. ISBN: 0-8247-4288-5. 2. Derek Swetnam: **Writing Your Dissertation, How to plan, prepare and present successful work**.2007, 3rd ed. ISBN: 978 1 84803 126 5. 3. Louis Cohen; Lawrence Manion and Keith Morrison: **Research Methods in Education**, 2005, 5th ed. ISBN 0-203-22434-5 Master e-book ISBN. 4. **Old Master and Bachelor thesis**, which are available in the Libraries of the University.	

5- Training Course of Master Water Structures

1- Training course: Study and carry out of immersion maps (plans) produced from supposed dam collapse using computing programs:

The course has been put to engineers working in field of dams engineering and water structures and water resources management. The goal of course is giving the engineers experience in executing and putting immersion maps produced from floods and supposed dam collapse and putting executed plans to reduce the humanity and materiality costs.

Course contents:

- Causes and machinery of flood occurrence (events);
- Methods of calculation of flood waves;
- Methods of defining of immersion lines;
- Causes and machinery of dam collapse occurrence;
- Putting measures (some regulation measures) to exploit the areas, which exist under stream of the dam and possible to immerse from the river valleys .

2- Training course: Calculation of Crop water requirements and design of Irrigation networks using computing programs:

The course has been put to engineers working in field of irrigation engineering, water structures, water resources management and agricultures engineering. The goal of course is giving the engineers experience in calculation and optimal design of opened and closed irrigation networks.

Course contents:

- Relationship between soil and water ;

Resources of irrigation water;

- Crop water management - Crop water requirements, measurements and irrigation scheduling
- Components of irrigation networks;
- Optimal planning and design of irrigation networks;
- Using of computer programs (software) in calculation of opened and closed irrigation networks ; Distribution and regulation of water flow in opened and closed irrigation networks;
- Irrigation project operation and maintenance ;
- GIS application in irrigation management.

3**-Training course: Water measurements**

The course has been put to engineers working in field of dams engineering, irrigation engineering, water structures and water resources management. The goal of course is giving the engineers experience of different **water measurement** of some water parameter related water structures ,rivers and groundwater.

Course contents:

- Inspection and observation of dams (settlement, seepage, evaluation of reading recorded water level in piezometers;
- Observation of parameters of Groundwater ;
- Observation of goodness of surface and groundwater;
- Climatically and hydro metrological measurements in river basins;
- Optimal planning and design of irrigation networks;
- Using of computer programs (software) in calculation of opened and closed irrigation networks ;
- Distribution and regulation of water flow in opened and closed irrigation networks.

Quality Management

Water Structures (MWS)

Master Programme

Tishreen University Lattakia

Department of Water Engineering and Irrigation

Faculty of Civil Engineering

2015

EDUWAT: 511251-TEMPUS-1-2010-1-DE-TEMPUS-SMHES
Development of a Modern Higher Education System for Water Engineering in Syria

Developed by

Prof. Dr. Eng. Izzeddin Hassan

Prof. Dr. Eng. Camille Bouras

Dr. Eng. Mounzer Hamad

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This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein	Tempus

Quality management and accreditation

University: Tishreen University
Faculty: Faculty of Civil Engineering

2- Specification of the Programme

2-1- Basic Data

- Programme name (MWS): Master course Water Structures

- Type of the Programme: single include one specific.

- Name of the participated Programmes: (none).
- Length of Programme (time): 4 Semester.
- Qualification (Certificate), which the Student get at End of the Programme: Master of Science (specialist of Water Structures).
- Language or the used Language in the Programme: Arabic is the main language. English Language is used to explain the scientific terms.
- **Place of Programme application**: University Campus, Building of Faculty of Civil Engineering.
- External Check Person:
- Date the latest acceptance of Specification of the Programme:

4-3- Professional Data

1-2-1- Message and Goal of the Programme

- **Notification of message and Goal of the Programme:**

The Department Water Engineering and Irrigation and Department of Environment Engineering in the Faculty of Civil Engineering in the Tishreen University undertake the preparation an excellent absolvent in the fields of Water Structures, qualified to continue his qualification and his professional development, able to compete and cover the need of the labour market in these Engineering fields. In addition to, the both Departments give a very good study and research plan aims to develop the scientific research and participation in professional and research projects.
Which contribute in supporting and covering the needs of development plans of the country, during the cooperation with the related scientific, research and service sides.

- Goals of the programme

The academic plan in the Master Course of Water Structures Program, aims at providing the students the following items:

57. High level information in science and computer techniques, and developing the skills in engineering sciences and its applications.
58. Developing the ability of the students to achieve various water Structures problems and water engineering studies, check and use it according to the engineering codes.
59. Comparing between the water engineering solutions, and choose the optimum one.
60. Developing the works skills and regulate the relationship between the work team which the best and have many specialists.
61. Strengthening the research ability, developing, and working with the modest software's, equipments… etc.
62. Developing the item of the scientific, social and cultural of the student's characters.
63. Continuous developing to get the high quality of the research, teaching…...etc.

1-2-2- Programme Composition and its Contents

a) Admission condition in the Programme: the admission will be done through the competition among the students, who have Bachelor in Fields: **Water Engineering, Water Engineering and Irrigation, Civil Engineering, Environmental Engineering.**

b) The conditions of success in the Programme:
Presence of theoretical, tutorial, and laboratory Lectures and present the required projects and scientific and laboratories reports.

c) Success from year to year: Success in all Modules in 1st and 2 nd Semester each studying year.

d) Completion of Programme:

Condition of accomplish of studying years	
1st year	Success in modules of 1st and 2nd semesters, the student can hold max. 2 Modules.
2nd year	- Success in modules of 3rd semesters, the student can hold max. 2 Modules from all foregone semesters - Success in modules of foregone semesters and Defense of Master Thesis in front of the commission.

e) Conditions of the completion of the Programme:

- Brief description of the kind of Practical Training/ Project Study:

The Student must carry out practical training about one Problem related to the subjects of Water Structures in one or more institution or incorporation, and he must present full study about this problem.

- **In which phase or phases of the programme this Practical Training/ Project Study is carried out :** This Study or Project must be carried out in the 3rd semester.
- **Number of Credit / or semesters for this Practical Training/ Project Study**: Offered in 3 rd semester with 10 cr. per week.

- **Description of evaluation procedures:** the evaluation should be done by a commission, which formed by the delegacy of faculty of civil engineering, the student must pass the module seminar and presentation in front of the commission.

- Brief description of the kind of Master Thesis

The Student must carry out Master Thesis with Defense about one Problem relate to the subjects of Water Structures in the 4th semester, and he must present full study about this problem in front of the commission.

- **In which phase from the programme the Master Thesis with Defense should be carried out:** This Master Thesis must be carried out in the 4th semester.

- Number of Credit / or semesters for this Masster Thesis with Defense:

Offered in 4th semester with 30 cr. per week.

- **Description of evaluation procedures:** the evaluation should be done by a commission, which formed by the delegacy of the faculty of civil engineering, the student must pass the module and presentation in front of the commission.

1-3- The Programme description:

The programme of Master course **Water Structures** based on theoretical lectures, laboratory meeting, Seminars scientific excursion approved in the study plan.

- Brief description of praxis experiences activity:

* Practical Project with report in dams and related structures projects;

* Practical Project with report in water engineering and irrigation networks projects;
* Practical Project with report in pumping stations projects
* Scientific excursion to water engineering;

- In which phase or phases of programmes the field experience should be introduce:

* Summer training in dams and related structures projects in 3rd semester;
* Summer training in irrigation networks projects in 3rd semester;
* Summer training in pumping stations projects in 3rd semester;
* Scientific excursion to water engineering projects in 1,2,3 semester.

2- Modules of Master Water Structures

		Actual		**Goal**		
Nr of Module and symbol		Credits	%	Credits	%	
	Modules in Mathematics and Natural Sciences	15	13%	12	10%	
	Modules in Engineering	10	8%	18	15%	
	Modules in Hydro Sciences	10	8%			
	Modules with Specialization	30	25%	42	35%	
	Elective Modules	10	8%			
	Modules for general Qualification	5	4%	6	5%	
	Practical Training /Project	10	8%	12	10%	
	Master Thesis plus Defense	30	25%	30	25%	
	Total	**120**	**100%**	**120**	**100%**	
	Module Semester	**1**	**2**	**3**	**4**	**Total/ECTS**
	Mathematics and Natural Sciences	10	5			**15**
	Engineering	10	5	5		**20**
	Hydro Sciences	10				**10**
	Specialization		15	5		**20**
	Elective Modules		5	5		**10**
	General Qualification			5		**5**
	Practical Training/ Project Study			10		**10**
	Master Thesis plus Defense				30	**30**
	Total	**30**	**30**	**30**	**30**	**120**
	Course Semester	**1**	**2**	**3**	**4**	**Total/ECTS**
	Mathematics and Natural Sciences	**10**	**5**			**15**
MWS 1	Advanced Mathematics	5				**5**
MWS 2	Mathematical and physical Modeling	5				**5**
MWS 3	Methods of scientific research		5			**5**
	Engineering		5	5		**10**
MWS 4	Concrete of Water Structures			5		**5**
MWS 5	Geotechnical Engineering of Water Structures		5			**5**
	Hydro Sciences	**10**				**10**
MWS 6	Advanced Hydraulics	5				**5**
MWS 7	Hydro Dynamic of Water Structures	5				**5**
	Specialization	**10**	**15**	**5**		**30**
MWS 8	Water Structures and River Engineering		5			**5**

MWS 9	Advanced Engineering Hydrology	5				**5**
MWS 10	Dams and related Water Structures		5			**5**
MWS 11	Pumping and Hydro power Stations		5			**5**
MWS 12	Technology of Water Structures			5		**5**
MWS 13	Irrigation and Drainage Advanced	5				**5**
	Elective Modules		**5**	**5**		**10**
MWS 14	Advanced Geodesy					**5**
MWS 15	Drainage Engineering and Land Reclamation					**5**
MWS 16	Maintenance and Rehabilitation of Water Structures					**5**
MWS 17	Ecology and Environment Protection					**5**
MWS 18	Agricultural Soil and Water Chemistry					**5**
MWS 19	Integrated Water Resources Management					**5**
From these modules students must select one module for each of the 2nd and 3rd Semester						
	General Qualification			**5**		**5**
MWS 20	Water Rights and Conflict Resolution			**5**		**5**
MWS 21	**Practical Training/Project study**			**10**		**10**
MWS 22	**Master Thesis plus Defense**				30	**30**
	Total	**30**	**30**	**30**	**30**	**120**
	Goal	**30**	**30**	**30**	**30**	**120**

3- Study Plan of Master Course Water Structures MWS

Nr of Module and symbol	Courses	S. 1	S. 2	S. 3	S. 4	Total/ECTS
	Modules in Mathematics and Natural Sciences					
MWS 1	Advanced Mathematics	3/2/0/2				**5**
MWS 2	Mathematical and physical Modeling	3/2/0/2				**5**
MWS 3	Methods of scientific re-search		3/2/0/2			**5**
	Engineering					
MWS 4	Concrete of Water Struc-tures			3/2/0/2		**5**
MWS 5	Geotechnical Engineering of Water Structures		3/2/0/2			**5**
	Hydro Sciences					
MWS 6	Advanced Hydraulics	3/2/0/2				**5**
MWS 7	Hydro Dynamic of Water Structures	3/2/2/0				**5**
	Specialization					
MWS 8	Water Structures and River Engineering		3/2/2/0			**5**
MWS 9	Advanced Engineering Hydrology	3/2/2/0				**5**
MWS 10	Dams and related Struc-tures		3/2/2/0			**5**
MWS 11	Pumping and Hydro power Stations		3/2/2/0			**5**
MWS 12	Technology of Water Structures			3/2/2/0		**5**
MWS 13	Irrigation and Drainage Advanced	3/2/2/0				**5**
	Elective Modules					
MWS 14	Advanced Geodesy		3/2/2/0	3/2/2/0		**5**
MWS 15	Drainage Engineering and Land Reclamation		0	0		**5**
MWS 16	Maintenance and Rehabili-tation of Water Structures		0	0		**5**
MWS 17	Ecology and Environment Protection		0	0		**5**
MWS 18	Agricultural Soil and Water Chemistry		0	0		**5**
MWS 19	Integrated Water Re-sources Management		0	0		**5**
	From these modules students must select one module in each Se-mester 2 and 3					
	General Qualification					
MWS 20	Water Rights and Conflict Resolution			3/2/2/0		**5**
	Practical Training/ Project Study					

MWS 21	Practical Training/ Project Study			**10**		**10**
	Master Thesis with Defense					
MWS 22	**Master Thesis with Defense**				**30**	**30**
	Total	**30**	**30**	**30**	**30**	**120**

Lecture/Tutorial/Laboratory/Excursion (homework's)

A: Knowledge and Understanding

a1: Advanced Mathematic with practical applications, differential and integral equations, Statistics methods, numerical mathematics. Mathematical and physical Modeling different Engineering subjects of Water Structures and their application and Execution. Methods of scientific research. Tidy development his methods of scientific thought to continue his scientific study and his professional works as civil engineer in field Water Structures and Environmental Engineering.

a2: Engineering Principles in field of Water Structures and rural Engineering and Environment.

a3: Engineering Principles in field of Water Structures: Irrigation networks Structures, Dams and related Structures, Canals, Aqueducts, Spillway, Inverted Siphons, River Engineering, Water Regulation in Irrigation Networks and rivers, Pumping and Hydro Power Stations, Maintenance and Rehabilitation of Water Structures. Protection and Conservation of sustainability of Water resources and Water Structures, Mathematical Modeling of several Water Structures. Ability of application these Engineering Principles and development them.

a4: Knowledge related to informatics and exploitation of Computing Programs in Practical Projects , in Master Thesis , Water Structures and to solve several Engineering problems and show the innovation ability.

a5: Principles of sustainable environmental Engineering of water resources, Irrigation and Land Use, Dams and related Structures, Canals, Aqueducts, Spillway, Inverted Siphons, River Engineering, Water Regulation in Irrigation Networks and rivers, Pumping and Hydro Power Stations and principles of beautiful Nature in design.

a6: Knowledge related to technologies of execution methods of engineering contracts and projects taking into consideration the economical Social and environmental input data.

a7: Ethics of exercises of professional and scientific work and their social and environmental reflections.

a8: Supply the graduate with required knowledge and understanding in accreditation principles and required common health and safety and other environmental subjects.

a9: Supply the graduate with required knowledge in exercises of related professional systems and their criterions, cods, laws and legislation, especially Legislation of Water and Environment and stick to them.

a10: Supply the graduate with required ability knowledge to conflate the knowledge of civil engineering with the different fields, and execute an integral engineering project.

a11 Supply the graduate with related required scientific and practical strange terms.

ARS(Academic Reference Standard)

	ARS(Academic Reference Standard)											
Nr of Module and symbol	Module Name	National Academic Reference Standard NARS										Additional Standards
		a_1	a_2	a_4	a_5	a_6	a_7	a_8	a_9	a_{10}	a_{11}	a_3
	Modules in Mathematics and Natural Sciences											
MWS 1	Advanced Mathematics	+		+			+			+	+	
MWS 2	Mathematical and physical Modeling	+		+			+			+	+	
MWS 3	Methods of scientific research	+		+			+			+	+	
	Engineering											
MWS 4	Concrete of Water Structures	+	+		+	+				+	+	+
MWS 5	Geotechnical Engineering of Water Structures	+	+		+	+				+	+	+
	Hydro Sciences											
MW**S** 6	Advanced Hydraulics	+								+	+	
MW**S** 7	Hydro Dynamic of Water Structures	+								+	+	
	Specialization											
MW**S** 8	Water Structures and River Engineering	+	+		+	+				+	+	+
MW**S** 9	Advanced Engineering Hydrology	+	+		+	+				+	+	+
MW**S** 10	Dams and related hydraulic Structures	+	+		+	+					+	+
MW**S** 11	Pumping and Hydro power Stations	+	+		+	+				+	+	+
MW**S** 12	Technology of Water Structures	+	+		+	+				+	+	+
MW**S** 13	Irrigation and Drainage Advanced	+	+		+	+				+	+	+
	Elective Modules											
MW**S** 14	Advanced Geodesy	+	+	+	+					+	+	+
MW**S** 15	Drainage Engineering and Land Reclamation	+	+	+		+			+	+	+	+
MW**S** 16	Maintenance and Rehabilitation of Water Structures	+	+		+	+	+		+	+	+	+
MW**S** 17	Ecology and Environment Protection	+	+		+			+	+	+	+	+
MW**S** 18	Agricultural Soil and Water Chemistry	+	+		+			+	+	+	+	+
MW**S**	Integrated Water	+	+	+	+	+	+	+	+	+	+	+

19	Resources Man-agement											
	From these modules students must select one module in each Semester 2 and 3											
	General Qualification											
MW**S** 20	Water Rights and Conflict Resolution					+	+		+	+	+	+
	Practical Training/ Project Study											
MW**S** 21	Practical Training/ Project Study		+	+	+	+	+	+	+	+	+	+
	Master Thesis with Defense											
MW**S** 22	Master Thesis with Defense		+	+	+	+	+	+	+	+	+	+

B- Intellectual Abilities

b_1: Evaluation and choosing the suitable methods to solve the problems in field Water Structures and make optimum solution to design different civil engineering in these Fields using suitable tools based on analytical and structural thought.

b_2: Evaluation and choosing the optimum planning of different hydraulics Structures and River Engineering using suitable tools based on analytical thought.

b_3: Evaluation and choosing the optimum solution for design of irrigation and drainage networks and their related structures, in addition to the required pumping Stations using suitable tools based on analytical thought.

b_4: Evaluation and choosing the optimum solution for design of dams and related structures and water intakes using suitable tools based on analytical thought.

b_5: Evaluation and choosing the optimum solution for water resources management and development using suitable tools and software based on analytical thought.

b_6: Implementation the acquired knowledge and the engineering principles to connect research, design and environment to protect and develop the water resources and the nature.

b_7: Integral application and connection the engineering knowledge and understanding the other engineering competences requirements, to get innovative engineering solutions.

b8: Offering the engineering solutions of civil engineering problems especially dams and other water structures and water resources management and development, irrigation and drainage networks and related Structures, based on finite resources and incongruent information.

b9: Analysis of engineering systems and their components and evaluating their consequences.

b10: Self-learning for dealing with modern innovative problems of civil engineering, especially dams and other water structures and water resources management and development, irrigation and drainage networks and related Structures and technical new software.

b_{11}: Abilities to introduce the engineering solution of several problems of water structures and Water resources management and development based on international scientific references and journals and other resources.

ARS(Academic Reference Standard)

	ARS(Academic Reference Standard)											
Nr of Module and symbol	Module Name	National Academic Reference Standard NARS								Additional Standards		
		b1	**b5**	**b6**	**b7**	**b8**	**b9**	**b10**	**b11**	**b2**	**b3**	**b4**
	Modules in Mathematics and Natural Sciences											
MWS 1	Advanced Mathematics	+	+	+	+	+		+	+	+		
MWS 2	Mathematical and physical Modeling	+	+	+	+	+	+	+	+	+		
MWS 3	Methods of scientific research	+	+	+	+	+	+	+	+	+		
	Engineering											
MWS 4	Concrete of Water Structures	+			+			+	+	+		
MWS 5	Geotechnical Engineering of Water Structures	+			+			+	+	+		
	Hydro Sciences											
MWS 6	Advanced Hydraulics	+			+	+	+	+	+	+		+
MWS 7	Hydro Dynamic of Water Structures	+			+	+	+	+	+	+		+
	Specialization											
MWS 8	Water Structures and River Engineering	+			+	+		+	+	+		+
MWS 9	Advanced Engineering Hydrology	+			+	+		+	+	+		
MWS 10	Dams and related hydraulic Structures	+			+	+		+	+	+		+
MWS 11	Pumping and Hydro power Stations	+			+	+		+	+	+		+
MWS 12	Technology of Water Structures	+			+	+	+	+	+	+	+	+
MWS 13	Irrigation and Drainage Advanced	+	+	+	+	+		+	+		+	
	Elective Modules											
MWS 14	Advanced Geodesy	+			+	+		+	+	+		
MWS 15	Drainage Engineering and Land Reclamation	+	+	+	+	+		+	+	+	+	
MWS 16	Maintenance and Rehabilitation of Water Structures	+			+	+	+	+	+	+		+
MWS 17	Ecology and Environment Protection	+	+	+	+	+	+	+	+	+		+
MWS 18	Agricultural Soil and Water Chemistry	+	+	+	+	+		+	+	+	+	
MWS 19	Integrated Water Resources Man-	+	+	+	+	+	+	+	+	+	+	+

	agement											
	From these modules students must select one module in each Semester 2 and 3											
	General Qualification											
MWS 20	Water Rights and Conflict Resolution	+	+	+	+	+	+	+	+	+	+	+
	Practical Training/ Project Study											
MWS 21	Practical Training/ Project Study	+	+	+	+	+	+	+	+	+	+	+
	Master Thesis with Defense											
MWS 22	**Master Thesis with Defense**	+	+	+	+	+	+	+	+	+	+	+

C- Professional and Practical Skills

C_1: The development of Ability of obligation and restraint of the Professional systems Basics,

C_2: Ability to work within team and regulating, moving and leading the collective team.

C_3: Ability to appoint the practical application of mathematical laws in other engineering modules, and enter them in continuing professional development.

C_4: Ability to expect hazards and develop, apply and improve the systems to manage and avoid them.

C_5: Ability to execute different engineering structures studies in fields dams and other water structures, river engineering, irrigation and drainage and related structures, water resources management and development taking into consideration the economical social and environmental output.

C_6: Ability to evaluate the geological cartography and execute different geological, hydrological and hydrological studies to establish different water structures engineering projects taking into consideration their impact on the other engineering studies and the economical social and environmental output.

C_7: Ability to study and design irrigation and drainage networks, land reclamation and canal networks and all related structures taking into consideration the economical social and environmental output.

C_8: Ability to execute profitable studies and make financial and time programs of engineering projects. In addition to preparing and executing work plan to achieve the goals of corporation.

C_9: Ability to appoint tools, software programs and different field engineering devices with obligation of professional safety basics.

C_{10}: Ability to use and appoint measurement devices, and execute related laboratory and fields experiments and analyzing the results.

ARS(Academic Reference Standard)

	ARS(Academic Reference Standard)										
Nr of Module and symbol	Module Name	National Academic Reference Standard NARS							Additional Standards		
		C_1	**C_2**	**C_3**	**C_4**	**C_8**	**C_9**	**C_{10}**	**C5**	**C6**	**C_7**
	Modules in Mathematics and Natural Sciences										
MWS 1	Advanced Mathematics			+	+	+		+	+		
MWS 2	Mathematical and physical Modeling			+	+	+	+	+	+		
MWS 3	Methods of scientific research	+	+	+	+	+	+	+	+		
	Engineering										
MWS 4	Concrete of Water Structures				+			+	+		
MWS 5	Geotechnical Engineering of Water Structures				+			+	+	+	+
	Hydro Sciences										
MWS 6	Advanced Hydraulics				+	+	+	+	+		+
MWS 7	Hydro Dynamic of Water Structures				+	+	+	+	+	+	+
	Specialization										
MWS 8	Water Structures and River Engineering		+		+			+	+		
MWS 9	Advanced Engineering Hydrology		+		+			+	+	+	
MWS 10	Dams and related hydraulic Structures		+		+			+	+		
MWS 11	Pumping and Hydro power Stations		+		+			+	+	+	+
MWS 12	Technology of Water Structures		+		+	+	+	+	+	+	+
MWS 13	Irrigation and Drainage Advanced		+		+			+	+	+	+
	Elective Modules										
MWS 14	Advanced Geodesy				+	+		+	+		+
MWS15	Drainage Engineering and Land Reclamation		+		+			+	+	+	+

MW**S** 16	Maintenance and Rehabilitation of Water Structures		+		+	+	+	+	+	+	
MW**S** 17	Ecology and Environment Protection	+	+		+	+	+	+	+		+
MW**S** 18	Agricultural Soil and Water Chemistry		+		+			+	+	+	+
MW**S** 19	Integrated Water Resources Management	+	+	+	+	+	+	+	+	+	
	From these modules students must select one module in each Semester 2 and 3										
	General Qualification										
MW**S** 20	Water Rights and Conflict Resolution	+	+	+	+	+	+	+	+	+	+
	Practical Training/ Project Study										
MW**S** 21	Practical Training/ Project Study	+	+	+	+	+	+	+	+	+	+
	Master Thesis with Defense										
MW**S** 22	**Master Thesis with Defense**	**+**	**+**	**+**	**+**	**+**	**+**	**+**	**+**	**+**	**+**

D- General Transferable Skills

D1: Ability to work actively within team with several specializations.

D2: Ability to show active and personal skills in different work environments.

D3: Ability to develop self-learning and follow a continuing learning processes.

D4: Ability to work within hard business work environment to achieve the required businesses in time and in different limits.

D5: Ability to manage tasks and resources in active serious form.

D6: Ability to follow and use advanced technologies and software programs in field of civil engineering especially in dams, other water structures, river Engineering and environmental engineering.

D7: Ability to acquire skills of Projects management.

D8: Ability to expose the designs and proposals and writing the scientific reports.

D9: Ability to realize a relationship and discussion with other sides.

D10: Possession of skills of required strange languages to carry out the profession and follow-up the epistemic development.

ARS(Academic Reference Standard)

	ARS(Academic Reference Standard)										
Nr of Module and symbol	Module Name	National Academic Reference Standard NARS									Additional Standards
		D_1	**D_2**	**D_3**	**D_4**	**D_5**	**D_6**	**D_8**	**D9**	**D10**	**D 7**
	Modules in Mathematics and Natural Sciences										
MWS 1	Advanced Mathematics	+		+		+	+		+	+	
MWS 2	Mathematical and physical Modeling	+		+		+	+		+	+	
MWS 3	Methods of scientific research	+		+		+	+	+	+	+	
	Engineering										
MWS 4	Concrete of Water Structures	+	+		+				+	+	+
MWS 5	Geotechnical Engineering of Water Structures	+	+		+				+	+	+
	Hydro Sciences										
MWS 6	Advanced Hydraulics			+		+	+		+	+	+
MWS 7	Hydro Dynamic of Water Structures			+		+	+		+	+	+
	Specialization										
MWS 8	Water Structures and River Engineering	+	+		+				+		+
MWS 9	Advanced Engineering Hydrology	+	+		+				+		+
MWS 10	Dams and related hydraulic Structures	+	+		+				+		+
MWS 11	Pumping and Hydro power Stations	+	+		+				+		+
MWS 12	Technology of Water Structures	+	+		+	+			+		+
MWS 13	Irrigation and Drainage Advanced	+	+		+				+		+
	Elective Modules										
MWS 14	Advanced Geodesy	+	+		+		+		+		+
MWS15	Drainage Engineering and Land Reclamation		+		+				+		+
MWS 16	Maintenance and Rehabilitation of Water Structures	+	+		+	+	+		+		+
MWS 17	Ecology and Environment Protection	+	+		+	+	+		+		+
MWS 18	Agricultural Soil and Water Chemistry	+	+		+				+		+
MWS 19	Integrated Water Resources Management	+		+		+	+	+	+	+	
	From these modules students must select one module in each Semester 2										

	and 3										
	General Qualification										
MWS 20	Water Rights and Conflict Resolution	+	+	+	+	+	+	+	+	+	+
	Practical Training/ Project Study										
MWS 21	Practical Training/ Project Study	+	+	+	+	+	+	+	+	+	+
	Master Thesis with Defense										
MWS 22	**Master Thesis with Defense**	**+**	**+**	**+**	**+**	**+**	**+**	**+**	**+**	**+**	**+**

4-Systems and special lists belong to the evaluation of students and check of standards

Input the programme standards which agreed upon, for min. time for success and for each rate				
Academic semester	1	2	3	4
Writing examination	Range between (60-70) of max. notes of modules (100%).			
Oral test (interview)	Max. 50 % of term paper note of modules (30-40%).			
several tests (tutorial – Laboratory)	Max. 50 % of term paper note of modules (30-40%).			

5- Evaluation of Education aimed output of programme

Evaluator	tool	sample
Student of final Semester.	questionnaire	all students
Absolvent	Form pages	all absolvent
Appointment sides	Form pages	25% business holders
External checks	-	-
External checks	questionnaire	Education Staff members, some members from the University Quality guarantee center
Others	-	-

6- Books and references

* Academic university Book.
* Printed Lectures.
* Arabic and strange available references in the Faculty library.
* Scientific periodically journals.
* Internet website.

Training Courses of suggested programmes

Tishreen University Lattakia

Department of Water Engineering and Irrigation
Faculty of Civil Engineering

2015

EDUWAT: 511251-TEMPUS-1-2010-1-DE-TEMPUS-SMHES
Development of a Modern Higher Education System for Water Engineering in Syria

Developed by
Prof.Dr. Eng. Izzeddin Hassan
Prof. Dr. Eng. Camille Bouras
Prof. Dr. Ali Al Asaad
Dr. Eng. Mohammad Dureid Al Addin
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This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein	Tempus

1- Training Course of Bachelor Water engineering and environment

- **Training course: Dam safety**
  The course has been put to engineers working in field, water structures, water resources management and in general engineering works. The goal of course is giving the absolvent the experience in field dam safety.

Course contents:

- Introduction to Dam safety
- Types of Dams
- Hydraulics inlet and outlet structures
- Causes of Dam failure
- The inspection program
- Dam safety laws
- Inspection of Dams and reporting
- Operation and maintenance of Dams and control structures
- Emergency actions and procedures.

- **Training course: Irrigation**
  The course has been put to engineers working in field, water structures, water resources management and in general engineering works. The goal of course is giving the absolvent the experience in field **irrigation**.

Course contents:
- Properties of agricultural lands;
- Properties of agricultural soils and Soil classification and characteristics;
- Irrigation hydraulic structures – storage reservoirs, spillways, canals, gates and check structures;
- Water conveyance, distribution, drainage and seepage;
- Crop water management - Crop water requirements, measurements and irrigation scheduling;
- Irrigation project operation and maintenance;
- GIS application in irrigation management.

- **Training course: Introduction to Water Resources**
  The course has been put to engineers working in field, water structures, water resources management and in general engineering works. The goal of course is giving the absolvent the experience in field **water resources.**

Course contents:
- Basic mathematics and computer skills related to water resources;
- Introduction to water resources engineering;
- Surface hydrology, Groundwater hydrology and Principles of groundwater hydrology and models;
- Soil classification – standard of soil classification, laboratory soil sieve analysis, soil porosity and density, etc.
- Principles in environmental engineering and science - Physical, chemical and biological processes in water and wastewater treatment systems and their relationship to the environment.

2- Training Course of Master Harbors Construction and Coastal Engineering

- **Training course: Shore Structures**

The goal of the course is definition of shore structures and methods of their design including sea waves breaker, vertical protection facilities and Sea quays.
The course have been suggested to engineers and specialists need more knowledge about Shore engineering basics and design sea and shore structures as waves breaker, vertical and oblique protection facilities and quays.

Course contents:

- Shore processes,
- Waves forecasting,
- Types of Shore Structures and influenced waves loads on them;
- Design of shore and sea structures.
-

- **Training course: Planning and designing of harbors**

The course has been put to engineers working in field of Planning and designing of harbors. The goal of course is developing of knowledge of absolvent about the Planning and designing of harbors.

Course contents:

- Planning of harbors;
- Shores processes;
- Sea waves breakers;
- Sea canals;
- Sea quays;
- Practical examples and case studies.

- **Training course: Sea waves breaker**

The course benefits the engineers, which work in designing of shore structures, especially sea wave breaker or which work as supervisor engineer of shore engineering projects.

Course contents:

- Knowing of several types of sea wave breaker and coefficient of defining their use.
- Engineering design of different sea waves breaker from initial to final design and accommodate of designing schemata and digital sections
- Impacts of establishing of sea wave breaker on neighbor shores.
- Executing and establishing of sea waves breakers.

3- Training Course of Master Water Structures

- **Training course: Study and carry out of immersion maps (plans) produced from supposed dam collapse using computing programs:**

  The course has been put to engineers working in field of dams engineering and water structures and water resources management. The goal of course is giving the engineers experience in executing and putting immersion maps produced from floods and supposed dam collapse and putting executed plans to reduce the humanity and materiality costs.

Course contents:

- Causes and machinery of flood occurrence (events);
- Methods of calculation of flood waves;
- Methods of defining of immersion lines;
- Causes and machinery of dam collapse occurrence;
- Putting measures (some regulation measures) to exploit the areas, which exist under stream of the dam and possible to immerse from the river valleys .

- **Training course: Calculation of Crop water requirements and design of Irrigation networks using computing programs:**

  The course has been put to engineers working in field of irrigation engineering, water structures, water resources management and agricultures engineering. The goal of course is giving the engineers experience in calculation and optimal design of opened and closed irrigation networks.

Course contents:

- Relationship between soil and water ;
- Resources of irrigation water;
- Crop water management - Crop water requirements, measurements and irrigation scheduling
- Components of irrigation networks;
- Optimal planning and design of irrigation networks;
- Using of computer programs (software) in calculation of opened and closed irrigation networks ; Distribution and regulation of water flow in opened and closed irrigation networks;
- Irrigation project operation and maintenance ;
- GIS application in irrigation management.

- **Training course: Water measurements**

  The course has been put to engineers working in field of dams engineering, irrigation engineering, water structures and water resources management. The goal of course is giving the engineers experience of different **water measurement** of some water parameter related water structures ,rivers and groundwater.

Course contents:

- Inspection and observation of dams (settlement, seepage, evaluation of reading recorded water level in piezometers;
- Observation of parameters of Groundwater ;
- Observation of goodness of surface and groundwater;
- Climatically and hydro metrological measurements in river basins;
- Optimal planning and design of irrigation networks;

- Using of computer programs (software) in calculation of opened and closed irrigation networks ;
- Distribution and regulation of water flow in opened and closed irrigation networks.

4- Training Course Master Water Resources Management

- **Training Course: Integrated water resources management**

  The course has been put to engineers working in field of sanitary engineering, irrigation engineering, water structures and water resources management. The goal of course is giving the absolvent the experience in field **Integrated water resources management**.

Course contents:

- Concept and principles of integrated water resources management;
- Management of water demand;
- System of evaluating and planning of water resources using program WEAP;
- Basics of water resources and components of water balance- practical examples;
- Water managements and evaluating of water resources- practical case;
- Construction of water data bases in GIS Environment;
- Construction of mathematical standard model ;
- Systems of coordinate and system of abortion and adaptation of work places of mathematical model;
- Connection between GIS and mathematical model.

- **Training Course: Water harvesting**

The course has been put to engineers working in field of irrigation engineering, water structures and water resources management. The goal of course is giving the absolvent the experience in field Water harvesting.

Course contents:

- Components of water harvesting system;
- Affecting Technical coefficients on using competence of water harvesting technologies;
- Technologies of water harvesting;
- Technical Evaluating of methods of water harvesting;
- Formation of rain storms and affecting coefficients on them;
- Methods of calculation of discharges in temporary streams;
- Mechanism of choosing the construction places of small dams;
- Engineering technologies of construction of water traps.
-

- **Training Course: Development of Water resources**

The course has been put to engineers working in field of irrigation engineering, water structures and water resources management. The goal of course is giving the absolvent the experience in field Development of water resources.

Course contents:

- Importance of hydrological studies and water measurements in estimating and exploiting of water resources;
- Study of Sedimentation in dams reservoirs;
- Methods of Exploitation of marine springs;
- Methods of sweetening of sea- and saltwater;
- Reuse of wastewater in Irrigation and other use;
- Increase of using efficiency in irrigation , drinking water and industry;

- Importance of understanding of concept of virtual water e and soft water path;
- Application some Computing programs and software in field of water resources management and saving it from pollution;

5- Training Course of Master Sanitary Engineering

- **Training course: Water supply networks**

  The course has been put to engineers working in field sanitary engineering, water structures and water resources management. The goal of course is giving the absolvent the experience in field Water supply networks.

Course contents:

- - Required database to design of Water supply networks;
- - Layout of water distribution networks;
- - Structures of tanking of drinking water;
- - Pumping stations of drinking water;
- - Hydraulically design of distribution of drinking water;
- - Principles and Structures of drinking water purification.
- - Application some Computing programs and software in field Water purification and supply networks.
-

- **Training course: Wastewater treatment and networks**

  The course has been put to engineers working in field sanitary engineering, water structures and water resources management. The goal of course is giving the absolvent the experience in field wastewater treatment and networks.

Course contents:

- Resources of wastewater;
- Unsteady behavior of wastewater;
- Hydraulical design of wastewater networks;
- Layout of collection networks of wastewater;
- Structures of tanking of wastewater;
- Pumping stations of wastewater;
- Principles and Structures of wastewater treatment;
- Application some Computing programs and software in field wastewater treatment and collection networks.

- **Training course: Study of Environmental Impact Assessment**

  The course has been put to engineers working in field sanitary engineering, water structures , water resources management and in general engineering works. The goal of course is giving the absolvent the experience in field Environmental Impact Assessment

  Course contents:

- Introduction to Environmental Impact Assessment;
- -Standard Elements of an Environmental Impact Assessment;
- Overview of Environmental Impact Assessment Tools;
- Environmental Impacts and Mitigation Measures to Be Considered in an EIA Process;
- Guidance on Possible Mitigation;
- Case Studies

MODULE COMPENDIUM

Agricultural Water Management (AWM)

Bachelor Programme

University of Aleppo

Faculty of Agricultural Engineering

2015

EDUWAT: 511251-TEMPUS-1-2010-1-DE-TEMPUS-SMHES
Development of a Modern Higher Education System for Water Engineering in Syria

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein

Preface

Basic contents of the education profiles	
Water Engineering	**Agricultural Water Management**
Focus of work: • Water supply • Drinking water • Urban waste water disposal • Water protection areas	**Focus of work:** • Agricultural irrigation and drainage • Water Resources Management • Water maintenance
Application fields: • Water authorities • Public utilities • Industrial enterprises • Enterprises for planning • Calculation and construction of plants	**Application fields:** • Agricultural and water authorities • Fields • Ecology and environment • Hydrology engineering
Main focus of education: • Drinking water supply and treatment • Industrial water supply • Urban waste water disposal • Industrial waste water disposal • Water protection areas • Waste water plant construction • Water quality	**Main focus of education:** • Agricultural irrigation systems • Agricultural drainage systems • Water harvesting • Storage engineering • Statics, construction • Soil science • Surface water • Groundwater

Basic education for all education profiles	
• Environmental law and water rights • Hydraulic • Waste water treatment • Water management	• Hydrology • Water supply • Land improvement • Soil and groundwater sciences

AU - Bachelor Course Agricultural Water Management – BAWM

	Credits	%
Modules with Basics in Mathematics and Natural Sciences	45	25%
Modules with Basics in Agriculture	20	11%
Modules with Basics in Engineering	25	14%
Modules with specialized Basics	30	17%
Elective Modules	20	11%%
Modules for general Qualification	10	6%
Practical Training /Project	15	8%
Bachelor examination	15	8%
Total	180	100%

Module Semester	**1**	**2**	**3**	**4**	**5**	**6**	**Total /ECTS**
Basics in Mathematics and Natural Sciences	**20**	**15**	**10**				**45**
Basics in Agriculture		**5**	**10**		**5**		**20**
Basics in Engineering	**5**	**5**	**10**	**5**			**25**
Specialized Basics				**10**	**10**	**10**	**30**
Elective Modules				**10**	**10**		**20**
General Qualification	**5**	**5**					**10**
Practical Training/ Project Study				**5**	**5**	**5**	**15**
Bachelor Theses incl. Defense						**15**	**15**
Total	**30**	**30**	**30**	**30**	**30**	**30**	**180**
Goal	**30**	**30**	**30**	**30**	**30**	**30**	**180**

Module Nr.	**Course Semester**	**1**	**2**	**3**	**4**	**5**	**6**	**ECTS**
	Basics in Mathematics and Natural Sciences	**20**	**15**	**10**				**45**
BAWM01	Mathematics	5	5	5				15
BAWM02	Statistics		5					5
BAWM03	Physics	5		5				10
BAWM04	Chemistry	5	5					10
BAWM05	Biology & Genetics	5						5
	Basics in Agriculture		**5**	**10**		**5**		**20**
BAWM06	Crop Production and Horticulture		5					5
BAWM07	Soil Science			5				5
BAWM08	Forest & Pastures Management					5		5
BAWM09	Agricultural Economy and Water Rights			5				5
	Basics in Engineering	**5**	**5**	**10**	**5**			**25**
BAWM10	Geodaesy/Topography				5			5
BAWM11	Meteorology		5					5
BAWM12	Fundamentals of Drawing and Farm Buildings			5				5
BAWM13	Computer Sciences	5						5
BAWM14	Hydraulics			5				5
	Specialized Basics				**10**	**10**	**10**	**30**
BAWM15	Water Ressources Management				5			5
BAWM16	Irrigation					5		5
BAWM17	Hydrology				5			5
BAWM18	Drainage						5	5
BAWM19	Ecology and Environmental Protection						5	5
BAWM20	Waste Water Discharge					5		5
	Elective Modules				**10**	**10**		**20**
BAWM21	Irrigation and Drainage Nets and Instruments				5			
BAWM22	Hydroinformatics				5			
BAWM23	Soil and Water Pollution					5		
BAWM24	Soil Water and Groundwater				5			
BAWM25	Water Quality and Water Treatment					5		
BAWM26	Watershed Managemen					5		
	General Qualification	**5**	**5**					**10**
BAWM27	English language	**5**						**5**
BAWM28	Arabic language and History		**5**					**5**
BAWM29	**Practical Training/ Project Study**				**5**	**5**	**5**	**15**
BAWM30	**Bachelor Thesis incl. Defense**						**15**	**15**
	Total	**30**	**30**	**30**	**30**	**30**	**30**	**180**

Curricula Structures - Bachelor Course Agricultural Water Management - BAWM

<table>
<tr><td>Semester 1</td><td rowspan="3">Mathematics</td><td>Physics</td><td rowspan="2">Chemistry</td><td>Biology & Genetics</td><td>Computer Sciences</td><td>English language</td></tr>
<tr><td>Semester 2</td><td>Statistics</td><td>Crop Production and Horticulture</td><td>Meteorology</td><td>Arabic language and History</td></tr>
<tr><td>Semester 3</td><td>Physics</td><td>Soil Science</td><td>Agricultural Economy and Water Rights</td><td>Fundamentals of Drawing and Farm Buildings</td><td>Hydraulics</td></tr>
<tr><td>Semester 4</td><td>Geodaesy/ Topography</td><td>Water Ressources Management</td><td>Hydrology</td><td colspan="2">Elective Modules</td><td rowspan="2">Practical Training/ Project Study</td></tr>
<tr><td>Semester 5</td><td>Forest & Pastures Management</td><td>Irrigation</td><td>Waste Water Discharge</td><td colspan="2">Elective Modules</td></tr>
<tr><td>Semester 6</td><td>Drainage</td><td>Ecology and Environmental Protection</td><td>Practical Training/ Project Study</td><td colspan="3">Bachelor Thesis incl. Defense</td></tr>
<tr><td>Credits</td><td>5</td><td>5</td><td>5</td><td>5</td><td>5</td><td>5</td></tr>
</table>

Modules in Natural Sciences 25%

Modules inTechnical Sciences 25%

Modules in Economic & Social Sciences 25%

Modules in Variable Sciences 25%

Module Number	**Module Name**	**Professor in Charge**
BAWM01	**Mathematics**	**Prof. Annan, Prof. Abbas, Dr. Naoum**
Contents and qualification aims	The module focuses on the one on linear algebra, analytic Geometry, single-and multi-dimensional differential and Integral calculus and special differential equations. In addition are solution methods for selected common treated differential equations. Derivations and limits, limited and unlimited integration, matrices and operations on matrices, definition and types of matrix, operations on matrices, solution of linear homogeneous equations using matrices method, special values and vectors, derivation of functions with one or more variable, extension according to Taylor and Mc-Lorn methods, definite integral and its engineering application, observation and modeling. Students have to continue familiarity with range, curve and surface integrals and integral sets of vector analysis. They able to apply systems of linear equations and Pictures, location and dimensional relationships of points, lines and Levels.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in physics and mathematics	
Applicability	The module is compulsory for the mathematical fundamentals of science education in the bachelor's degree Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam is a written examination (120 minutes for every semester).	
Frequency of the module	The module is offered in winter, summer and winter term.	
Credit points	The module earns 15 cr.	
Work load	Work load is 450 hours.	
Duration of the module	The module takes three terms.	
Suggested references	- Annan, T. - 1995, Mathematics, Aleppo University Publications - Annan, T. - 2009, Mathematics 2, Aleppo University Publications - Hannawi, A. - 2010, Mathematics 1, Aleppo University Publications - -Hanife, M. - 2014, Mathematics 1, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BAWM02	**Statistics**	**Prof. Annan, Dr. Jaddouh**
Contents and qualification aims	The module provides an introduction to the basics of stochastic and provides a selection of important cases of practical mathematical statistics in front. This is mainly due to practical engineering problems, such as received by hydrological or environmental problems. In addition, selected software is presented and involved. Students will learn statistical methods and procedures to work. They have to be prepared in amounts of data capable of statistically to evaluate and work problem-oriented. .	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in physics and mathematics	
Applicability	The module is compulsory for the mathematical fundamentals of science education in the bachelor's degree Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	- Jazmati, S. - 1993, Statistics and Errors, Aleppo University Publications - Annan, T. - 2002, Statistics, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BAWM03	**Physic**	**N.N.**
Contents and qualification aims	• **The module provides an overview of the physical basis of the mechanics, thermodynamics, electricity and magnetism, waves and atoms.** • **An introductory course in physics without calculus, covering mechanics (kinematics, dynamics, energy, and rotational motion), oscillations and waves, sound, light, and geometrical optics is given.** • **Errors and physicist quantum, temperature: manufacturing of thermal balances, linear thermal expansion of solids, surface expansion of solids, volumetric expansion of solids, expansion of fluids, expansion of gases, latent heat, gas laws.** • **The students will know the basics of physics and are in the Position that knowledge for recognizing and editing of specialized and interdisciplinary scientific issues to use it.** •	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in physics and mathematics	
Applicability	The module is compulsory for the mathematical fundamentals of science education in the bachelor's degree Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes for every semester), and seminar paper (50 hours).	
Frequency of the module	The module is offered in winter and winter term.	
Credit points	The module earns 10 cr.	
Work load	Work load is 300 hours.	
Duration of the module	The module takes two terms.	
Suggested references	- Hamo, A. - 2014, Physics for Engineers 1, Aleppo University Publications - Akshar, J.K. - 2010, Physics for Engineers 2, Aleppo University Publications - Issa, A; Akshar,J.K. - 2013, Physics for Engineers, Aleppo University Publications - Drau, W; Kayash, S. - 2009, Physics for Engineers (Practical Part), Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BAWM04	**Chemistry**	**Prof. Abdalla, Dr. Mesto, Dr. Ashkar**
Contents and qualification aims	• **The module consists the introduction to chemistry through study of atomic and molecular structure, radiation and nuclear chemistry, valence theory, coordination chemistry, periodic table, and states of matter. introduction to gases, solutions, acids, bases, and concept of equilibrium.** • **Periodic properties of the elements, geometry of molecules and molecular orbitals, chemical balance and the law of mass action, oxidation reactions and returns will be reviewed.** • **Design to survey organic chemistry and biochemistry and their impact upon daily existence.** Students learn theoretical and technical foundations of anorganic, organic and bio-chemistry, in the understanding of the reaction in aquatic systems.	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in chemistry, biology and mathematics	
Applicability	The module is compulsory for the mathematical fundamentals of science education in the bachelor's degree Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes for every semester), and labor examination (50 hours).	
Frequency of the module	The module is offered in winter and summer term.	
Credit points	The module earns 10 cr.	
Work load	Work load is 300 hours.	
Duration of the module	The module takes two terms.	
Suggested references	- Mehyo, A.; Abbasi, Z. - 2009, Organic Chemistry, Aleppo University Publications - Hassoun, N.; Alyousef, H. - 2009, Organic Chemistry, Aleppo University Publications - Hassoun, N.; Alyousef, H. - 2008, General and Analytical Chemistry (Practical part), Aleppo University Publications - Warde, Y. - 2011, Chemistry for Engineers, Aleppo University Publications - Hassoun, N.; Alyousef, H. - 2009, Organic Chemistry, Aleppo University Publications - Abdalla, H.; Zoubeide, A. - 2013, General and Analytical Chemistry, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BAWM05	**Biology & Genetics**	**Prof. Alzainab, Prof. Hamandush, Prof. Alsheikh Kaddour**
Contents and qualification aims	Focuses of the module are the principles of cell biology, physiology, ecology, genetics, and evolution. An introduction to the phylogeny, structure, function and adaptation of unicellular organisms, plants and animals in the biosphere. The occurrence and importance of microorganisms (especially bacteria) in the biosphere. An introduction to the microbiology of soil, water, plants, food, and animals. Basic concepts of population genetics (mutation, gene flow, natural selection, genetic drift). Principles and concepts of genetics as revealed by classical and modern investigation. Topics will emphasize the interaction of microbial genetics with molecular biology and biotechnology.	
Module character	5 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in biology and chemistry	
Applicability	The module is compulsory for the mathematical fundamentals of science education in the bachelor's degree Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	- Banoud, A.; Nabghali, N. - 2003, Chemistry and Microbiology, Aleppo Universit Publications - Aswad, W. - 1997, Genetics Science, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BAWM06	**Crop Production and Horticulture**	**Prof. Tarabishi, Dr. Marouf**
Contents and qualification aims	The module cares about botany in general and in the production of crops and horticulture in particular, molecular composition of plant cell, membrane structure and function, chromosome, plant tissues, root and stem, structure of leaf. reproductive organs, flower, fruit. It also includes the basics of crop production and types (grain crops, legumes, fiber crops, sugar crops and industrial crops) and especially those that grow in the region. Add to display the principles of horticulture, which includes the production of vegetables and fruit trees of all kinds, and the production of flowers and ornamental plants. Students got from this decision, general information and basic in general botany, crop production and horticulture.	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in biology and chemistry	
Applicability	The module is compulsory for engineering fundamentals training in the bachelor's degree Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), the excursion documentation (20 hours), and a written term paper (30 hours).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	- Follett, R.F.; Stewart, B.A. – 1985 Soil Erosion and Crop Productivity, American Society for Agronomy - Nahhal, I. - 2003, Dendrology, Aleppo University Publications - Hamwi, M.; Kardoush, M.; Alsahhar, M.; Borak, S. – 1998 Horticulture and Vegetables, Aleppo University Publications - Tarabishi, Z.; Gharibo, G.; Arab, S.; Assani, M. – 2005 Crop Production, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BAWM07	**Soil Science**	**Prof. Saddik, Prof. Nanna**
Contents and qualification aims	The module focuses on basics of soil science with special emphasis on soil geology, hydrogeology, physical, chemical and biological soil properties, soil development and classification of soils as well as principles of the geologic and geotechnical relationships concerning unconsolidated and solid rock in deeper layers. The theoretical knowledge will be completed by regional and applied aspects for agriculture, forestry and water management. The students are proficient in fundamental aspects of soils to assess soils relating to their chemical and physical characteristics.	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in geology, physics and mathematics	
Applicability	The module is compulsory for engineering fundamentals training in the bachelor's degree Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), labor examination (50 hours), and the excursion documentation (20 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	- Summer, M. E. - 2000, Soil Science, CRC Ress Publications - Abbasi, Z.; Sadik, M.A.; Aljerdi, A. - 1990, Soil Science, Aleppo University Publications - Dermosh, K; Kamel, W.;Safar, T. - 1999, Soil Science, Aleppo University Publications - Kadaan, N. - 2007, Soil Mechanic, Aleppo University Publications - - Seraj Eldin, M. Kh. – 2013, Soil Mechanic (Practical part), Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BAWM08	**Forest & Pastures Management**	**Dr. Khatib,, Dr. Mansour, Dr. Malekh**
Contents and qualification aims	The course covers all topics related to forests and forest trees, pastures and vegetation, and is particularly interested in studying the bioclimates and trees appropriate for each region, and interests in the environment of trees and spread, as well as to invest and protect forest fires. In the area of pastures and rangeland environments covers the most common plants in each region and the classification of plants and ways to propagate and cultivate and maintain, as the value of pastoral care or food for these plants. Student gets full knowledge in the area of forests in terms of nature spread and the trees grow, preservation and protection, in addition to knowledge of the pasture areas of plants and the most important pastoral value, importance and propagate.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in biology and chemistry	
Applicability	The module is compulsory for engineering fundamentals training in the bachelor's degree Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), the excursion documentation (20 hours), and a written term paper (30 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	- Rahme, A.; Nahhal, I.; Shalabi, M.N. - 1998, Forstery, Aleppo University Publications - Nahhal, I. - 2003, Dendrology, Aleppo University Publications - Sankari,M.N. – 1987, Pastures Plants, Aleppo University Publications - - Sivakumar, M.V.K.; Zöbisch, M.A.; Maukonen, T. – 1988, Wind Erosion ICARDA Publications	

Module Number	**Module Name**	**Professor in Charge**
BAWM09	**Agricultural Economy & Water Rights**	**Prof. Abdellatif**
Contents and qualification aims	The module worked with fundamentals of the economy and its terms. The overall economic system, how it works, and the instruments used to solve social problems. Emphasis will be on decision-making involving the entire economic system and segments of it. Focus to be on management of the various components and the entire system, types of problems confronted now and in the future. Nature and organization of agricultural and food markets as economic institutions. Spatial and temporal price relationships, and the role of market structure. Water pricing, water unit productivity, water costs, water use, demand, supply alternatives, and water rights as well as water law and international conventions on water will be covered in the module. These include basics of constitutional law and selected civil liberties, fundamentals of general administrative law, international contracts. Students will be able to understanding the fundamentals of economy and they have idea about the structure and organization of Syrian's agriculture-food system, the operation, financing, linkages, and functions of its components. Also they will understand the topic of water pricing and water rights.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in mathematics	
Applicability	The module is compulsory for engineering fundamentals training in the bachelor's degree Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam is a written examination (120 minutes).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	- Abou Ayash, A.; Alsaddi, F. – 1989, Engineering Economy, Damascus University Publications - Abdellatif, A. – 2004, Agricultural Economy, Aleppo University Publications - - Safar, T.; Aldarir, A.N. -2003, Water Resources, Aleppo University Publications	

Module Number	Module Name	Professor in Charge
BAWM10	**Geodesy/Topography**	**Prof. Barbara**
Contents and qualification aims	The module Geodesy contents Fundamentals of geodetic measurements; astronomical observations; Surveying applications for engineering, construction, mining and transportation work. General concepts of surveying, main principles of errors theory, surveying instruments, distances, angles and directions measurement, leveling and elevations measurement, detail survey. Used to perform benchmark circuits, profile leveling, topographic maps and straight line extensions. Surveying work and planning irrigation and drainage networks, leveling agriculture lands. Evaluation of the structure of soil cover: Also it was used principles of geographic and land information systems and their use in spatial analysis and information management. A total station, computer programs and use of GPS are introduced. Students acquire skills for the Surveying and staking of agricultural objects, they will use basic principles of geographic and land information systems and their use in spatial analysis and information management.	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in physics and mathematics and statistics	
Applicability	The module is compulsory for engineering fundamentals training in the bachelor's degree Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	- Najem, W. - 2003, Geodesy 1, Aleppo University Publications - Najem, W. - 2007, Geodesy 2, Aleppo University Publications - Osman, I. - 1998, Geodesy 3, Aleppo University Publications - Zeini, A. - 2006, Topographic Geodesy, Aleppo University Publications - - Najem, W. - 2012, Geographical information systems, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BAWM11	**Meteorology**	**Dr. Kawwas, Dr. Kelani**
Contents and qualification aims	The module provides an introduction to the Meteorology, it imparts a broader meteorological and climatological knowledge and an overview of the meteorological data collection. It includes following skills: physical description of meteorological elements (pressure, temperature, wind, humidity, radiation); Thermodynamics of dry and moist air, cloud and precipitation formation; Heat balance of the soil and the atmospheric boundary layer; Atmospheric dynamics; Fundamentals of Weather and Climatology. These include in particular the basic principles; assessment procedures for all components of the water balance. The module consists besides the climate, its foundations and its variability meteorological instruments, stations and data are an essential Focus. Students are able to describe the major atmospheric phenomena and processes on a physical basis. They are also able to analyze meteorological data, as well as of methods of observation and modeling.	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in physics and mathematics	
Applicability	The module is compulsory for engineering fundamentals training in the bachelor's degree Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	- Abbas, J. - 1995, Climate and Meteorology, Aleppo University Publications - Kawwas, S.; Kelani, S. - 2009, Climate and Meteorology, Aleppo University Publications - Najem, W. - 2012, Geographical information systems, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BAWM12	**Fundamentals of Drawing and Farm Buildings**	**Dr. Alsaleh**
Contents and qualification aims	• **The module consists lectures and discussions of current topics related to Architecture engineering. Studies in analysis, design, test, and construction of buildings.** Analysis and design of structures to house animals and plants and to process and store animal and plant products. Introduction to environmental control systems and animal waste management. The analyses of heat and water vapour transfer through the structure of buildings are used to design heating, ventilation and refrigeration systems. Heat conduction and convection as well as radiation are included in the analysis of heat transfer. Ventilation systems are designed for livestock shelters, produce storages and greenhouses. Student will be able to draw and construct small building which use to storage products or which use as animals houses.	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in physics and mathematics	
Applicability	The module is compulsory for engineering fundamentals training in the bachelor's degree Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and seminar paper (50 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	- Aldarir, A. N.; Ibrahim, Z. - 1994, Farm Buildings, Aleppo University Publications - Sawaf, M - 2007, Engineering Drawing, Aleppo University Publications - Shamas, N.; Istanbuli, Z. - 1993, Geometric Representation, Aleppo University Publications - - Aldarir, A. N.; Ibrahim, Z. - 2010, Agricultural Buildings, Alfurat University Publications	

Module Number	**Module Name**	**Professor in Charge**
BAWM13	**Computer Sciences**	**Prof. Annan**
Contents and qualification aims	The module covers the fundamentals of the application possibilities in editing scientific and technical issues. This includes the use of widely available and developing their own problem-specific tools or Software components. Computer modeling to automate and simulate construction operations. Techniques and approaches for integrating digital data sources with engineering spatial databases. Approximation of boundary value and initial value problems; variational methods, hybrid and mixed method; convergence and accuracy of finite element approximations; recent developments, advanced applications. Students will be able to edit quantitative Problems and appropriate methods of Hydro Systems Analysis apply. This includes the selection, use and the development of software and software components.	
Module character	5 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in physics, mathematics and active computer skills	
Applicability	The module is compulsory for engineering fundamentals training in the bachelor's degree Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and seminar paper (50 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	- Aldobiat, M.; Annan, T. - 1995, Computers and Programming, Aleppo University Publications - Abdalli, H.; Alabdalla, S. A. - 1996, Computers and Programming, Aleppo University Publications - - Annan, T. - 2014, informatics Technology and Programming, Aleppo University Publications	

Module Number	Module Name	Professor in Charge
BAWM14	**Hydraulics**	**Dr. Naoum**
Contents and qualification aims	The module provides an introduction to the Hydraulics. In focus of Hydromechanics represents the hydrostatic dealing with liquids at rest. Based on the physical properties of water pressure distributions, level surfaces, compressive forces are treated on flat and curved surfaces, buoyancy and swimming and floating stability. n the second part of the module are basic knowledge for hydrodynamics, the theory of the motion of fluids and the interaction with the boundaries of the flow region, mediated. Starting from the basic conservation laws of Hydromechanics laminar and turbulent flow in pipes and open channel flow are explained in the stationary case. This module includes an internship in the lab with Experiment. Fluid properties; hydrostatics; flow concepts; continuity, energy, and momentum equations and applications; flow measurements, pipe and channel flow. The students learn with the latest measuring technology to deal and to interpret the ways to carry out a hydraulic model experiment and evaluate the test results and apply them to the outdoors.	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Knowledge in physics, higher mathematics	
Applicability	The module is compulsory for engineering fundamentals training in the bachelor's degree Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	- Shamas, N.; Arab, H. - 1994, Hydraulics 1, Aleppo University Publications - Kazan, N. - 1985, Hydraulics, Aleppo University Publications - Alrifai, M. F. - 1983, Fundamentals of Hydraulics, Aleppo University Publications - - Alrifai, M. F. - 1985, Hydraulics (Practical Part), Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BAWM15	**Water Resources Management**	**Dr. Khouri**
Contents and qualification aims	The module consists terminology and principles of water resources such as rains, floods, rivers and groundwater. Occurs after use of the elements of the water balance and placement of task-relevant methods of data collection and processing an introduction to various methods of water budget calculations. Studying water resources management, as surface runoff and its extremes: floods and draughts. Water resources modeling, water balance, models of significant rainfall-runoff events, groundwater flow, groundwater collection, wells are topics.. Design and management of surface and groundwater systems; use of mathematical programming, simulation, and economic theory. Strategies and concepts of integrated water resources management are part of the module. Additionally strategies to consider the socio-economical and political framework as well as the capacity development are introduced. The students are able to analyze tasks of management and management optimization of water resources and to find solutions of the regional boundary conditions.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in mathematics and advanced knowledge in hydromechanics and soils	
Applicability	The module is a compulsory module for specialized training in the bachelor's degree Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam is a written examination (120 minutes).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	- Alshami, Ch. - 1987, Water Resources, Damascus University Publications - - Safar. T.; Aldarir, A.N. - 2003, Water Resources, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BAWM16	**Irrigation**	**Prof. Aldarir**
Contents and qualification aims	The module includes principles of irrigation as the sources of water, the relationship between plant, soil and water, use of water for transpiration and evaporation (eva-potranspiration), crop water requirements, irrigation water supply, fertigation, water balance equation, control and management of irrigation water distribution, general fra-mework with special regard to semi arid areas. It contents also main types of irrigation systems (basin irri-gation, furrow irrigation, border irrigation, sprinkler irrigati-on, drip irrigation, and underground irrigation), scheduling the irrigation and economical study. Students having full knowledge about irrigation projects, they will be able to design, construction and management of irrigation projects, and evaluation of modern irrigation systems in practice.	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in mathematics and advanced knowledge in hydromechanics and soil	
Applicability	The module is a compulsory module for specialized training in the bachelor's degree Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	- Jensen, M. E. - 1983, Farm Irrigation System, American So-ciety of Agricultural Engineering - Abbas, J;. Aldarir, A.N. - 1995, Irrigation and Drainage, Aleppo University Publications - Safar, T.; Aldarir, A.N. - 1997, Agricultural Irrigation, Aleppo University Publications - Stewart, B.A.; Nelsen, D.R.. - 1990, Irrigation of Agricultural Crops, American Society of Agronomy - - Aldarir, A.N.; Alhaj Houssein, M. - 2008, Agricultural Irriga-tion and Drainage, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BAWM17	**Hydrology**	**Prof. Abbas, Dr. Khouri**
Contents and qualification aims	The module provides an introduction to the Hydrology, the module also covers hydrology cycle: Rainfall measurements, average rainfall depth, consistency check and adjusting of station, records, estimation of missing data, computations of evapotranspiration and infiltration values. A major portion of the course is devoted to the mathematical modeling of hydrological processes. The various classes of models are treated and their use for the calculation of runoff formation and concentration as well as for the flow curve shown exemplarily deepened. Students are able to analyze hydrologic data, hydrograph theory, hydrologic estimations for design of water control projects; flood control and reservoir routing and to assess significance for water management tasks.	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in physics, mathematics and hydraulic	
Applicability	The module is compulsory for engineering fundamentals training in the bachelor's degree Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	- Alrifai, M. F. - 1990, Hydrology, Aleppo University Publications - Alcheblak, M.; Alnajjar, M. H. - 1995, Hydrology, Damascus University Publications - Masad, Sh. - 2005, Hydrology, Aleppo University Publications - Shagale, A.; Jaara, A. N. - 2007, Hydrology 1, Aleppo University Publications - - Abdelrahman, A. - 2010, Applied Hydrology, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BAWM18	**Drainage**	**Dr. Alhaj Houssein**
Contents and qualification aims	The module includes fundamentals of drainage benefits and importance of drainage; water balance; types of drainage systems; design and construction of main surface and subsurface drainage systems; drainage materials, necessities of drainage and its relationship to the water system in soil. Also it contents mechanisms of putting drainage pipes, filters around pipes, protection and installations of drainage discharges, general form of drainage network, modeling of groundwater movement and regulated, planning of open drainage network, rainy drainage and economical studies. Students having full knowledge about drainage, they will be able to design, management and evaluation of drainage projects.	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in mathematics and advanced knowledge in hydromechanics and soil	
Applicability	The module is a compulsory module for specialized training in the bachelor's degree Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	- Abbas, J.; Aldarir, A.N. - 1995, Irrigation and Drainage, Aleppo University Publications - Alhaj Houssein, M. - 1997, Agricultural Drainage, Aleppo University Publications - Skaggs, R.W.; Van Schilfgarade, J. - 1999, Agricultural Drainage, American Society of Agronomy - - Aldarir, A.N.; Alhaj Houssein, M. - 2008, Agricultural Irrigation and Drainage, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BAWM19	**Ecology and Environmental Protection**	**Dr. Darkalt**
Contents and qualification aims	The module recorded the Ecology processes and the current environmental changes. The focus is on basic structures and functions of ecosystems and usable services. With regard to the population ecology and biodiversity are treated the population genetic information acquisition and conversion, and demographic processes. The concept linear, integer and nonlinear programming simulation; mathematical modeling and optimization with design applications in civil and environmental engineering environment and ecosystems, disruption of ecosystems, atmospheric environment are shown. Students will have basic knowledge and a scientific understanding of the function, stability, self-regulation and dynamics of characteristic semi-natural and natural ecosystems adequately built and the environmental media. They can derive and explain certain protection measures for the design and the regeneration of these ecosystems.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in physics and mathematics	
Applicability	The module is a compulsory module for specialized training in the bachelor's degree Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	- Almefti, M.B.- 1995, Environmental Engineering 2, Damascus University Publications - Farah, P. - 1996, Solid Waste and Environment Pollution, Aleppo University Publications - Nahhal, I. – 2003, Forstry Ecology, Aleppo University Publications - Bannoud, A.; Habboub, M.H.. - 2009, Environmental Protection, Aleppo University Publications - - Darkalt, A.; Kawwas, S.; Alkhatib, M.; Khalil, K. - 2005, Ecology Science, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BAWM20	**Waste Water Discharge**	**Dr. Ali**
Contents and qualification aims	The module includes sewage water, its importance, and the types of wastewater (house water, industrial areas and rainwater) in addition it studied the physical, chemical and biological properties. The methods of wastewater collection and transported by channel or pipes to deliver it to treatment plants, also it includes the design of wastewater transport network, also it provides knowledge about the processes in the entire Wastewater treatment plant . The scientific background of the processes are explained and applied to different treatment levels. The processes and the technical implementation of various procedures are deepened explained, as are the interactions between wastewater and sludge treatment. Students are able to describe the scientific and technical basics of cleaning and transport processes of water and substances in natural and engineered systems and to apply planning and optimization of wastewater systems. They can also to current and future-oriented analyze methods of waste water and sludge treatment, also optimize and apply the design and operation.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in physics, chemistry and biology	
Applicability	The module is a compulsory module for specialized training in the bachelor's degree Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	- Murad Agha, M. - 1991, Waste Water, Aleppo University Publications - Bannoud, A.; Barakat, R. - 1997, Waste Water, Aleppo University Publications - Karmo, O.; Wahbe, H. - 1994, Waste Water, Damascus University Publications - - Murad Agha, M.; Bannoud, A. - 2010, Waste Water Treatment, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BAWM21	**Irrigation and Drainage Nets and Instruments**	**Prof. Aldarir, Dr. Naoum, Dr. Alhaj Houssein**
Contents and qualification aims	The module contains principles and design of internal networks. Also to determine installation, inspection and maintenance of the nets and instruments. It also belongs planning modern irrigation networks, required installations for irrigation, initial planning steps for irrigation networks, hydrograph for irrigation network canals, calculation the longitudinal and cross-sections for irrigation canals, control systems and management in irrigation networks and feasibility study in irrigation projects. It is important to design and operation of modern (sprinkler and trickle) irrigation systems, economical study, evaluation of modern irrigation systems in practice. Also to design and construction of tile drains, mole drains, vertical drainage, construction equipments and evaluation of drainage projects. Students will be able to understand the instruments which use in the irrigation or drainage projects, also they capable to design network for irrigation or drainage projects.	
Module character	5 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in mathematics and advanced knowledge in hydromechanics, soil, irrigation and drainage	
Applicability	The module is compulsory elective module in the subsidiary subjects basics in the bachelor's degree Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	- Abbas, J.; Aldarir, A.N. - 1995, Irrigation and Drainage, Aleppo University Publications - Jensen, M. E. - 1983, Farm Irrigation System, American Society of Agricultural Engineering - Alhaj Houssein, M. - 1997, Agricultural Drainage, Aleppo University Publications - Alkebtani, F.; Abou Rahim, M.; Alsaied Hasan, A.; Jeran, A. – 2000 Irrigation nets, Alexandria University Publications - - Aldarir, A.N.; Alhaj Houssein, M. - 2008, Agricultural Irrigation and Drainage, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BAWM22	**Hydroinformatics**	**Prof. Annan,** **Prof. Abbas**
Contents and qualification aims	Mathematical and informational bases of Geoinformatics; fundamentals of spatial data modeling and spatial data analysis. Fundamentals of spatial database and geographic information systems; Overview of current research fields of geoinformatics. Practical Deepening the basis of simple geospatial application examples. The students have overview of the geospatial and dominate numerous simple application strategies. They will be able to edit quantitative problems of water being appropriate methods of Hydro Systems Analysis apply. They dominate basic, essential tools of geoinformatics, in particular the application of geographic information systems.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in physics and mathematics	
Applicability	The module is compulsory elective module in the subsidiary subject basics in the bachelor's degree Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	- Shamas, N.; Arab, H. - 1994, Hydraulics 1, Aleppo University Publications - Masad, Sh. - 2005, Hydrology, Aleppo University Publications - Shagale, A.; Jaara, A. N. - 2007, Hydrology 1, Aleppo University Publications - - Aldobiat, M.; Annan, T. - 1995, Computers and Programming, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BAWM23	**Soil and Water Pollution**	**Prof. Kaddour**
Contents and qualification aims	The module consist soil pollution, pollution of water resources, agricultural and industrial pollution, pollution with pesticides and fertilizer, environmental impact assessment, environmental legislation and standards. To determine the causes and control of air, water, and land pollution in relation to their effects on health, aesthetics, economics, and ecology. Also how to use current remote sensing systems and case histories of applications in measuring the environment. Students are able to use modern measuring and can use probe sampling techniques. They understand the pollution reasons to process specialized tasks in the field of soil. They will understand causes of the pollution and how to avoid it.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in geology, physics, chemistry and ecology	
Applicability	The module is compulsory elective module in the subsidiary subject basics in the bachelor's degree Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	- Abbasi, Z.; Sadik, M.A.; Aljerdi, A. - 1990, Soil Science, Aleppo University Publications - Farah, P. - 1996, Solid Waste and Environment Pollution, Aleppo University Publications - Safar. T.; Aldarir, A.N. - 2003, Water Resources, Aleppo University Publications - Kamel, W.; Abbasi, Z.; Kaddour, B..; Alsteif, M. - 2010, Soil and Water Pollution, Aleppo University Publications - Wahbi, A.; Teret., M. - 2012, Water Relations, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BAWM24	**Soil Water and Ground-water**	**Dr. Teret**
Contents and qualification aims	Focus of the module is to quantify dynamic flow and solute transport processes in the soil and groundwater. These include the flow to wells and ditches, flow in heterogeneous and anisotropic porous media and conservative substance propagation processes. In the module fundamentals of soil physics and soil hydrology are provided and the impact of soil properties and land use. The impacts of the soil on surface runoff, tendency for salinisation and water erosion as well as measures of their reduction are discussed. The presented topics are deepened within tutorials and practical training, where tasks like sampling, measurement of groundwater levels, and determination of hydraulic conductivities are carried out. The students learn quantitative methods by which both scientific and technical issues in the areas of soil and groundwater hydraulics and reactive material spread in the underground space to be processed. They are able to measure and describe hydrological processes in soils. They apply basic calculation and evaluation methods, estimate the impact of land use and simulate water and matter fluxes in soils using some models.	
Module character	5 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in mathematics and advanced knowledge in hydromechanics, soil, irrigation and drainage	
Applicability	The module is compulsory elective module in the subsidiary subjects basics in the bachelor's degree Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	- Jensen, M.E.; Burman, R.D.; Allen, R. - 1987, Evapotranspiration and Irrigation Water Requirements, American Society of Civil Enfgineering - Wahbi, A.; Teret., M. - 2012, Water Relations, Aleppo University Publications - Masad, Sh. - 2005, Hydrology, Aleppo University Publications - Shagale, A.; Jaara, A. - 2007, Hydrology 1, Aleppo University Publications - - Cheikh Mashel, M.A. - 2005, Engineerin Geology, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Char-ge**
BAWM25	**Water Quality and Water Treatment**	**Dr. Fares, Dr. Ali**
Contents and qualification aims	The module complements to the module Drinking Water Supply. It assumes knowledge of the most important occurring inorganic and organic substances mediate in the water, in particular entry, behavior and the toxicological relevance are the focus. Pathways in the hydrosphere, as well as the complex rela-tionships of the behavior of these compounds and the inte-ractions between them. Students know the biochemical reactions occurring in the aquatic environment. They know the most important inor-ganic and organic substances in water, and get the know-ledge about the important of water pollutants and their re-levance for water quality. Physical -chemical procedures to remove these materials for drinking water processing are introduced. Students will acquire the ability to work inde-pendently and experimentally traceable evaluate and inter-pret results of laboratory tests.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in chemistry, biology, physics and ma-thematics	
Applicability	The module is compulsory elective module in the subsidia-ry subjects basics in the bachelor's degree Agricultural Wa-ter Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	- Alsamman, M.; Alsulh, M. - 1997, Chemistry and Microbio-logy of Water, Aleppo University Publications - Alsamman, M. - 2007, Water Analyse, Aleppo University Publications - Aldusuki, H.; Aituni, H. - 2010, The Foundations of Desalina-tion , Translation from Alazme, M. - - Kamel, W.; Abbasi, Z.; Kaddour, B..; Alsteif, M. - 2010, Soil and Water Pollution, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BAWM26	**Watershed Management**	**Prof. Abbas, Dr. Khouri**
Contents and qualification aims	The module will develop competence of the students for integrated watershed management. Methods of data collection and analysis, of determination and forecast of supplies as well as methods to obtain water demand are introduced. The fundamentals of development and application of methods to dimension and simulate reservoirs and flood protection measures are explained. Decision support systems are imparted to aggregate the single elements of watershed management. Main contents are the software application to quantify hydrologic, hydraulic, and sedimentary processes at the scale of watersheds. Based on the acquired analytical competences in the fields of water balance, runoff in open channels, transport of sediments and hydrologic data analysis the module focuses on the application of recent model approaches for basic examples. The students know the main procedures and tools for integrative watershed management (data acquisition, analysis, forecast, dimensioning, simulation) regarding balancing between demand and supply using typical control elements as dam and absorption reservoirs. They are able to understand and simulate the complex interactions between land use and water use, run-off dynamics and morphology within a watershed.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in mathematics and advanced knowledge in hydromechanics, soil, irrigation and drainage	
Applicability	The module is compulsory elective module in the subsidiary subjects basics in the bachelor's degree Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	- Follett, R.F.; Stewart, B.A. – 1985 Soil Erosion and Crop Productivity, American Society for Agronomy - Masad, Sh. - 2005, Hydrology, Aleppo University Publications - - Shagale, A.; Jaara, A. N. - 2007, Hydrology 1, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BAWM27	**English Language**	N.N.
Contents and qualification aims	The module provides the basics of the language, due to the basic principles of learning a foreign language in terms of conversation, speak and writing. It also includes the study of the grammar and writing principles. Students learn in the end, writing, listening and speaking so that they are able to understand the language better. They can also understand some of the dialects.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in foreign language	
Applicability	The module is compulsory for the bachelor's degree Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	- Oxford university, Principles of English language	

Module Number	**Module Name**	**Professor in Charge**
BAWM28	**Arabic Language and History**	N.N.
Contents and qualification aims	The module provides the rules and principles developed around the Arabic language and the use of words and phrases include, as scheduled address to the grammar. Also includes a history of the Arabs and the Arab world and the most important dates of the Rising. Students learn in the end, sophisticated language and style to use words and sentences so that they are able to understand the language better.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in language and history	
Applicability	The module is compulsory for the bachelor's degree in Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	- Ministry of high education, Arabic language for students	

Module Number	**Module Name**	**Professor in Charge**
BAWM29	**Practical Training/ Project Study**	N.N.
Contents and qualification aims	The Student must carry out practical training about one Problem belongs to subjects of Water engineering and Environment in one or more institution or incorporation, and he must present full study about this problem	
Module character	Practical Training/ Project Study: 6 hours tutorial per week	
Prerequisite of attendance	Basic Knowledge of Practical Training/ Project Study, the student must be in the 5th Semester	
Applicability	The module is suitable for the professional and research oriented studies in agricultural and environmental engineering.	
Prerequisite to achieve credit points	Having passed the module seminar and presentation before commission.	
Frequency of the module	The module is offered annually.	
Credit points	The module earns 15 cr.	
Work load	The workload is 450 hours	
Duration of the module	The module takes three terms starting in Semester 4.	
Suggested references		

Module Number	**Module Name**	**Professor in Charge**
BAWM30	**Bachelor Thesis incl. Defense**	N.N.
Contents and qualification aims	The Student must work Bachelor Thesis with Defense about one problem belongs to the subjects of Agricultural Water Management in the semester, he must present full study about this problem	
Module character	Bachelor Thesis with Defense: 12 hours tutorial per week	
Prerequisite of attendance	Basic Knowledge of Bachelor Thesis with Defense, the student must be in the 6th Semester	
Applicability	The module is suitable for the professional and research oriented studies in agricultural and environmental engineering	
Prerequisite to achieve credit points	Having passed the module presentation before a commission	
Frequency of the module	The module is offered in 6th Semester.	
Credit points	The module earns 30 cr.	
Work load	Work load is 900 hours.	
Duration of the module	The module takes one term.	
Suggested references		

Study Regulations for the Bachelors degree program in Agricultural Water Management
University of Aleppo

Table of Contents:

1- Scope
2- Aims of the program
3- Admission Requirements
4- Beginning and duration of study
5- Teaching and Learning
6- Structure and implementation of studies
7- Study contents
8- Credits (credits)
9- Academic Advising

1- Scope

These study regulations based on the Examination Regulations aim, content, structure and sequence of study for the Bachelor's degree program in agricultural water management at the University of Aleppo.

2- Aims of the program

The course prepares both activities in water management practice as well as a postgraduate Master's degree; the latter should be the rule. Students have the, incorporating the latest scientific findings, for professional practice and a postgraduate master's degree basic and necessary expertise. The students are able construction and operation of technical equipment for the production, storage and redistribution of the limited water resources actively to contribute in the planning. They are able thus to contribute in a globally changing world to solve problems in water management in the field of agriculture and related fields. After incorporation into professional practice among the possible activities: participation in water and wastewater associations and government agencies in planning and consulting offices, research facilities, and involvement in plant engineering company.

3- Admission Requirements:

A Prospective Students may be enrolled only if they have to enter university or a relevant subject specific university or recognized by law or by the relevant state as equivalent admission requirement. The program requires both an interest in the agricultural and engineering sciences as well as for the basic scientific subjects of mathematics, physics, chemistry and biology.

4- Beginning and duration of study:

The course can be taken each winter semester.

The standard period of study includes classroom, self-study, and examinations. It amounts, including the completion of the bachelor's thesis and the colloquium six semesters.

5- Teaching and Learning:

The curriculum is structured modularly. In each module the content of teaching through lectures, tutorials, seminars, internships, study tours, and tutorials are taught, strengthened and deepened.

Lectures serve to explain the subject matter and content areas of the modules and discussed. Exercises are aimed at acquiring necessary methodological and content knowledge. Seminars allow students to inform themselves on the basis of literature or other materials under guidance over a selected area of concern, and the acquiring knowledge is going to carry forward to discuss in the group or represent in writing. The self-study takes place during studies and serves the autonomous acquisition of the required skills of the module and the learning control.

6- Structure and implementation of studies:

The course is modular. The curriculum is divided into six semesters.

A total of 180 credits must be obtained. The sixth semester is emphasis on writing a Bachelor's thesis with the colloquium available.

Contents and objectives, comprised of teaching and learning, conditions, availability, frequency, effort, and duration of the individual modules can be found in the module descriptions

The courses will be held in Arabic.

The study plan, and access to elective modules may be amended upon the proposal of the study commission by the faculty.

7- Study contents:

The study of Agricultural Water Management is a complex and multidisciplinary study that has the technical water management systems and their numerous links to the compartments soil and atmosphere, and society to the object. The Course of this study are both scientific foundations of Hydrobiology and chemistry and structural foundations of agricultural engineering including hydraulic engineering. In the compulsory modules students acquire the theoretical foundations and specialized knowledge. The predominantly interdisciplinary module offers ensure the integration of scientific and engineering disciplines with the application-oriented disciplines. So the water is conveyed from the beginning of their studies at an interdisciplinary, cross-curricular reference for the study. The student is to know, which is required for the development, modernization, construction and operation of the water supply, wastewater treatment and water management.

In addition, student is trained in the computer-aided modeling, simulation and optimization of basin-related water management processes and systems. In the elective modules, the student is thorough knowledge in accordance with their own interests and taking into account its possible future professional orientation. The interdisciplinary elective modules allow students to expand the already acquired knowledge in the compulsory area of study on a limited level.

8- Credits :

ECTS credits document the average workload of students and their individual academic progress. One credit corresponds to a workload of 30 hours. As a rule, 60 credits are awarded each academic year, i.e. 30 per semester. Due to the nature and scope in the module descriptions referred lectures and coursework and examinations, as well as through self-study of undergraduate thesis and the colloquium total of 180 credit points can be acquired included. In principle credits are modular basis and only be awarded if the module examination is passed. The module descriptions are rules about how many credits can be earned by one module and the conditions under which this is possible in detail.

9- Adaptation of module descriptions:

In order to adapt to changing conditions, the module descriptions in the context of an optimal study organization except with the fields "Module Name", "Contents and objectives", "teaching methods", "Requirements for awarding credit points" and "Credits and grades" in a simplified procedures be changed.

In the simplified procedure, the Faculty Council decides to change the module description on a proposal from the Commission study. The amendments shall be published faculty usual.

Quality Management and Accreditation

The Quality Management is the act of overseeing all activities and tasks needed to maintain a desired level of excellence. This includes creating and implementing quality planning and assurance, as well as quality control and quality improvement.

University: Aleppo University

Faculty: Faculty of Agricultural Engineering

Specification of the Program

1- Basic Data

Program Name (BAWM):
Program of Agricultural Water Management

Type of the Program:
single

Name of the participated Program:
(none).

Duration o f the Program:
6 Semesters.

Qualification (Certificate), which the student get at the end of the program:
Bachelor of Agricultural Engineering (Specialist in Agricultural Water Management).

Language used in the Program:
Arabic is the main language. Several modules are presented in English.

Place of Program application: University Campus, Buildings of Faculty of Agricultural Engineering.

External Check Person:

Date the latest acceptance of specification of the Program:

2- Professional Data

2-1- Objectives of the course

Developing Course: it needs objectives:
Objectives describe what learners will be able to do at the end of instruction, and they provide clear reasons for teaching. When writing ob-

jectives be sure to describe the intended result of instruction rather than the process o f instruction itself.

Reasons for objectives:

In order to select and design instructional content, materials or methods and to have a sound basis by which success can be measured.

- To give designers and instructors an objective method to determine how successful their educational material has been. By clearly stating the results the learners should accomplish. Instructors can identify whether students have gained the appropriate skills and knowledge.
- Because objectives should be stated before teatchers begin to develop instructional materials. They provide students the means to organize their efforts toward accomplishing the desired behaviors.

Developing a course typically requires:

- Understanding how people learn
- Considering principles and models of course design
- Writing learning goals and outcomes

Strategy for developing courses:

- **Plan**: create a time line, including all resources, activities, dates, and personnel training.
- **Do:** implement the plan and collect data.
- **Check:** analyze the results of the plan.
- **Act**: act on what was learned and determine the next steps.

How the Curriculum should be evaluated:

- Questions may be included to evaluate:
- The relevance of the content.
- The appropriateness of the course design.
- The effectiveness of the faculty.
- The adequacy of the logistical arrangements such as registration, facilities, and food service.

Course Evaluations:

- Evaluation system is an important tool that helps improve teaching and learning at the Institute. All university instructors participate in course evaluations. All scientific staff has to be evaluated every year, and the results of evaluations have to be considered. The instructor must be absent from the location where this online evaluation is taking place. The process of gathering information about the impact of learning and of teaching practice on student learning, analyzing and interpreting this information, and responding to and acting on the results, is valuable for several reasons. They are beneficial because instructors can review how others interpret their teaching methods, thereby improving their instruction.

- The information can be also used by administrators, along with other input, to make summative decisions and make formative recommendations way, to attempt to influence the outcome of this evaluation rating.
- Course evaluations are implemented in one of two ways, either summative or formative.

Guidelines for quality assurance within higher education:

- Institutions should have a policy and associated procedures for the assurance of the quality and standards of their programs and awards. They should also commit themselves explicitly to the development of a culture, which recognizes the importance of quality, and quality assurance, in their work. To achieve this, institutions should develop and implement a strategy for the continuous enhancement of quality.
- The strategy, policy and procedures should have a formal status and be publicly available. They should also include a role for student.
- A quality management principle is a comprehensive and fundamental rule for leading and organization, aimed at continually improving performance over the long term by focusing on customers while addressing the needs of all other stakeholders.

Notification of message and Goal of the Program:

- The Department of Rural Engineering in the Faculty of Agricultural Engineering in Aleppo University undertake the preparation of an excellent absolvent in the fields of Agricultural Water Management, qualified to continue the qualification and professional development, able to compete and cover the need of the labor market in these Engineering fields. In addition to, the Departments give a very good studying and research plan aims to development the scientific research and participation in professional and research projects. The department contributes in supporting and covering the needs of development plans of the country, during the operation with the related scientific, research and service sides.

Goals of the program:

The academic plan in the Bachelor course of Agricultural Water Management, aims at providing the students the following items:

- High level information in science and computer techniques, and developing the skills in engineering sciences and its applications.
- Developing the ability of the students to achieve various agricultural water engineering studies, check and use it according to the engineering codes.

- Comparing between the engineering solutions, and choose the optimum ones.
- Developing the work skills and regulate the relationship between the work team which the best and have many specialists.
- Strengthening the research ability, developing, and working with the modest software's, equipment's… etc.
- Developing the item of the scientific, social and cultural site of the student's characters.
- Continuous developing to get the high quality of the research, teaching…...etc.
- High level information in science and computer techniques, and developing the skills in engineering sciences and its applications.

2-2- Program Composition and its Contents

- **Admission conditions in the Program**:
  The admission will be done through the competition among the students, who have got the secondary school certificate – scientific branch, national level.
- **The conditions of success in the Program:**
  Presence of theoretical, tutorial, and laboratory lectures and present the required projects and scientific and laboratories reports.
- **Success from year to year**:
  Success in all modules in 1st and 2nd Semester each studying year.
- **Completion of Program**:

Condition of accomplish (get over) of studying years	
st year	Success in modules of 1st and 2nd semesters, the student can hold max. 4 modules.
nd year	Success in modules of 3rd and 4th semester, the student can hold max. 4 modules from all foregone semesters
rd year	Success in modules of 5th and 6th semester, and in all foregone semesters

Conditions of the completion of the Program:

- **Brief description of the kind of Practical Training/ Project Study:**
  The Student must carry out practical training about one problem related to the subjects of Agricultural Water Management in one or

more institutions or incorporations, and he must present full study about this problem.

- **In which phase or phases of the program this Practical Training/ Project Study is carried out :**
  This Study or Project must be carried out in the 5th semester.
- **Number of credits / or semesters for this Practical Training/ Project Study:**
  Offered in 5th and 6th semester with 15 cr.
- **Description of evaluation procedures**: T
  he evaluation should be done by a commission, which is formed by the delegacy of Faculty of Agricultural Engineering; the student has to pass the module seminar and presentation in front of the commission.

Brief description of the kind of Bachelor Thesis:
The Student has to carry out Bachelor Thesis about one problem related to the subjects of Agricultural Water Management in the 6th semester, and he must present a full study about this problem in front of the commission.

- **In which phase from the program the Bachelor Thesis with defense should be carried out:**
  This Bachelor Thesis must be carried out in the 6th semester.
- **Number of Credits / or semester for this Bachelor Thesis with defense:**
  Offered in 6th semester with 15 cr.

Description of evaluation procedures:
The evaluation should be done by a commission, which formed by the delegacy of Faculty of Agricultural Engineering; the student must pass the module and presentation in front of the commission.

3- The Program description

The program of Agricultural Water Management is based on theoretical lectures, laboratory meeting, scientific excursion and summer training approved in the study plan.

Brief description of praxis experiences activity:

- Summer training in surveying works in field;
- Summer training in sanitary projects;
- Summer training in water engineering projects;
- Summer training in agricultural and irrigation projects;
- Scientific excursion to water engineering and sanitary projects

In which phase or phases of the program the field experience should be introduced:

- Surveying works in 3rd semester;
- Summer training in sanitary projects in 5th semester;
- Summer training in water engineering and irrigation projects in 4th and 5th semester;
- Scientific excursion to water engineering and sanitary projects in 4th, 5th and 6th semester

MODULE COMPENDIUM

Agricultural Water Engineering

(AWM)

Master Programme

University of Aleppo

Faculty of Agricultural Engineering

2015

EDUWAT: 511251-TEMPUS-1-2010-1-DE-TEMPUS-SMHES

Development of a Modern Higher Education System for Water Engineering in Syria

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Preface

Basic contents of the education profiles	
Water Engineering	**Agricultural Water Management**
Focus of work: • Water supply • Drinking water • Urban waste water disposal • Water protection areas	**Focus of work:** • Agricultural irrigation and drainage • Water Ressources Management • Water maintenance
Application fields: • Water authorities • Public utilities • Industrial enterprises • Enterprises for planning • Calculation and construction of plants	**Application fields:** • Agricultural and water authorities • Fields • Ecology and environment • Hydrology engineering
Main focus of education: • Drinking water supply and treatment • Industrial water supply • Urban waste water disposal • Industrial waste water disposal • Water protection areas • Waste water plant construction • Water quality	**Main focus of education:** • Agricultural irrigation systems • Agricultural drainage systems • Water harvesting • Storage engineering • Statics, construction • Soil science • Surface water • Groundwater

Basic education for all education profiles	
• Environmental law and water rights • Hydraulic • Waste water treatment • Water management	• Hydrology • Water supply • Land improvement • Soil and groundwater sciences

AU - Master Course Agricultural Water Management – MAWM

	Credits	**%**
Modules in Mathematics	10	8%
Modules in Engineering & Hydro Sciences	20	17%
Modules with Specialization	20	17%
Elective Modules	20	17%
Modules for general Qualification	**5**	4%
Practical Training /Project	15	13%
Master Thesis plus Defense	30	25%
Total	**120**	**100%**

Module **Semester**	**1**	**2**	**3**	**4**	**Total/ECTS**
Mathematics / Statistics	5	5			**10**
Engineering & Hydro Sciences	10	10			**20**
Specialization	5	10	5		**20**
Elective Modules	10		10		**20**
General Qualification			5		**5**
Practical Training/ Project Study		5	10		**15**
Master Thesis plus Defense				30	**30**
Total	**30**	**30**	**30**	**30**	**120**

Module Nr.	Course Semester	1	2	3	4	Total/ ECTS
	Mathematics / Statistics	**5**	**5**			**10**
MAWM01	Mathematics / Statistics	5				5
MAWM02	Modeling and Simulation		5			5
	Engineering & Hydro Sciences	**10**	**10**			**20**
MAWM03	Hydrology	5				5
MAWM04	Soil and Water Relationship	5				5
MAWM05	Hydromechanics		5			5
MAWM06	Agricultural Meteorology		5			5
	Specialization	**5**	**10**	**5**		**20**
MAWM07	Salted Soils	5				5
MAWM08	Waste Water Treatment and Use		5			5
MAWM09	Advanced Irrigation		5			5
MAWM10	Advanced Drainage			5		5
	Elective Modules *	**10**		**10**		**20**
MAWM11	Climate Change	5				
MAWM12	Solid Waste Management			5		
MAWM13	Agricultural Ecology	5				
MAWM14	Biotechnology			5		
MAWM15	Water Transport and Distribution	5				
MAWM16	Use and Modeling of Groundwa-ter			5		
	General Qualification			**5**		**5**
MAWM17	Scientific Writing			5		5
MAWM18	**Practical Training/Project study**		**5**	**10**		**15**
MAWM19	**Master Thesis plus Defense**				**30**	**30**
	Total	**30**	**30**	**30**	**30**	**120**

*From these modules students must select two modules for each of the1st. and 3rd. Semes-ter

Curricula Structures - Master Course Agricultural Water Management

Semester 1	**Mathematics /Statistics**	**Hydrology**	**Soil and Water Relationship**	**Salted Soils**	**Elective Modules**	
Semester 2	**Modeling and Simulation**	**Hydromechanics**	**Agricultural Meteorology**	**Waste Water Treatment and Use**	**Advanced Irrigation**	**Practical Training/ Project Study**
Semester 3	**Advanced Drainage**	**Scientific Writing**	**Elective Modules**		**Practical Training/ Project Study**	
Semester 4	**Master Thesis**					
Credits	5	5	5	5	5	5

- Modules in Natural Sciences 10% - 25%
- Modules inTechnical Sciences 10 - 25%
- Modules in Economic & Social Sciences 5% - 15%
- Modules in Variable Sciences 55% - 70%

Module Number	**Module Name**	**Professor in Charge**
MAWM01	**Mathematics / Statistics**	**Prof. Annan, Dr. Naoum, Dr. Jaddouh**
Contents and qualification aims	Advanced topics in engineering mathematics, including special functions, orthogonal functions and Fourier series, boundary value problems in various coordinate systems, integral transforms, partial differential equations and introduction to complex variable theory. Descriptive statistics, discrete and continuous probability distributions, parameter estimation, statistical modeling, confidence intervals, hypothesis testing, parametric and nonparametric resampling tests, and introduction to variance analysis, correlation and regression analysis. The use of computer-based mathematical tools will be an integral part of the course. Aims of qualification are the development of skills and abilities for problem oriented work using statistical methods and operations including selected software.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge of mathematics for engineers, Statistics, computer aided skills.	
Applicability	The module is compulsory for the Master Course Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MAWM02	**Modeling and Simulation**	**Prof. Annan**
Contents and qualification aims	• **The module consist introduction of computer assisted design programmes, structural analysis types, elements types, techniques and applications of modeling. Foundation of modeling, numerical methods, model building, guidelines for modeling, modeling systems, application aspects, model operation control will be studies, considered and applied.** Basic concepts, formulation, and application of finite element techniques for numerical solution of problems in structural and continuum mechanics, geotechnical engineering, and water resources engineering. • **Students will apply modeling in a special study and carry out application forms on a local project, enabling them to understand the modeling and its applications in the field of water. In particular the application of geographic information systems will done.**	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge of mathematics for engineers, Statistics, computer aided skills.	
Applicability	The module is compulsory for the Master Course Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MAWM03	**Hydrology**	**Prof. Abbas , Dr. Khouri**
Contents and qualification aims	The module teaches the basic fundamentals of the processes in the atmosphere and hydrosphere. Hydrologic cycle streamflow, evapotranspiration, hydrographs, runoff relations, flood routing, frequency and duration studies, and application of hydrologic techniques. Radiation, precipitation, evaporation, water and Energy storage are discussed. The module considers also formation - runoff pathways, Flooding areas, relevant physical processes during and after flood events.. In addition, it will administrative control measures studied and discussed. The students can analyze hydrological information (data, forecasts and consulting) and are able to apply their knowledge for water supply management tasks. The students have available to analysis of hydrologic data, hydrograph theory, hydrologic estimations for design of water control projects; flood control and reservoir routing. Also integrated watershed management and water conservation, water management systems for environmental protection will be done.	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in physics and mathematics.	
Applicability	The module is compulsory for the Master Course Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	Module Name	Professor in Charge
MAWM04	**Soil and Water Relations-hip**	**Dr. Wahbi**
Contents and qualification aims	This course addresses properties and processes in soil, state and transport of matter and energy affecting environment and agriculture, effect of various environmental events on soil properties, management of properties and processes for various practical agricultural, hydrological and environmental applications including land reclamation. Ion exchange, dissolved organic matter, ecological functions, organomineral complexes in the soil, organic contaminants in the soil system, water movement in the soil, application of soil chemistry on the solution of the environmental problems will be also considered. Students have understood all the terms related to the science of soil and were able to take samples of the soil and hold all the physical and chemical analyzes. .	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in geology, soil and chemistry.	
Applicability	The module is compulsory for the Master Course Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MAWM05	**Hydromechanics**	**Dr. Naoum**
Contents and qualification aims	The Contents of module are the physical properties of water, starting with the hydrostatics and the mainly steady hydrodynamics with emphasis on the principles of conservation of energy, mass and momentum, pipe hydraulics, open channel hydraulics. Flow classifications, channel properties, critical flow, uniform flow formulas, channel design, and gradually varied flow profile computations. The students are able to solve hydro-mechanical issues ,in engineering identification of hydro-mechanical problems and quantitative solution of hydro-mechanical tasks and are capable of application of these results to the dimensioning of hydraulic structures and hydro-technical installations or scientific implementation. This includes the selection, use and development of software and Software components.	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in physics and higher mathematics.	
Applicability	The module is compulsory for the Master Course Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MAWM06	**Agricultural Meteorology**	**Dr. Kawwas, Dr. Kelani**
Contents and qualification aims	The module provides the composition and properties of atmospheric and hydrosphere. The module including energy, solar radiation, atmospheric moisture. temperature, pressure, air density, clouds, precipitation and wind. Climatology, climate affecting factors, world climate classification, climatic variation, trends, models, microclimatology, and remote sensing devices for weather observation will be considered. The students learn with the latest measuring technology the relevant processes in atmosphere and hydrosphere, as well as of methods of observation and modeling. This help them to understand all components of the water cycle and to evaluate and Research Meteorological Programs and apply them to the outdoors.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Advanced knowledge in physics, chemistry and biology.	
Applicability	The module is compulsory for the Master Course Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MAWM07	**Salted Soils**	**Prof. Dermoush, Prof. Kamel**
Contents and qualification aims	The module includes the definition of saline soils and its importance and spread in the world, especially in the arid and semi-arid regions. In addition to study the methods of reclamation; leashing processes and requirements as well as appropriate irrigation methods. It also includes the use of saline water to irrigate in the projects. The students learn the importance of saline soils and to determine the leaching requirements. They are able to choice the appropriate irrigation method. They can also classify and manage salted soils.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in soil, geology and chemistry.	
Applicability	The module is compulsory for the Master Course Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MAWM08	**Waste Water Treatment and Use**	**Prof. Aldarir, Dr. Ali**
Contents and qualification aims	The module provides an understanding of technical processes that are important for the water quality and the purification of various effluents of concern. Also it provides knowledge about the processes in the entire wastewater treatment plant, in particular on the physical, biological and chemical wastewater treatment and sludge treatment. T he scientific background of the processes are explained and applied to different treatment stages. The possibility of the use of treatments water and Sludge will be discussed. Students are able to current and future-oriented Analyze methods of waste water and sludge treatment, to optimize and apply for the design and operation.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in ecology, biology and chemistry.	
Applicability	The module is compulsory for the Master Course Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MAWM09	**Advanced Irrigation**	**Prof. Aldarir**
Contents and qualification aims	The module provides an introduction to some of the special topics such as programming related to irrigation; irrigation scheduling; irrigation automation; fertilizing irrigation in addition to the design and operation of modern irrigation systems (drip and sprinkler irrigation); irrigation by using unnatural water resources; economical study and feasibility of irrigation projects; evaluation of modern irrigation systems in practice. Students can use programming and use of irrigation programs or models related to water requirements, irrigation scheduling, crop water requirements and design of irrigation systems.	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in hydraulic, irrigation, computer skills, chemistry and mathematics.	
Applicability	The module is compulsory for the Master Course Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MAWM10	**Advanced Drainage**	**Dr. Alhaj Houssein**
Contents and qualification aims	The module provides the necessities of drainage and its relationship to the water system in soil. It contents the general form of drainage network, water balance, drainage methods, design and construction of tile drains, construction equipments, economical studies types of drainage and established its choice. Reuse of drainage water, modeling of groundwater movement and regulated drainage and evaluation of drainage projects. students will be able to understand the topics of drainage and water balance in addition to design of drainage network and determine the accessories and the use of mathematical models and management of integrated drainage projects.	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in hydraulic, irrigation, drainage, computer skills, chemistry and mathematics.	
Applicability	The module is compulsory for the Master Course Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MAWM11	**Climate Change**	**Dr. Kawwas, Dr. Kelani**
Contents and qualification aims	The module includes climate changes and their interaction with atmospheric trace matters and vegetation. Global change makes demands to all natural resources (soil, water, air), where e.g. the water supply and its use are dependent on natural and economical requirements. Climate change is exemplarily shown to explain the use of limited resources in the light of a changing world. Its understanding requires knowledge about the earth-atmosphere, system. The module focuses on the state of the art of climate research (data, methods and results) including the feedback with the hydrosphere and biosphere. The presentations of the students complete the programs. The students improve their knowledge about system understanding of climate change by integrative treatment of climatic processes. They are able to explain complex relationships and develop a reliable conflict understanding of questions relevant to natural resources in connection with climate.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in meteorology, hydrology, physics, chemistry and mathematics.	
Applicability	The module is compulsory elective for the Master Course Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MAWM12	**Solid Waste Management**	**Prof. Aldarir, Dr. Ali**
Contents and qualification aims	The module defines terms and provides techniques from the areas of deposition and aftercare of waste and pollutant characterization of contaminated sites. Following topics were covered in this module, characterization and sources of solid wastes; solid waste management; collection systems; processing; disposal; and recycle. Central focus in part deposit and provide follow-up topics such as types, classes, after-care and construction of landfills. In contrast, in the part of the characterization of pollutants are potential groups of substances, risks and measures the damage description in the focus of attention. Students learn essential foundations for the deposition of wastes, solid waste management, disposal, recycle, residues and contaminants.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in biology, chemistry, and mathematics.	
Applicability	The module is compulsory elective for the Master Course Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MAWM13	**Agricultural Ecology**	**Dr. Darkalt**
Contents and qualification aims	The module provides an introduction of ecology as a pure and applied science, its hierarchy of living systems and the ecosystem concept are introduced. Also it will be conside-red populations and ecosystems; biodiversity in different spatial and temporal scales; global change and sustainabi-lity in ecology. Environmental pollution: the causes and control of air, water, and land pollution in relation to their effects on health, aesthetics, economics, and ecology. Identify capacities and limitations of control, utilisation, conservation, and regeneration of populations and ecosys-tems. The students have skills to understand causalities and ef-fects due to fast changes of dynamic balances within popu-lations, communities and the entire biosphere. They will be able to application of advanced physical and chemical measurement and calculation techniques to environmental engineering problems.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in meteorology, hydrology, ecology, bio-logy and chemistry.	
Applicability	The module is compulsory elective for the Master Course Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MAWM14	**Biotechnology**	**N.N.**
Contents and qualification aims	The module includes the basic biotechnological processes focus on biotechnological processes in the environmental sector. Graduates dispose knowledge of (bio)degradation of contaminants under different environmental conditions and are able to assess risks for conservation resources at contaminated sites. The students possess knowledge of biological and non-biological remediation processes as a base for decisions about alternative solutions.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge of chemistry, biology, physics, mathematics, and geology.	
Applicability	The module is compulsory elective for the Master Course Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MAWM15	**Water Transport and Distribution**	**Dr. Naoum**
Contents and qualification aims	The module overviews the methods and the instruments for planning, operation and maintenance of water transport and distribution systems. Students are able to developing the network of a distribution system, apply basic principles of economy in the selection of design options for the distribution systems, and apply current network and software to capture their use in data and inventory management of transmission and distribution systems.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in hydrosciences, engineering sciences, mathematic, physic and skills of computer..	
Applicability	The module is compulsory elective for the Master Course Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MAWM16	**Use and Modeling of Ground-water**	**Prof. Abbas**
Contents and qualification aims	The module deals with numerical groundwater flow and solute transport models as essential tools of groundwater management. This includes the associated basic ideas and the functionality of these tools as well as their use in water management practice. In addition, the concrete illustration of relevant water management components and phenomena is practiced in computer models. Students are after completion of the module is able to create numerical groundwater models to simulate flow and transport processes in aquifers and to interpret the results in relation to the real situation.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in meteorology, hydrology, ecology, hydraulic and chemistry.	
Applicability	The module is compulsory elective for the Master Course Agricultural Water Management.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MAWM17	**Scientific writing**	**N. N.**
Contents and qualification aims	The Scientific Writing Resource is course material that teaches how to write effectively. The material is not about correctness (grammar, punctuation, etc), but about communicating what you intend to the reader. It can be used either in a science class or by individuals. It is intended for science students at the graduate level. Students will be able to communicate better not only with other researchers, but with the public, who funds your research. If scientists were better writers, the gap between the public and academy would shrink. The students gain skills to supervise projects self dependently and are prepared to hold other management functions. Module.	
Module character	2 hours of lectures per week , self-study 4 hours of practical training per week , self-study	
Prerequisite of attendance	Basic knowledge in hydrosciences, agricultural and civil engineering, computer sciences; advanced knowledge in mathematics and statistics.	
Applicability	The module is compulsory for the Master Course Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), presentations and the project work (75 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MAWM18	**Practical training/Study Project**	**N.N.**
Contents and qualification aims	The Student must carry out practical training about one Problem belongs to subjects of the Master course of water resources management in one or more institution or incorporation, and he must present full study about this problem	
Module character	Practical Training/ Project Study: 6 hours tutorial per week	
Prerequisite of attendance	Basic Knowledge of Practical Training/ Project Study, the student must be in the 3rd Semester.	
Applicability	The module is suitable for the professional and research oriented studies in civil and environmental engineering .	
Prerequisite to achieve credit points	Having passed the module seminar and presentation before a commission	
Frequency of the module	The module is offered in summer and winter term.	
Credit points	The module earns 15 cr.	
Work load	Work load is 450 hours.	
Duration of the module	The module takes two term.	

Module Number	**Module Name**	**Professor in Charge**
MAWM19	**Master Thesis with Defense**	**N.N.**
Contents and qualification aims	The Student must work Master Thesis with Defense about one Problem belongs to the subjects of the Master course of water resources management in one or more institution or incorporation, and he must present full study about this problem.	
Module character	Master Thesis with Defense: 12 hours tutorial per week	
Prerequisite of attendance	Basic Knowledge of Master Thesis with defense, the student must be in 4th Semester	
Applicability	Tthe module is suitable for the professional and research oriented studies in civil and environmental engineering	
Prerequisite to achieve credit points	Having passed the module presentation before a commission	
Frequency of the module	The module is offered in 4th semester	
Credit points	The module earns 30 cr. The final Grade is generated with 100% as presentation in front of committee	
Work load	The work load is 900 hours	
Duration of the module	The module takes one term.	

Quality Management and Accreditation

The Quality Management is the act of overseeing all activities and tasks needed to maintain a desired level of excellence. This includes creating and implementing quality planning and assurance, as well as quality control and quality improvement.

University: Aleppo University

Faculty: Faculty of Agricultural Engineering

Specification of the Program

1- Basic Data

Program Name (MAWM):
Program of Agricultural Water Management

Type of the Program:
single

Name of the participated Program:
(none).

Duration of the Program:
4 Semesters.

Qualification (Certificate), which the student get at the end of the program:
Master of Agricultural Engineering (Specialist in Agricultural Water Management).

Language used in the Program:
Arabic is the main language. Several modules are presented in English.

Place of Program application:
University Campus, Buildings of Faculty of Agricultural Engineering.

External Check Person:

Date the latest acceptance of specification of the Program:

2- Professional Data

2-1- Objectives of the course

Developing Course: it needs objectives:
Objectives describe what learners will be able to do at the end of instruction, and they provide clear reasons for teaching. When writing objectives be sure to describe the intended result of instruction rather than the process o f instruction itself.

Reasons for objectives:

- In order to select and design instructional content, materials or methods and to have a sound basis by which success can be measured.
- To give designers and instructors an objective method to determine how successful their educational material has been. By clearly stating the results the learners should accomplish. Instructors can identify whether students have gained the appropriate skills and knowledge.
- Because objectives should be stated before teatchers begin to develop instructional materials. They provide students the means to organize their efforts toward accomplishing the desired behaviors.

Developing a course typically requires:

- Understanding how people learn
- Considering principles and models of course design
- Writing learning goals and outcomes

Strategy for developing courses:

- Plan: create a time line, including all resources, activities, dates, and personnel training.
- Do: implement the plan and collect data.
- Check: analyze the results of the plan.
- Act: act on what was learned and determine the next steps.

How the Curriculum should be evaluated:

- Questions may be included to evaluate:
- The relevance of the content.
- The appropriateness of the course design.
- The effectiveness of the faculty.
- The adequacy of the logistical arrangements such as registration, facilities, and food service.

Course Evaluations:

Evaluation system is an important tool that helps improve teaching and learning at the Institute. All university instructors participate in course evaluations. All scientific staff has to be evaluated every year, and the results of evaluations have to be considered. The instructor must be absent from the location where this online evaluation is taking place. The process of gathering information about the impact of learning and of teaching practice on student learning, analyzing and interpreting this information, and responding to and acting on the results, is valuable for several reasons.They are beneficial because instructors can review how

others interpret their teaching methods, thereby improving their instruction.
The information can be also used by administrators, along with other input, to make summative decisions and make formative recommendations way, to attempt to influence the outcome of this evaluation rating. Course evaluations are implemented in one of two ways, either summative or formative.

Guidelines for quality assurance within higher education:

- Institutions should have a policy and associated procedures for the assurance of the quality and standards of their programs and awards. They should also commit themselves explicitly to the development of a culture, which recognizes the importance of quality, and quality assurance, in their work. To achieve this, institutions should develop and implement a strategy for the continuous enhancement of quality.
- The strategy, policy and procedures should have a formal status and be publicly available. They should also include a role for student.
- A quality management principle is a comprehensive and fundamental rule for leading and organization, aimed at continually improving performance over the long term by focusing on customers while addressing the needs of all other stakeholders.

Notification of message and Goal of the Program:

- The Department of Rural Engineering in the Faculty of Agricultural Engineering in Aleppo University undertake the preparation of an excellent absolvent in the fields of Agricultural Water Management, qualified to continue the qualification and professional development, able to compete and cover the need of the labor market in these Engineering fields. In addition to, the Departments give a very good studying and research plan aims to development the scientific research and participation in professional and research projects. The department contributes in supporting and covering the needs of development plans of the country, during the operation with the related scientific, research and service sides.

Goals of the program:

The academic plan in the Master course of Agricultural Water Management, aims at providing the students the following items:

- High level information in science and computer techniques, and developing the skills in engineering sciences and its applications.

- Developing the ability of the students to achieve various agricultural water engineering studies, check and use it according to the engineering codes.
- Comparing between the engineering solutions, and choose the optimum ones.
- Developing the work skills and regulate the relationship between the work team which the best and have many specialists.
- Strengthening the research ability, developing, and working with the modest software's, equipment's… etc.
- Developing the item of the scientific, social and cultural site of the student's characters.
- Continuous developing to get the high quality of the research, teaching…...etc.
- High level information in science and computer techniques, and developing the skills in engineering sciences and its applications.

2-2- Program Composition and its Contents

- **Admission conditions in the Program:**
  The admission will be done through the competition among the students, who have got the secondary school certificate – scientific branch, national level.
- **The conditions of success in the Program:**
  Presence of theoretical, tutorial, and laboratory lectures and present the required projects and scientific and laboratories reports.
- **Success from year to year**:
  Success in all modules in 1st and 2nd Semester each studying year.
- **Completion of Program**:

Condition of accomplish (get over) of studying years	
1st year	Success in modules of 1st and 2nd semesters, the student can hold max. 2 Modules.
2nd year	- Success in modules of 3rd semesters, the student can hold max. 2 Modules from all foregone semesters. - Success in modules of foregone semesters and Defense of Master Thesis in front of the commission.

Conditions of the completion of the Program:

- **Brief description of the kind of Practical Training/ Project Study:**
  The Student must carry out practical training about one problem related to the subjects of Agricultural Water Management in one or

more institutions or incorporations, and he must present full study about this problem.

- **In which phase or phases of the program this Practical Training/ Project Study is carried out :**
  This Study or Project must be carried out in the 2nd and 3rd semester.
- **Number of credits / or semesters for this Practical Training/ Project Study:**
  Offered with 15 cr.
- **Description of evaluation procedures**:
  The evaluation should be done by a commission, which is formed by the delegacy of Faculty of Agricultural Engineering; the student has to pass the module seminar and presentation in front of the commission.

Brief description of the kind of Master Thesis:
The Student has to carry out Master Thesis about one problem related to the subjects of Agricultural Water Management in the 4th semester, and he must present a full study about this problem in front of the commission.

- **In which phase from the program the Bachelor Thesis with defense should be carried out:**
  This Master Thesis must be carried out in the 4th semester.
- **Number of Credits / or semester for this Bachelor Thesis with defense:**
  Offered in 4th semester with 30 cr.

Description of evaluation procedures:
The evaluation should be done by a commission, which formed by the delegacy of Faculty of Agricultural Engineering; the student must pass the module and presentation in front of the commission.

3- The Program description

The program of Agricultural Water Management is based on theoretical lectures, laboratory meeting, scientific excursion and summer training approved in the study plan.

Brief description of praxis experiences activity:

- Summer training in surveying works in field;
- Summer training in sanitary projects;
- Summer training in water engineering projects;
- Summer training in agricultural and irrigation projects;
- Scientific excursion to water engineering and sanitary projects

In which phase or phases of the program the field experience should be introduced:

- Surveying works in 2nd semester;
- Summer training in sanitary projects in 3rd semester;
- Summer training in water engineering and irrigation projects in 3rd semester;
- Scientific excursion to water engineering and sanitary projects in 2nd semester

MODULE COMPENDIUM

Water Engineering (WE)

Bachelor Programme

University of Aleppo

Faculty of Civil Engineering

2015

EDUWAT: 511251-TEMPUS-1-2010-1-DE-TEMPUS-SMHES
Development of a Modern Higher Education System for Water Engineering in Syria

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Preface
Basic contents of the education profiles

Water Engineering	Agricultural Water Management
Focus of work: • Water supply • Drinking water • Urban waste water disposal • Water protection areas	**Focus of work:** • Agricultural irrigation and drainage • Water Ressources Management • Water maintenance
Application fields: • Water authorities • Public utilities • Industrial enterprises • Enterprises for planning • Calculation and construction of plants	**Application fields:** • Agricultural and water authorities • Fields • Ecology and environment • Hydrology engineering
Main focus of education: • Drinking water supply and treatment • Industrial water supply • Urban waste water disposal • Industrial waste water disposal • Water protection areas • Waste water plant construction • Water quality	**Main focus of education:** • Agricultural irrigation systems • Agricultural drainage systems • Water harvesting • Storage engineering • Statics, construction • Soil science • Surface water • Groundwater

Basic education for all education profiles	
• Environmental law and water rights • Hydraulic • Waste water treatment • Water management	• Hydrology • Water supply • Land improvement • Soil and groundwater sciences

AU Bachelor Course of Water Engineering BWE

	Credits	%
Modules with Basics in Mathematics and Natural Sciences	45	25%
Modules with Basics in Engineering	30	17%
Modules with Basics in Hydro Sciences	20	11%
Modules with specialized Basics	30	17%
Elective Modules	15	8%
Modules for general Qualification	10	6%
Practical Training /Project	15	8%
Bachelor examination	15	8%
Total	180	100%

Module Semester	1	2	3	4	5	6	Total/ECTS
Basics in Mathematics and Natural Sciences	**20**	**15**	**10**				**45**
Basics in Engineering	**5**	**5**	**10**	**5**	**5**		**30**
Basics in Hydro Sciences		**5**	**5**	**5**	**5**		**20**
Specialized Basics			**5**	**10**	**5**	**10**	**30**
Elective Modules				**10**	**5**		**15**
General Qualification	**5**	**5**					**10**
Practical Training/ Project Study					**10**	**5**	**15**
Bachelor Theses incl. Defense						**15**	**15**
Total	**30**	**30**	**30**	**30**	**30**	**30**	**180**

Module Nr.	**Course Semester**	**1**	**2**	**3**	**4**	**5**	**6**	**Total/ECTS**
	Basics in Mathematics and Natural Sciences	**20**	**15**	**10**				**45**
BWE01	Mathematics	5	5					**10**
BWE02	Statistics			5				**5**
BWE03	Physics	5	5					**10**
BWE04	Chemistry	5	5					**10**
BWE05	Biology	5						**5**
BWE06	Computer Sciences			5				**5**
	Basics in Engineering	**5**	**5**	**10**	**5**	**5**		**30**
BWE07	Reinforced Concrete Construction				5			**5**
BWE08	Fundamentals of Engineering Drawing	5						**5**
BWE09	Structural Engineering					5		**5**
BWE10	Soil Science & Soil Mechanic			5				**5**
BWE11	Meteorology		5					**5**
BWE12	Geodesy / Geoinformatics			5				**5**
	Basics in Hydro Sciences		5	5	5	5		**20**
BWE13	Hydraulics		5					**5**
BWE14	Hydrometry					5		**5**
BWE15	Hydrology			5				**5**
BWE16	Pumping Stations				5			**5**
	Specialized Basics			**5**	**10**	**5**	**10**	**30**
BWE17	Irrigation			5				**5**
BWE18	Drainage				5			**5**
BWE19	Drinking Water Supply					5		**5**
BWE20	Waste Water Discharge						5	**5**
BWE21	Hydraulic Installations						5	**5**
BWE22	Water Ressources Management and Water Rights				5			**5**
	Elective Modules				**10**	**5**		**15**
BWE23	Soil Water and Groundwater				5			
BWE24	Water Quality and Water Treatment				5			
BWE25	Ecology and Environmental Protection					5		
BWE26	Watershed Management					5		
BWE27	Fundamentals of Waste Management				5			
	General Qualification	5	5					**10**
BWE28	English language	5						**5**
BWE29	Arabic language and History		5					**5**
BWE30	**Practical Training/ Project Study**					**10**	**5**	**15**
BWE31	**Bachelor Thesis incl. Defense**						**15**	**15**
	Total	**30**	**30**	**30**	**30**	**30**	**30**	**180**

Curricula Structures - Bachelor Course Water Engineering - BWE

Semester 1	**Mathematics**	**Physics**	**Chemistry**	**Biology**	**Fundamentals of Engineering Drawing**	**English Language**
Semester 2				**Meteorology**	**Hydraulics**	**Arabic Language and History**
Semester 3	**Statistics**	**Computer Sciences**	**Soil Science & Soil Mechanic**	**Geodesy / Geoinformatics**	**Hydrology**	**Irrigation**
Semester 4	**Reinforced Concrete Construction**	**Pumping Stations**	**Drainage**	**Water Ressources Management and Water Rights**	**Elective Modules**	
Semester 5	**Structural Engineering**	**Hydrometry**	**Drinking Water Supply**	**Elective Modules**	**Practical Training/ Project Study**	
Semester 6	**Waste Water Discharge**	**Hydraulic Installations**	**Practical Training/ Project Study**	**Bachelor Thesis incl. Defense**		
Credits	5	5	5	5	5	5

Modules in Natural Sciences 25%

Modules inTechnical Sciences 25%

Modules in Economic & Social Sciences 25%

Modules in Variable Sciences 25%

Module Number	**Module Name**	**Professor in Charge**
BWE01	**Mathematics**	**Dr. Hanife**
Contents and qualification aims	The module focuses on the one on linear algebra, analytic Geometry, single-and multi-dimensional differential and Integral calculus and special differential equations. In addition are solution methods for selected common treated differential equations. Derivations and limits, limited and unlimited integration, matrices and operations on matrices, definition and types of matrix, operations on matrices, solution of linear homogeneous equations using matrices method, special values and vectors, derivation of functions with one or more variable. Extension according to Taylor and Mc-Lorn methods, definite integral and its engineering application, observation and modeling. Students have continue familiarity with range, curve and surface integrals and integral sets of vector analysis. They able to apply systems of linear equations and Pictures, location and dimensional relationships of points, lines and Levels.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in physics and mathematics	
Applicability	The module is compulsory for the mathematical fundamentals of science education in the bachelor's degree Water Engineering.	
Prerequisite to achieve credit points	The module exam is a written examination (120 minutes).	
Frequency of the module	The module is offered in winter and summer term.	
Credit points	The module earns 10 cr.	
Work load	Work load is 300 hours.	
Duration of the module	The module takes two terms.	
Suggested references	– Hanife, M. - 2001, Mathematics 4, Aleppo University Publications – Hanife, M. - 2002, Numerical Mathematics, Aleppo University Publications – Annan, T. - 2009, Mathematics 2, Aleppo University Publications – Hanife, M. - 2011, Mathematics 2, Aleppo University Publications – Hanife, M. - 2014, Mathematics 1, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BWE02	**Statistics**	N.N.
Contents and qualification aims	The module provides an introduction to the basics of stochastic and provides a selection of important cases of practical mathematical statistics in front. This is mainly due to practical engineering problems, such as received by hydrological or environmental problems. In addition, selected software is presented and involved. Students will learn statistical methods and procedures to work. They have to be prepared in amounts of data capable of statistically to evaluate and work problem-oriented.	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in physics and mathematics	
Applicability	The module is compulsory for the mathematical fundamentals of science education in the bachelor's degree Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	– Jazmati, S. - 1993, Statistics and Errors, Aleppo University Publications – Annan, T. - 2002, Statistics, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BWE03	**Physics**	Dr. Baza
Contents and qualification aims	• **The module provides an overview of the physical basis of the Mechanics, thermodynamics, electricity and magnetism ,** • **Waves and atoms.** • **An introductory course in physics without calculus, covering mechanics (kinematics, dynamics, energy, and rotational motion), oscillations and waves, sound, light, and geometrical optics is given.** • **Errors and physicist quantum, temperature: manufacturing of thermal balances, linear thermal expansion of solids, surface expansion of solids, volumetric expansion of solids, expansion of fluids, expansion of gases, latent heat, gas laws.** • **The students will know the basics of physics and are in the Position that knowledge for recognizing and editing of specialized and interdisciplinary scientific issues to use it.**	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in physics and mathematics	
Applicability	The module is compulsory for the mathematical fundamentals of science education in the bachelor's degree Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and seminar paper (50 hours).	
Frequency of the module	The module is offered in winter and summer term.	
Credit points	The module earns 10 cr.	
Work load	Work load is 300 hours.	
Duration of the module	The module takes two terms.	
Suggested references	– Hamo, A. - 2014, Physics for Engineers 1, Aleppo University Publications – Akshar, J.K. - 2010, Physics for Engineers 2, Aleppo University Publcations – Issa, A; Akshar,J.K. - 2013, Physics for Engineers, Aleppo University Publications – Drau, W; Kayash, S. - 2009, Physics for Engineers (Practical Part), Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BWE04	**Chemistry**	**Dr. Nabghali**
Contents and qualification aims	• **The module consists the introduction to chemistry through study of atomic and molecular structure, radiation and nuclear chemistry, valence theory, coordination chemistry, periodic table, and states of matter. Introduction to gases, solutions, acids, bases, and concept of equilibrium.** • **Periodic properties of the elements, geometry of molecules and molecular orbitals, chemical balance and the law of mass action, oxidation reactions and returns will be reviewed.** • **Design to survey organic chemistry and biochemistry and** • **their impact upon daily existence.** Students learn theoretical and technical foundations of anorganic, organic and bio-chemistry, in the understanding of the reaction aquatic systems.	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in chemistry, biology and mathematics	
Applicability	The module is compulsory for the mathematical fundamentals of science education in the bachelor's degree Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in winter and summer term.	
Credit points	The module earns 10 cr.	
Work load	Work load is 300 hours.	
Duration of the module	The module takes two terms.	
Suggested references	– Nabghali, N.; Habbaba, J. - 2003, Inorganic Chemistry, Aleppo University Publications – Warde, Y. – 2011, Chemistry for Engineers, Aleppo University Publications – Warde, Y.; Naser, F. - 2011, Chemistry for Engineers (Practical part), Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BWE05	**Biology**	N.N.
Contents and qualification aims	Focuses of the module are the principles of cell biology, physiology, ecology, genetics, and evolution. An introduction to the phylogeny, structure, function and adaptation of unicellular organisms, plants and animals in the biosphere. The occurrence and importance of microorganisms (especially bacteria) in the biosphere. An introduction to the microbiology of soil, water, plants, food, and animals. Basic concepts of population genetics (mutation, gene flow, natural selection, genetic drift). Principles and concepts of genetics as revealed by classical and modern investigation. Topics will emphasize the interaction of microbial genetics with molecular biology and biotechnology.	
Module character	5 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in biology and chemistry	
Applicability	The module is compulsory for the mathematical fundamentals of science education in the bachelor's degree Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	– Restom, M. - 1990, Chemistry and Microbiology (Practical part), Aleppo University Publications – Banoud, A.; Nabghali, N. - 2003, Chemistry and Microbiology, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BWE06	**Computer Sciences**	**Dr. Adas, Dr. Hendia**
Contents and qualification aims	The module covers the fundamentals of the application possibilities in editing scientific and technical issues. This includes the use of widely available and developing their own problem-specific tools or Software components. Computer modeling to automate and simulate construction operations. Techniques and approaches for integrating digital data sources with engineering spatial databases. Approximation of boundary value and initial value problems; variational methods, hybrid and mixed method; convergence and accuracy of finite element approximations; recent developments, advanced applications. students will be able to edit quantitative Problems and appropriate methods of Hydro Systems Analysis apply. This includes the selection, use and the development of software and Software components.	
Module character	5 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in physics, mathematics and active computer skills	
Applicability	The module is compulsory for engineering fundamentals training in the bachelor's degree Water Engineering..	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and seminar paper (50 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	– Aldobiat, M.; Annan, T. - 1995, Computers and Programming, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BWE07	**Reinforced Concrete Const-ruction**	**Prof. Moulhem**
Contents and qualification aims	• **The module provides an introduction to the reinforced concrete. It displays the specific material properties and resistance, strength diagrams, streaming and shrinking, selection and distribution of reinforcement and the interaction of the two materials are steel and concrete composite and explains the basics of the force calculation, dimensioning and detailing the most important components in Concrete taught. In the special case of containers and pipes of reinforced concrete is discussed.** It explains also the Studying and design of mushroom slabs, stairs, common and band (progressive) foundations, Supportive walls foundations. Students are able to construct simple reinforced concrete components independently and measure.	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in physics and mathematics and chemistry	
Applicability	The module is compulsory for engineering fundamentals training in the bachelor's degree Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	– , G. - 1991, Foundation Engineering (Practical Ta-douri, Sh. - 1996, Facilities reinforced concrete, Aleppo University Publications – Tadouri, Sh.; Dabbagh, M.A. - 2012, Reinforced concrete, Aleppo University Publications – Kadaan, N. - 2012, Foundation Engineering, Aleppo University Publications – Houmsi, M. - 2007, Foundation Engineering, Aleppo University Publications – -ELIASpart), Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BWE08	**Fundamentals of Engineering Drawing**	**N.N.**
Contents and qualification aims	• **The module consists lectures and discussions of current topics related to Architecture engineering. Studies in analysis, design, test, and construction of buildings.** • **Projection methods, vertical projection on two perpendicular planes intersection of lines and planes, orthogonal lines and planes, methods of solving problems in descriptive geometry, circle drop.** Student will be able to draw and construct building and projects.	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in mathematics	
Applicability	The module is compulsory for engineering fundamentals training in the bachelor's degree Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and seminar paper (50 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	– Sawaf,M - 2007, Engineering Drawing, Aleppo University Publications – - Shamas, N..; Istanbuli, Z. - 1993, Geometric Representation, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BWE09	**Structural Engineering**	**Prof. Mouselli, Dr. Fattal**
Contents and qualification aims	The module explains the construction of building in the planning stages is newly constructed buildings and the placement of the bases for representation in architectural drawings. Furthermore, knowledge of the key design elements of a building are taught according to the construction progress. The students have a basic knowledge of the description of properties and microstructure of materials taking into account time, temperature and humidity conditions. They have detailed knowledge of the properties of organic and metallic materials. In addition, students have a detailed knowledge of the properties of inorganic, non-metallic building materials. They know the basic mechanisms relevant in connecting with each other and building materials in building associations and are able to derive measures to improve the durability of building materials.	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in physics, mathematics and chemistry	
Applicability	The module is compulsory for engineering fundamentals training in the bachelor's degree Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	– Kadaan, N. - 2002, Structural Dynamic, Aleppo University Publications – - Badawi, M. M.; Suffo, M.. - 1998, Mechanical construction, Aleppo University Publications – Suffo, M.. - 2008, Mechanical construction, Aleppo University Publications – - Janzeer, S. - 2014, Mechanical construction, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BWE10	**Soil Science & Soil Mechanic**	**Prof. Kadan , Dr. Jabal**
Contents and qualification aims	The module focuses on basics of soil science with special emphasis on soil geology, hydrogeology, physical, chemical and biological soil properties, soil development and classification of soils as well as principles of the geologic and geotechnical relationships concerning unconsolidated and solid rock in deeper layers. Mechanical properties of soil, soil pressure, compressing soil, stresses and strains in soil and soil improvement will be covered. The students are proficient in fundamental aspects of soils to assess soils relating to their chemical and physical characteristics. Students will know essential functions and processes in the compartments soil and groundwater as a prerequisite for further knowledge acquisition in the Hydro Sciences and are able to hold simple subject-related questions edit.	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in geology, physics and mathematics	
Applicability	The module is compulsory for engineering fundamentals training in the bachelor's degree Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	– Hamzeh, M. M. – 2007, Soil Mechanic 1, Aleppo University Publications – Seraj Eldin, M. Kh. – 2009, Soil Mechanic 2, Aleppo University Publications – Abbasi, Z.; Sadik, M.A.; Aljerdi, A. - 1990, Soil Science, Aleppo University Publications – Dermosh, K; Kamel, W.;Safar, T. - 1999, Soil Science, Aleppo University Publications – Kadaan, N. - 2007, Soil Mechanic, Aleppo University Publications – - Seraj Eldin, M. Kh. – 2013, Soil Mechanic (Practical part), Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BWE11	**Meteorology**	**N.N.**
Contents and qualification aims	The course covers all topics related to the basic fundamentals of the processes in the atmosphere and hydrosphere. Energy and water balance are shown on a physical basis. Radiation, precipitation, evaporation, over and underground drainage, water and energy storage are discussed. The module consists besides the climate, its foundations and its variability. Meteorological instruments, stations and data are an essential Focus. Students are able to describe significant atmospheric phenomena and processes on a physical basis. Also they will analyze and evaluate meteorological and hydrological information and their relevance for water management tasks. They have knowledge of the key processes in the atmosphere and hydrosphere, as well as methods for their observation and modeling. These include in particular the basic principles; Assessment procedures for all components of the water balance. .	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Good math and physic skills and basic knowledge of computer use	
Applicability	The module is compulsory for engineering fundamentals training in the bachelor's degree Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	– Abbas, J. - 1995, Climate and Meteorology, Aleppo University Publications – Kawwas, S.; Kelani, S. - 2009, Climate and Meteorology, Aleppo University Publications – Najem, W. - 2012, Geographical information systems, Aleppo University Publications	

Module Number	Module Name	Professor in Charge
BWE12	**Geodesy / Geoinformatics**	**Prof. Najm, Dr. Othman**
Contents and qualification aims	The module Geodesy contents Fundamentals of geodetic measurements; astronomical observations and surveying applications for engineering. General concepts of surveying, main principles of errors theory, surveying instruments, distances, angles and directions measurement, leveling and elevations measurement, detail survey. Used to perform benchmark circuits, profile leveling, topographic maps and straight line extensions. Also it was used principles of geographic and land information systems and their use in spatial analysis and information management. Mathematical and informational bases of Geoinformatics; Fundamentals of spatial data modeling and spatial data analysis; Fundamentals of spatial database and geographic information systems; Overview of current research fields of geoinformatics. A total station, computer programs and use of GPS are introduced. There are skills to identify types of GPS observable; Principles of GPS operations; GPS error analysis; Field method; Data collection, processing and GPS applications. Students acquire skills for the Surveying and staking of agricultural objects, they will use basic principles of geographic and land information systems and their use in spatial analysis and information management. They dominate, essential tools of geoinformatics, particularly the application of geographic information systems.	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Good math skills and basic knowledge of computer use (data management, office software, internet research, email) are required.	
Applicability	The module is compulsory for engineering fundamentals training in the bachelor's degree Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	– Najem, W.;2003, Geodesy 1, Aleppo University Publications – Najem, W.;2007, Geodesy 2, Aleppo University Publications – Osman, I.;1998, Geodesy 3, Aleppo University Publications – Zeini, A.;2006, Topographic Geodesy, Aleppo University Publications – Najem, W; 2012, Geographical information systems, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BWE13	**Hydraulics**	**Dr. Arab , Dr. Altunji**
Contents and qualification aims	The module provides an introduction to the hydraulic. In focus Hydromechanic represents the hydrostatic dealing with liquids at rest. Based on the physical properties of water pressure distributions, level surfaces, compressive forces are treated on flat and curved surfaces, buoyancy and swimming and floating stability. In the second part of the module are basic knowledge for hydrodynamics, the theory of the motion of fluids and the interaction with the boundaries of the flow region, mediated. Starting from the basic conservation laws of Hydromechanics laminar and turbulent flow in pipes and open channel flow are explained in the stationary case. This module includes an internship in the lab with Experiment. Fluid properties; hydrostatics; flow concepts; continuity, energy, and momentum equations and applications; flow measurements, pipe and channel flow. The students learn with the latest measuring technology to deal and to interpret the ways to carry out a hydraulic model experiment and evaluate the test results and apply them to the outdoors.	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Knowledge in physics, higher mathematics	
Applicability	The module is compulsory for engineering fundamentals training in the bachelor's degree Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	– Shamas, N.; Arab, H. - 1994, Hydraulics 1, Aleppo University Publications – Kazan, N. - 1985, Hydraulics, Aleppo University Publications – Alrifai, M. F. - 1983, Fundamentals of Hydraulics, Aleppo University Publications – Alrifai, M. F. - 1985, Hydraulics (Practical Part), Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BWE14	**Hydrometry**	**Dr. Abdelrahman**
Contents and qualification aims	The module covers the importance, extraction, transmission and primary processing of hydrological data. It will be provided with theoretical and practical knowledge of the main methods of Hydrometry. In addition to the handling of individual cases will be discussed criteria for task-specific selection of measurement points and the use of appropriate equipment. Also trends under the use of microelectronics rapidly progressive, discussed further development of measurement technology. Students may be task-oriented use modern measuring technology to solutions of specific tasks, as well as a monitoring and planning tasks in the operation of monitoring networks.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Knowledge in physics, higher mathematics	
Applicability	The module is compulsory for engineering fundamentals training in the bachelor's degree Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	– Alcheblak, M.; Alnajjar, M. H. - 1995, Hydrology, Damascus University Publications – Shagale, A.; Jaara, A. - 2007, Hydrology 1, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BWE15	**Hydrology**	**Dr. Bashi**
Contents and qualification aims	The module provides an introduction to the Hydrology, it includes radiation, precipitation and evaporation. In addition, make the climate, its foundations and its variability an essential focus. These include in particular the basic principles; assessment procedures for all components of the water balance. The module also covers hydrology cycle: Rainfall measurements, average rainfall depth, consistency check and adjusting of station, records, estimation of missing data, computations of evapotranspiration and infiltration values. The module consists besides the climate, its foundations and its variability. Students are able to analyze meteorological and hydrologic data, hydrograph theory, hydrologic estimations for design of water control projects; flood control and reservoir routing and to assess significance for water management tasks.	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in physics and mathematics	
Applicability	The module is compulsory for engineering fundamentals training in the bachelor's degree Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	– Alrifai, M. F. - 1990, Hydrology, Aleppo University Publications – Alcheblak, M.; Alnajjar, M. H. - 1995, Hydrology, Damascus University Publications – Masad, Sh. - 2005, Hydrology, Aleppo University Publications – Shagale, A.; Jaara, A. N. - 2007, Hydrology 1, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BWE16	**Pumping Stations**	**Dr. Idris**
Contents and qualification aims	• **The module provides an introduction to the pumps, need of pumping stations in projects, main elements of pumping networks, hydraulic design of pumping networks and calculation of the cost of pumping network and determine economic diameter. It contains also the design of pumping networks, cavitation in pumps and pipes, protection from negative pressure, water hammer, types of pumping stations, pumps and investment and maintenance of pumping networks.** It includes the selection of the type and number of stages, determination of main dimensions, the approximate interpretation of the main functional elements and the consideration of the energy conversion losses and the interaction energy of the machine and plant. The student should be able to solve typical engineering problems that are typical interdisciplinary due to their thermodynamic, fluidic, structural mechanics and materials engineering aspects. He should be able to apply the acquired basic knowledge in the development, manufacture and operation of power machines.	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in physics and mathematics	
Applicability	The module is compulsory for engineering fundamentals training in the bachelor's degree Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	– Damerji, I. - 1982, Water Machines, Aleppo University Publications – Kazan, N. - 1990, Pumping Stations , Aleppo University Publications – - Ashlek, M. - 1998, Maintenance of Irrigation and Drainage nets , Damascus University Publications	

Module Number	**Module Name**	**Professor in Charge**
BWE17	**Irrigation**	**Dr. Baradii**
Contents and qualification aims	The module includes principles of irrigation as the sources of water, the relationship between plant, soil and water, use of water for transpiration and evaporation (evapotranspiration), crop water requirements, irrigation water supply, fertigation, water balance equation, control and management of irrigation water distribution, general framework with special regard to semi arid areas. It contents also main types of irrigation systems (basin irrigation, furrow irrigation, border irrigation, sprinkler irrigation, drip irrigation, and underground irrigation), scheduling the irrigation and economical study. Students having full knowledge about irrigation projects, they will be able to design, construction and management of irrigation projects, and evaluation of modern irrigation systems in practice.	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in mathematics and advanced knowledge in hydromechanics and soil	
Applicability	The module is compulsory for engineering fundamentals training in the bachelor's degree Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	– Kazan, N. - 1983, Irrigation and Drainage, Aleppo University Publications – Jensen, M. E. - 1983, Farm Irrigation System, American Society of Agricultural Engineering – Stewart, B.A.; Nelsen, D.R.. - 1990, Irrigation of Agricultural Crops, American Society of Agronomy – Alkanj, A. - 1993, Irrigation, Tishreen University Publications – Abbas, J.; Aldarir, A.N. - 1995, Irrigation and Drainage, Aleppo University Publications – Baradi, A. - 2008, Irrigation, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BWE18	**Drainage**	**Dr. Haj Houmaidi**
Contents and qualification aims	The module includes fundamentals of drainage benefits and importance of drainage; water balance; types of drainage systems; design and construction of main surface and subsurface drainage systems; drainage materials, necessities of drainage and its relationship to the water system in soil. Also it contents mechanisms of putting drainage pipes, filter around pipes, protection and installations of drainage discharges, general form of drainage network, modeling of groundwater movement and regulated, planning of open drainage network, rainy drainage and economical studies. Students having full knowledge about drainage, they will be able to design, management and evaluation of drainage projects.	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in mathematics and advanced knowledge in hydromechanics and soil	
Applicability	The module is compulsory for engineering fundamentals training in the bachelor's degree Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	– Kazan, N. - 1983, Irrigation and Drainage, Aleppo University Publications – Abbas, J.; Aldarir, A.N. - 1995, Irrigation and Drainage, Aleppo University Publications – Alhaj Houssein, M. - 1997, Drainage, Aleppo University Publications – Baradi, A. - 1998, Irrigation and Drainage, Aleppo University Publications – - Skaggs, R.W.; Van Schilfgarade, J. - 1999, Agricultural Drainage, American Society of Agronomy	

Module Number	**Module Name**	**Professor in Charge**
BWE19	**Drinking Water Supply**	**Dr. Habboub, Dr. Dai**
Contents and qualification aims	In the module will discuss about the methods and processes of modern drinking water treatment as well as the development of constructions for drinking water distribution and the economical operation, in the context of changing raw water quality and changing conditions of water distribution. • **The students know basic scientific and technical knowledge of the relations of these areas. These are conditions for the further acquisition of knowledge. They are able to compute and interpret the single steps und to dimension water distribution systems. The students know possible influences on water quality during water treatment, distribution and storage and are able to evaluate disturbances of quality and to suggest adequate measures.**	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in physics and mathematics and knowledge in hydromechanics	
Applicability	The module is compulsory for engineering fundamentals training in the bachelor's degree Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	– Alshami, Ch. - 1987, Water Supply, Damascus University Publications – Hajjar, S.; Bannoud, A.; Habboub, H.; Dai, M. - 2012, Water Nets, Aleppo University Publications – Hakem, J. - 1996, Water Supply, Aleppo University Publications – Husain, S.K.- 1974, Water Supply and Sanitary Engineering, Oxford Publishing	

Module Number	**Module Name**	**Professor in Charge**
BWE20	**Waste Water Discharge**	**Prof. Bannoud, Prof. Mourad Agha**
Contents and qualification aims	The module includes sewage water, its importance, and the types of wastewater (house water, industrial areas and rainwater) in addition it studied the physical, chemical and biological properties. The methods of wastewater collection and transported by channel or pipes to deliver it to treatment plants, also it includes the design of wastewater transport network, also it provides knowledge about the processes in the entire Wastewater treatment plant . The scientific background of the processes are explained and applied to different treatment levels. The processes and the technical implementation of various procedures are deepened explained, as are the interactions between wastewater and sludge treatment. Students are able to describe the scientific and technical basics of cleaning and transport processes of water and substances in natural and engineered systems and to apply planning and optimization of wastewater systems. They can also to current and future-oriented analyze methods of waste water and sludge treatment, also optimize and apply the design and operation.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in physics, chemistry and biology and knowledge in hydromechanics	
Applicability	The module is a compulsory module for specialized training in the bachelor's degree Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	– Murad Agha, M. - 1991, Waste Water, Aleppo University Publications – Bannoud, A.; Barakat, R. - 1997, Waste Water, Aleppo University Publications – Karmo, O.; Wahbe, H. - 1994, Waste Water, Damascus University Publications – - Murad Agha, M.; Bannoud, A. - 2010, Waste Water Treatment, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BWE21	**Hydraulic Installations**	**Prof. Chagale**
Contents and qualification aims	• **The module recorded river water outlet construction, sedimentation basins, flood water drainage construction, siphons, spreaders, connection constructions, protection of canal falls. The focus is on basic structures and functions of dam construction, selecting the appropriate type of dam and preliminary studies of dam site, earth dams, concrete and Mmasonry dams, arc dams, heavy dams, appurtenant installations, sediment in dam reservoirs.** • **Students will have basic knowledge and a scientific understanding of the installation. They can the hydraulic installations.** •	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in physics and mathematics and advanced knowledge in hydromechanics	
Applicability	The module is a compulsory module for specialized training in the bachelor's degree Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	– Shamas, N.; Arab, H. - 1994, Hydraulics 1, Aleppo University Publications – Wakil, M. - 1993, Water installations, Aleppo University Publications – Alrifai, M. F. - 1985, Hydraulics (Practical Part), Aleppo University Publications – - Shagale, A.; Jaara, A. N. - 2012, Water installations, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BWE22	**Water Resources Management and Water Rights**	**Dr. Sadek, Dr. Abdelrahman**
Contents and qualification aims	The module consists terminology and principles of water resources such as rains, floods, rivers and groundwater. Occurs after use of the elements of the water balance and placement of task-relevant methods of data collection and processing an introduction to various methods of water budget calculations. Studying water resources management, as surface runoff and its extremes: floods and draughts. Water resources modeling , water balance, models of significant rainfall-runoff events, Groundwater flow, groundwater collection and wells are topics. Design and management of surface and groundwater systems; use of mathematical programming, simulation, and economic theory. Strategies and concepts of integrated water resources management are part of the module. Additionally strategies to consider the socio-economical and political framework as well as the capacity development are introduced. Water pricing, water unit productivity, water costs, water use, demand, supply alternatives, and water rights as well as water law and international conventions on water will be covered in the module. These include basics of constitutional law and selected civil liberties, fundamentals of general administrative law, international contracts. The students are able to analyze tasks of management and management optimization of water resources and to find solutions of the regional boundary conditions.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in mathematics and advanced knowledge in hydromechanics and soils	
Applicability	The module is a compulsory module for specialized training in the bachelor's degree Water Engineering.	
Prerequisite to achieve credit points	The module exam is a written examination (120 minutes).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	– Alshami, Ch. - 1987, Water Resources, Damascus University Publications – - Safar. T.; Aldarir, A.N. - 2003, Water Resources, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BWE23	**Soil Water and Groundwater**	**Prof. Masad**

Contents and qualification aims	Focus of the module is to quantify dynamic flow and solute transport processes in the soil and groundwater. These include the flow to wells and ditches, flow in heterogeneous and anisotropic porous media and conservative substance propagation processes. In the module fundamentals of soil physics and soil hydrology are provided and the impact of soil properties and land use. The impacts of the soil on surface runoff, tendency for Stalinization and water erosion as well as measures of their reduction are discussed. The presented topics are deepened within tutorials and practical training, where tasks like sampling, measurement of groundwater levels, and determination of hydraulic conductivities are carried out. The students learn quantitative methods by which both scientific and technical issues in the areas of soil and groundwater hydraulics and reactive material spread in the underground space to be processed. They are able to measure and describe hydrological processes in soils. They apply basic calculation and evaluation methods, estimate the impact of land use and simulate water and matter fluxes in soils using some models.
Module character	5 hours of lectures per week
Prerequisite of attendance	Basic knowledge in mathematics and advanced knowledge in hydromechanics, soil, irrigation and drainage
Applicability	The module is compulsory elective module in the subsidiary subjects basics in the bachelor's degree Water Engineering.
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).
Frequency of the module	The module is offered in summer term.
Credit points	The module earns 5 cr.
Work load	Work load is 150 hours.
Duration of the module	The module takes one term.
Suggested references	– Wahbi, A.; Teret., M. - 2012, Water Relations, Aleppo University Publications – Masad, Sh. - 2005, Hydrology, Aleppo University Publications – Shagale, A.; Jaara, A. - 2007, Hydrology 1, Aleppo University Publications – - Cheikh Mashel, M.A. - 2005, Engineerin Geology, Aleppo University Publications

Module Number	**Module Name**	**Professor in Charge**
BWE24	**Water Quality and Water Treatment**	**N.N.**
Contents and qualification aims	The module complements to the module Drinking Water Supply. It assumes knowledge of the most important occurring inorganic and organic substances mediate in the water, in particular entry, behavior and the toxicological relevance are the focus. Pathways in the hydrosphere, as well as the complex relationships of the behavior of these compounds and the interactions between them. Students know the biochemical reactions occurring in the aquatic environment. They know the most important inorganic and organic substances in water, and get the knowledge about the important of water pollutants and their relevance for water quality. Physical -chemical procedures to remove these materials for drinking water processing are introduced. Students will acquire the ability to work independently and experimentally traceable evaluate and interpret results of laboratory tests.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in chemistry, biology, physics and mathematics	
Applicability	The module is compulsory elective module in the subsidiary subjects basics in the bachelor's degree Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	– Alsamman, M.; Alsulh, M. - 1997, Chemistry and Microbiology of Water, Aleppo University Publications – Alsamman, M. - 2007, Water Analyse, Aleppo University Publications – -Aldusuki, H.; Aituni, H. - 2010, The foundations of Desalination , Translation from Alazme, M.	

Module Number	**Module Name**	**Professor in Charge**
BWE25	**Ecology and Environmental Protection**	**Dr. Sharhouli**
Contents and qualification aims	The module recorded the Ecology processes and the current environmental changes. The focus is on basic structures and functions of ecosystems and usable services. With regard to the population ecology and biodiversity are treated the population genetic information acquisition and conversion, and demographic processes. The concept linear, integer and nonlinear programming simulation; mathematical modeling and optimization with design applications in civil and environmental engineering environment and ecosystems, disruption of ecosystems, atmospheric environment are shown. Students will have basic knowledge and a scientific understanding of the function, stability, self-regulation and dynamics of characteristic semi-natural and natural ecosystems adequately built and the environmental media. They can derive and explain certain protection measures for the design and the regeneration of these ecosystems.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in chemistry, biology, physics and mathematics	
Applicability	The module is compulsory elective module in the subsidiary subjects basics in the bachelor's degree Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and labor examination (50 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	– Almefti, M.B.- 1995, Environmental Engineering 2, Damascus University Publications – Farah, P. - 1996, Solid Waste and Environment Pollution, Aleppo University Publications – Bannoud, A.; Habboub, M.H.. - 2009, Environmental Protection, Aleppo University Publications – Darkalt, A.; Kawwas, S.; Alkhatib, M.; Khalil, K. - 2005, Ecology, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BWE26	**Watershed Management**	**Dr. Arafat, Dr. Abdelrah-man**
Contents and qualification aims	The module will develop the students competence for integrated watershed management. Methods of data collection and analysis, of determination and forecast of supplies as well as methods to obtain water demand are introduced. The fundamentals of development and application of methods to dimension and simulate reservoirs and flood protection measures are explained. Decision support systems are imparted to aggregate the single elements of watershed management. Main contents are the software application to quantify hydrologic, hydraulic, and sedimentary processes at the scale of watersheds. Based on the acquired analytical competences in the fields of water balance, runoff in open channels, transport of sediments and hydrologic data analysis the module focuses on the application of recent model approaches for basic examples. The students know the main procedures and tools for integrative watershed management (data acquisition, analysis, forecast, dimensioning, simulation) regarding balancing between demand and supply using typical control elements as dam and absorption reservoirs. They are able to understand and simulate the complex interactions between land use and water use, run-off dynamics and morphology within a watershed.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in mathematics and advanced knowledge in hydromechanics, soil, irrigation and drainage	
Applicability	The module is compulsory elective module in the subsidiary subjects basics in the bachelor's degree Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	– Masad, Sh. - 2005, Hydrology, Aleppo University Publications – - Shagale, A.; Jaara, A. N. - 2007, Hydrology 1, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BWE27	**Fundamentals of Waste Management**	**Prof. Bannoud, Dr. Sharhouli**
Contents and qualification aims	The module defines terms and provides techniques from the areas of deposition and aftercare of waste and pollutant characterization of contaminated sites. Central focus in part deposit and provide follow-up topics such as types, designs, classes, after-care and constructi-on of landfills. In contrast, in the part of the characterization of pollutants are potential groups of substances, risks and measures the damage description in the focus of attention. Students learn essential foundations for the deposition of wastes, residues and contaminants.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in chemistry, biology, physic and soil science	
Applicability	The module is compulsory elective module in the subsidia-ry subjects basics in the bachelor's degree Water Enginee-ring.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	– Farah, P. - 1996, Solid Waste and Environment Pollu-tion, Aleppo University Publications – Bannoud, A. - 1996, Solid Waste Treatment, Aleppo University Publications – Bannoud, A.; Habboub, M.H.. - 2009, Environmental Protection, Aleppo University Publications	

Module Number	**Module Name**	**Professor in Charge**
BWE28	**English Language**	N.N.
Contents and qualification aims	The module provides the basics of the language, due to the basic principles of learning a foreign language in terms of conversation, speak and writing. It also includes the study of the grammar and writing principles. Students learn in the end, writing, listening and speaking so that they are able to understand the language better. They can also understand some of the dialects.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in foreign language	
Applicability	The module is compulsory for the bachelor's degree Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	– Oxford university, Principles of English language	

Module Number	**Module Name**	**Professor in Charge**
BWE29	**Arabic Language and History**	N.N.
Contents and qualification aims	The module provides the rules and principles developed around the Arabic language and the use of words and phrases include, as scheduled address to the grammar. Also includes a history of the Arabs and the Arab world and the most important dates of the Rising. Students learn in the end, sophisticated language and style to use words and sentences so that they are able to understand the language better.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in language and history	
Applicability	The module is compulsory for the bachelor's degree Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	
Suggested references	– Ministry of high education, Arabic language for students	

Module Number	**Module Name**	**Professor in Charge**
BWE30	**Practical Training/ Project Study**	N.N.
Contents and qualification aims	The Student must carry out practical training about one Problem belongs to subjects of Water engineering and Environment in one or more institution or incorporation, and he must present full study about this problem	
Module character	Practical Training/ Project Study: 6 hours tutorial per week	
Prerequisite of attendance	Basic Knowledge of Practical Training/ Project Study, the student must be in the 5^{th} Semester	
Applicability	The module is suitable for the professional and research oriented studies in water land environmental engineering.	
Prerequisite to achieve credit points	Having passed the module seminar and presentation be-fore commission.	
Frequency of the module	The module is offered annually.	
Credit points	The module earns 15 cr.	
Work load	Work load is 450 hours .	
Duration of the module	The module takes two terms starting in Semester 5.	
Suggested references		

Module Number	**Module Name**	**Professor in Charge**
BWE31	**Bachelor Thesis incl. Defense**	N.N.
Contents and qualification aims	The Student must work Bachelor Thesis with Defense about one problem belongs to the subjects of Agricultural Water Management in the semester, he must present full study about this problem	
Module character	Bachelor Thesis with Defense: 6 hours tutorial per week	
Prerequisite of attendance	Basic Knowledge of Bachelor Thesis with defense, the student must be in the 6th Semester	
Applicability	The module is suitable for the professional and research oriented studies in agricultural and environmental engineering	
Prerequisite to achieve credit points	Having passed the module presentation before a commission	
Frequency of the module	The module is offered in 6 th Semester .	
Credit points	The module earns 15 cr.	
Work load	Work load is 450 hours	
Duration of the module	The module takes one term.	
Suggested references		

Study Regulations for the Bachelors degree program in Water Engineering University of Aleppo

Table of Contents:

1- Scope
2- Aims of the program
3- Admission Requirements
4- Beginning and duration of study
5- Teaching and Learning
6- Structure and implementation of studies
7 - Study contents
8- Credits (credits)
9- Academic Advising

1- Scope

These study regulations based on the Examination Regulations aim, content, structure and sequence of study for the Bachelor's degree program in water engineering at the University of Aleppo.

2- Aims of the program

The course prepares both activities in water management practice as well as a postgraduate Master's degree; the latter should be the rule. Students have the, incorporating the latest scientific findings, for professional practice and a postgraduate master's degree basic and necessary expertise. The students are able construction and operation of technical equipment for the production, storage and redistribution of the limited water resources actively to contribute in the planning. They are able thus to contribute in a globally changing world to solve problems in water management and related fields.

After incorporation into professional practice among the possible activities: participation in water and wastewater associations and government agencies in planning and consulting offices, research facilities, and involvement in plant engineering company.

3- Admission Requirements:

A Prospective Students may be enrolled only if they have to enter university or a relevant subject specific university or recognized by law or by the relevant state as equivalent admission requirement. The program requires both an interest in the engineering sciences as well as for the basic scientific subjects of mathematics, physics, chemistry and biology.

4- Beginning and duration of study:

The course can be taken each winter semester.

The standard period of study includes classroom, self-study, and examinations. It amounts, including the completion of the bachelor's thesis and the colloquium six semesters.

5- Teaching and Learning:

The curriculum is structured modularly. In each module the content of teaching through lectures, tutorials, seminars, internships, study tours, and tutorials are taught, strengthened and deepened.

Lectures serve to explain the subject matter and content areas of the modules and discussed. Exercises are aimed at acquiring necessary methodological and content knowledge. Seminars allow students to inform themselves on the basis of literature or other materials under guidance over a selected area of concern, and the acquiring knowledge is going to carry forward to discuss in the group or represent in writing. The self-study takes place during studies and serves the autonomous acquisition of the required skills of the module and the learning control.

6- Structure and implementation of studies:

The course is modular. The curriculum is divided into six semesters.

A total of 180 credits must be obtained. The sixth semester is emphasis on writing a Bachelor's thesis with the colloquium available.

Contents and objectives, comprised of teaching and learning, conditions, availability, frequency, effort, and duration of the individual modules can be found in the module descriptions .

The courses will be held in Arabic. The study plan, and access to elective modules may be amended upon the proposal of the study commission by the faculty.

7- Study contents:

The study of Water Engineering is a complex and multidisciplinary study that has the technical water management systems and their numerous links to the compartments soil

and atmosphere, and society to the object. The Course of this study are both scientific foundations of Hydrobiology and chemistry and structural foundations of engineering including hydraulic engineering. In the compulsory modules students acquire the theoretical foundations and specialized knowledge. The predominantly interdisciplinary module offers ensure the integration of scientific and engineering disciplines with the application-oriented disciplines. So the water is conveyed from the beginning of their studies at an interdisciplinary, cross-curricular reference for the study.
The student is to know, which is required for the development, modernization, construction and operation of the water supply, wastewater treatment and water management including waste product - treatment. In addition, student is trained in the computer-aided modeling, simulation and optimization of basin-related water management processes and systems. In the elective modules, the student is thorough knowledge in accordance with their own interests and taking into account its possible future professional orientation. The interdisciplinary elective modules allow students to expand the already acquired knowledge in the compulsory area of study on a limited level.

8- Credits :

ECTS credits document the average workload of students and their individual academic progress. One credit corresponds to a workload of 30 hours. As a rule, 60 credits are awarded each academic year, i.e. 30 per semester. Due to the nature and scope in the module descriptions referred lectures and coursework and examinations, as well as through self-study of undergraduate thesis and the colloquium total of 180 credit points can be acquired included. In principle credits are modular basis and only be awarded if the module examination is passed. The module descriptions are rules about how many credits can be earned by one module and the conditions under which this is possible in detail.

9- Adaptation of module descriptions:

In order to adapt to changing conditions, the module descriptions in the context of an optimal study organization except with the fields "Module Name", "Contents and objectives", "teaching methods", "Requirements for awarding credit points" and "Credits and grades" in a simplified procedures be changed.
In the simplified procedure, the Faculty Council decides to change the module description on a proposal from the Commission study. The amendments shall be published faculty usual.

Quality Management and Accreditation

The Quality Management is the act of overseeing all activities and tasks needed to maintain a desired level of excellence. This includes creating and implementing quality planning and assurance, as well as quality control and quality improvement.

University: Aleppo University

Faculty: Faculty of Civil Engineering

Specification of the Program

1- Basic Data

Program Name (BWE):

program of Water Engineering

Type of the Program:

single

Name of the participated Program:

(none).

Duration of the Program:

6 Semesters.

Qualification (Certificate), which the student get at the end of the program:

Bachelor of Civil Engineering (Specialist in Water Engineering).

Language used in the Program:

Arabic is the main language. Several modules are presented in English.

Place of Program application:

University Campus, Buildings of Faculty of Civil Engineering.

External Check Person:

Date the latest acceptance of specification of the Program:

2- Professional Data

2-1- Objectives of the course

Developing Course: it needs objectives:

Objectives describe what learners will be able to do at the end of instruction, and they provide clear reasons for teaching. When writing objectives be sure to describe the intended result of instruction rather than the process o f instruction itself.

Reasons for objectives:

In order to select and design instructional content, materials or methods and to have a sound basis by which success can be measured.

- To give designers and instructors an objective method to determine how successful their educational material has been. By clearly stating the results the learners should accomplish. Instructors can identify whether students have gained the appropriate skills and knowledge.
- Because objectives should be stated before teatchers begin to develop instructional materials. They provide students the means to organize their efforts toward accomplishing the desired behaviors.

Developing a course typically requires:

- Understanding how people learn
- Considering principles and models of course design
- Writing learning goals and outcomes

Strategy for developing courses:

- Plan: create a time line, including all resources, activities, dates, and personnel training.
- Do: implement the plan and collect data.
- Check: analyze the results of the plan.
- Act: act on what was learned and determine the next steps.

How the Curriculum should be evaluated:

- Questions may be included to evaluate:
- The relevance of the content.
- The appropriateness of the course design.
- The effectiveness of the faculty.
- The adequacy of the logistical arrangements such as registration, facilities, and food service.

Course Evaluations:

- Evaluation system is an important tool that helps improve teaching and learning at the Institute. All university instructors participate in course evaluations. All scientific staff has to be evaluated every year, and the results of evaluations have to be considered. The instructor must be absent from the location where this online evaluation is taking place. The process of gathering information about the impact of learning and of teaching practice on student learning, analyzing and interpreting this information, and responding to and acting on the results, is valuable for several reasons.They are beneficial because instructors can review how others interpret their teaching methods, thereby improving their instruction.

- The information can be also used by administrators, along with other input, to make summative decisions and make formative recommendations way, to attempt to influence the outcome of this evaluation rating.
- Course evaluations are implemented in one of two ways, either summative or formative.

Guidelines for quality assurance within higher education:

- Institutions should have a policy and associated procedures for the assurance of the quality and standards of their programs and awards. They should also commit themselves explicitly to the development of a culture, which recognizes the importance of quality, and quality assurance, in their work. To achieve this, institutions should develop and implement a strategy for the continuous enhancement of quality.
- The strategy, policy and procedures should have a formal status and be publicly available. They should also include a role for student.
- A quality management principle is a comprehensive and fundamental rule for leading and organization, aimed at continually improving performance over the long term by focusing on customers while addressing the needs of all other stakeholders.

Notification of message and Goal of the Program:

The Department of Water Engineering in the Faculty of Civil Engineering in Aleppo University undertake the preparation of an excellent absolvent in the fields of Water Engineering, qualified to continue the qualification and professional development, able to compete and cover the need of the labor market in these Engineering fields. In addition to, the Departments give a very good studying and research plan aims to development the scientific research and participation in professional and research projects. The department contributes in supporting and covering the needs of development plans of the country, during the operation with the related scientific, research and service sides.

Goals of the program:

The academic plan in the **Bachelor course of Water Engineering**, aims at providing the students the following items:

- High level information in science and computer techniques, and developing the skills in engineering sciences and its applications.

- Developing the ability of the students to achieve various water engineering studies, check and use it according to the engineering codes.
- Comparing between the engineering solutions, and choose the optimum ones.
- Developing the work skills and regulate the relationship between the work team which the best and have many specialists.
- Strengthening the research ability, developing, and working with the modest software's, equipment's… etc.
- Developing the item of the scientific, social and cultural site of the student's characters.
- Continuous developing to get the high quality of the research, teaching…...etc.
- High level information in science and computer techniques, and developing the skills in engineering sciences and its applications.

2-2- Program Composition and its Contents

- **Admission conditions in the Program:**
- The admission will be done through the competition among the students, who have got the secondary school certificate – scientific branch, national level.
- **The conditions of success in the Program:**
- Presence of theoretical, tutorial, and laboratory lectures and present the required projects and scientific and laboratories reports.
- **Success from year to year**:
- Success in all modules in 1st and 2nd Semester each studying year.
- **Completion of Program**:

Condition of accomplish (get over) of studying years	
1st year	Success in modules of 1st and 2nd semesters, the student can hold max. 4 modules.
2nd year	Success in modules of 3rd and 4th semester, the student can hold max. 4 modules from all foregone semesters
3rd year	Success in modules of 5th and 6th semester, and in all foregone semesters

Conditions of the completion of the Program:

- **Brief description of the kind of Practical Training/ Project Study:**
- The Student must carry out practical training about one problem related to the subjects of Water Engineering in one or more institutions or incorporations, and he must present full study about this problem.
- **In which phase or phases of the program this Practical Training/ Project Study is carried out :** This Study or Project must be carried out in the 5th semester.
- **Number of credits / or semesters for this Practical Training/ Project Study:**
- Offered in 5th and 6th semester with 15 cr.
- **Description of evaluation procedures**:
- The evaluation should be done by a commission, which is formed by the delegacy of Faculty of Civil Engineering; the student has to pass the module seminar and presentation in front of the commission.

Brief description of the kind of Bachelor Thesis
The Student has to carry out Bachelor Thesis about one problem related to the subjects of Water Engineering in the 6th semester, and he must present a full study about this problem in front of the commission.
In which phase from the program the Bachelor Thesis with defense should be carried out:

- This Bachelor Thesis must be carried out in the 6th semester.
- Number of Credits / or semester for this Bachelor Thesis with defense:
- Offered in 6th semester with 15 cr.

Description of evaluation procedures:
The evaluation should be done by a commission, which formed by the delegacy of Faculty of Civil Engineering; the student must pass the module and presentation in front of the commission.

3- The Program description

The program of Water Engineering based on theoretical lectures, laboratory meeting, scientific excursion and summer training approved in the study plan.
Brief description of praxis experiences activity:

- Summer training in surveying works in field;
- Summer training in sanitary projects;
- Summer training in water engineering and irrigation projects;
- Scientific excursion to water engineering and sanitary projects

In which phase or phases of the program the field experience should be introduced:

- Surveying works in 3rd semester;
- Summer training in sanitary projects in 5th semester;
- Summer training in water engineering and irrigation projects in 4th and 5th semester;
- Scientific excursion to water engineering and sanitary projects in 4^{th}, 5^{th} and 6^{th} semester

MODULE COMPENDIUM

Water Engineering (WE)

Master Programme

University of Aleppo

Faculty of Civil Engineering

2015

EDUWAT: 511251-TEMPUS-1-2010-1-DE-TEMPUS-SMHES
Development of a Modern Higher Education System for Water Engineering in Syria

Preface

Basic contents of the education profiles	
Water Engineering	**Agricultural Water Management**
Focus of work: • Water supply • Drinking water • Urban waste water disposal • Water protection areas	**Focus of work:** • Agricultural irrigation and drainage • Water Ressources Management • Water maintenance
Application fields: • Water authorities • Public utilities • Industrial enterprises • Enterprises for planning • Calculation and construction of plants	**Application fields:** • Agricultural and water authorities • Fields • Ecology and environment • Hydrology engineering
Main focus of education: • Drinking water supply and treatment • Industrial water supply • Urban waste water disposal • Industrial waste water disposal • Water protection areas • Waste water plant construction • Water quality	**Main focus of education:** • Agricultural irrigation systems • Agricultural drainage systems • Water harvesting • Storage engineering • Statics, construction • Soil science • Surface water • Groundwater

Basic education for all education profiles	
• Environmental law and water rights • Hydraulic • Waste water treatment • Water management	• Hydrology • Water supply • Land improvement • Soil and groundwater sciences

AU Master Course Water Engineering - MWE

	Credits	%
Modules in Mathematics	10	8%
Modules in Engineering	10	8%
Modules in Hydro Sciences	10	8%
Modules with Specialization	20	17%
Elective Modules	20	17%
Modules for general Qualification	10	8%
Practical Training /Project	10	8%
Master Thesis plus Defense	30	25%
Total	**120**	**100%**

Module Semester	1	2	3	4	Total/ECTS
Mathematics	5	5			10
Engineering	5	5			10
Hydro Sciences	5	5			10
Specialization	5	10	5		20
Elective Modules	10		10		20
General Qualification		5	5		10
Practical Training/ Project Study			10		10
Master Thesis plus Defense				30	30
Total	**30**	**30**	**30**	**30**	**120**

Module Nr.	Course Semester	1	2	3	4	Total/ ECTS
	Mathematics	**5**	**5**			**10**
MWE01	Advanced Mathematics	5				5
MWE02	Modeling and Simulation		5			5
	Engineering	**5**	**5**			**10**
MWE03	Construction Materials	5				5
MWE04	Hydro Systems Analysis		5			5
	Hydro Sciences	**5**	**5**			**10**
MWE05	Hydromechanics	5				
MWE06	Hydraulic Engineering		5			5
	Specialization	**5**	**10**	**5**		**20**
MWE07	Advanced Irrigation	5				5
MWE08	Advanced Drainage		5			5
MWE09	Waste Water Treatment			5		5
MWE10	Climate Changes		5			5
	Elective Modules *	**10**		**10**		**20**
MWE11	Hydrochemistry	5				
MWE12	Biotechnology	5				
MWE13	Use and Modeling of Groundwa-ter			5		
MWE14	Urban Water	5				
MWE15	Ecological Modeling			5		
MWE16	Water Transport and Distribution			5		
	General Qualification		**5**	**5**		**10**
MWE17	Scientific Writing		5			5
MWE18	Research Project			5		5
MWE19	**Practical Training/Project stu-dy**			**10**		**10**
MWE20	**Master Thesis plus Defense**				**30**	**30**
	Total	**30**	**30**	**30**	**30**	**120**

* rom these modules students must select two modules for each of the1st. and 3rd. Semes-ter

Curricula Structures - Master Course Water Engineering - MWE

Semester 1	**Advanced Mathe-matics**	**Construction Materials**	**Hydromechanics**	**Advanced Irrigation**	**Elective Modules**	
Semester 2	**Modeling and Simu-lation**	**Hydro Systems Analysis**	**Hydraulic Enginee-ring**	**Climate Changes**	**Advanced Draina-ge**	**Scientific Writing**
Semester 3	**Waste Water Treatment**	**Elective Modules**		**Research Project**	**Practical Training/ Project Study**	
Semester 4	**Master Thesis**					
Credits	5	5	5	5	5	5

Modules in Natural Sciences
10% - 25%

Modules inTechnical Sciences
10 - 25%

Modules in Economic & Social Sciences
5% - 15%

Modules in Variable Sciences
55% - 70%

Module Number	**Module Name**	**Professor in Charge**
MWE01	**Advanced Mathematics**	**Dr. Hanife**
Contents and qualification aims	Advanced topics in engineering mathematics, including special functions, orthogonal functions and Fourier series, boundary value problems in various coordinate systems, integral transforms, partial differential equations and introduction to complex variable theory. Descriptive statistics, discrete and continuous probability distributions, parameter estimation, statistical modeling, confidence intervals, hypothesis testing, parametric and nonparametric resampling tests, and introduction to variance analysis, correlation and regression analysis. The use of computer-based mathematical tools will be an integral part of the course. Aims of qualification are the development of skills and abilities for problem oriented work using statistical methods and operations including selected software.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge of mathematics for engineers, Statistics, computer aided skills	
Applicability	The module is compulsory for the Master Course Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MWE02	**Modeling and Simulation**	**Dr. Istanbouli**
Contents and qualification aims	• **The module consist introduction of computer assisted design programmes, structural analysis types, elements types, techniques and applications of modeling. Foundation of modeling, numerical methods, model building, guidelines for modeling, modeling systems, application aspects, model operation control will be studies, considered and applied.** Basic concepts, formulation, and application of finite element techniques for numerical solution of problems in structural and continuum mechanics, geotechnical engineering, and water resources engineering. • **Students will apply modeling in a special study and carry out application forms on a local project, enabling them to understand the modeling and its applications in the field of water. In particular the application of geographic information systems.**	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge of mathematics for engineers, Statistics, computer aided skills	
Applicability	The module is compulsory for the Master Course Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MWE03	**Construction Materials**	**Prof. Kaddour**
Contents and qualification aims	The module teaches the basic fundamentals of the Construction Materials. It contains general properties of materials, rocks and aggregates, hydro-bonds and cement mortar, cement, concrete, carbon bonds, steel and some of the materials used in civil engineering works. . The students can apply their knowledge for Construction Materials tasks.	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in physics, mathematics and basic of engineering sciences	
Applicability	The module is compulsory for the Master Course Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MWE04	**Hydro Systems Analysis**	**Prof. Chagale**
Contents and qualification aims	The focus of this module are firstly the analysis and simulation of hydroystems, for other sensing and monitoring procedures in the water industry and Hydrobiology. This includes, numerical methods for the solution of the corresponding process equations, model calibration and validation with measured data. Selected topics are reinforced with structured lectures from water management practice (representatives of engineering firms, government agencies or water suppliers) as well as from applied research. Students are able to analyze water management problems from different regions and climates, to model and visualize. .	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in hydrosciences, engineering sciences, mathematic, regional water management and hydrology.	
Applicability	The module is compulsory for the Master Course Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MWE05	**Hydromechanics**	**Dr. Arab , Dr. Altunji**
Contents and qualification aims	The contents of module are the physical properties of water, starting with the hydrostatics and the mainly steady hydrodynamics with emphasis on the principles of conservation of energy, mass and momentum, pipe hydraulics, open channel hydraulics. Flow classifications, channel properties, critical flow, uniform flow formulas, channel design, and gradually varied flow profile computations. Based on the physical properties of water pressure distributions, level surfaces, compressive forces are treated on flat and curved surfaces, buoyancy and swimming and floating stability. Basic knowledge of hydrodynamics, the theory of the motion of fluids and the interaction with the boundaries of the flow region, mediated. Starting from the basic conservation laws of Hydromechanics The students are able to solve hydro-mechanical issues, in engineering identification of hydro-mechanical problems and quantitative solution of hydro-mechanical tasks and are capable of application of these results to the dimensioning of hydraulic structures and hydro-technical installations or scientific implementation. This includes the selection, use and development of software and Software components.	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in hydrosciences, physics, higher mathematics and engineering sciences.	
Applicability	The module is compulsory for the Master Course Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MWE06	**Hydraulic Engineering**	**Dr. Arab , Dr. Altunji**
Contents and qualification aims	On the basis of knowledge about natural watercourses hydraulic structures for flood protection (levees, water retention reservoirs) and for use of water (weirs, dams, water power stations) are discussed with respect to water management, ecological and economic aspects. Environmentally friendly structures, sustainability and renewable energies are dealt with emphasis. In addition navigation engineering systems are introduced. The students have knowledge about the design, operation and calculation of hydraulic structures.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in hydrosciences, physics, higher mathematics and engineering sciences.	
Applicability	The module is compulsory for the Master Course Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MWE07	**Advanced Irrigation**	**Dr. Baradi**
Contents and qualification aims	The module provides an introduction to some of the special topics such as programming related to irrigation; irrigation scheduling; irrigation automation; fertilizing irrigation in addition to the design and operation of modern irrigation systems (drip and sprinkler irrigation); irrigation by using unnatural water resources; economical study and feasibility of irrigation projects; evaluation of modern irrigation systems in practice. Students can use programming and use of irrigation programs or models related to water requirements, irrigation scheduling, crop water requirements and design of irrigation systems.	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in hydraulic, irrigation, computer skills, chemistry and mathematics	
Applicability	The module is compulsory for the Master Course Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MWE08	**Advanced Drainage**	**Dr. Haj Houmaidi**
Contents and qualification aims	The module provides the necessities of drainage and its relationship to the water system in soil. It contents the general form of drainage network, water balance, drainage methods, design and construction of tile drains, construction equipments, economical studies types of drainage and established its choice. Reuse of drainage water, modeling of groundwater movement and regulated drainage and evaluation of drainage projects. students will be able to understand the topics of drainage and water balance in addition to design of drainage network and determine the accessories and the use of mathematical models and management of integrated drainage projects.	
Module character	6 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in hydraulic, irrigation, drainage, computer skills, chemistry and mathematics	
Applicability	The module is compulsory for the Master Course Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MWE09	**Waste Water Treatment**	**Prof. Bannoud , Dr. Dai**
Contents and qualification aims	The module provides an understanding of technical processes that are important for the water quality and the purification of various effluents of concern. Also it provides knowledge about the processes in the entire wastewater treatment plant, in particular on the physical, biological and chemical wastewater treatment and sludge treatment. T he scientific background of the processes are explained and applied to different treatment stages. The possibility of the use of treatments water and Sludge will be discussed. Students are able to current and future-oriented Analyze methods of waste water and sludge treatment, to optimize and apply for the design and operation.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in ecology, biology and chemistry	
Applicability	The module is compulsory for the Master Course Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MWE10	**Climate Change**	**N.N.**
Contents and qualification aims	The module includes climate changes and their interaction with atmospheric trace matters and vegetation. Global change makes demands to all natural resources (soil, water, air), where e.g. the water supply and its use are dependent on natural and economical requirements. Climate change is exemplarily shown to explain the use of limited resources in the light of a changing world. Its understanding requires knowledge about the earth-atmosphere system. The module focuses on the state of the art of climate research (data, methods and results) including the feedback with the hydrosphere and biosphere. The presentations of the students complete the program. The students improve their knowledge about system understanding of climate change by integrative treatment of climatic processes. They are able to explain complex relationships and develop a reliable conflict understanding of questions relevant to natural resources in connection with climate.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in meteorology, hydrology, physics, chemistry, and mathematics	
Applicability	The module is compulsory for the Master Course Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MWE11	**Hydrochemistry**	**Prof. Nabghali**
Contents and qualification aims	The focus hydrochemistry deals particularly on theoretical foundations that are necessary in aquatic systems for understanding the reaction balance. Characteristics of water and aqueous solutions, absorption and desorption, acid-alkali-reactions, chemical precipitation, redox reactions, chelate formation, and coupled equilibrations. The students know the behavior of chemicals in aquatic systems and are able to evaluate them qualitatively and quantitatively. They have profound knowledge about the main hydrochemical processes within natural and technical cycles. They are able to apply physiochemical laws for basic hydrochemical computations.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in soil, geology and chemistry	
Applicability	The module is compulsory for the Master Course Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MWE12	**Biotechnology**	**N.N.**
Contents and qualification aims	The module includes the basic biotechnological processes focusing on biotechnological processes in the environmental sector. Graduates dispose knowledge of (bio)degradation of contaminants under different environmental conditions and are able to assess risks for conservation resources at contaminated sites. The students possess knowledge of biological and non-biological remediation processes as a base for decisions about alternative solutions.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge of chemistry, biology, physics, mathematics, and geology	
Applicability	The module is compulsory elective for the Master Course Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MWE13	**Use and Modeling of Groundwater**	**Dr. Istanbuli, Dr. Abdelrahman**
Contents and qualification aims	The module deals with numerical groundwater flow and solute transport models as essential tools of groundwater management. This includes the associated basic ideas and the functionality of these tools as well as their use in water management practice. In addition, the concrete illustration of relevant water management components and phenomena is practiced in computer models. Students are after completion of the module is able to create numerical groundwater models to simulate flow and transport processes in aquifers and to interpret the results in relation to the real situation.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in meteorology, hydrology, ecology, hydraulic and chemistry.	
Applicability	The module is compulsory elective for the Master Course Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MWE14	**Urban Water**	**Dr. Sadek**
Contents and qualification aims	The module overviews the systems of urban water management as well as methods for drawing of untreated water, water treatment and distribution. The main aspects of the module include dimensioning of water treatment reactors and distribution nets, and analysis and optimization of operation and maintenance. Understanding of the basics and engineered realisation are weighted equally. The module includes also overview of the system of waste water disposal, consisting of waste water and rain water discharge as well as waste water and sludge treatment. The focus lies on models to describe the relevant processes and the techniques to dimension and efficiently operate waste water structures. The mechanisms of the contamination with matter are described. The students are able to identify and implement important processes of the urban water system and to design and optimize plants of water supply. They are able to picture important processes of the urban water system, to dimension plants of water supply and wastewater disposal, and to estimate the impacts for the affected water body..	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in meteorology, hydrology, ecology, hydrosciences and regional water management.	
Applicability	The module is compulsory elective for the Master Course Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MWE15	**Ecological Modeling**	**Dr. Adas,** **Dr. Hendia**
Contents and qualification aims	The module aims at early identification, description and assessment of impacts of proposed projects on the environment. It also aims to deepen existing ecological knowledge and to network and to develop ecological models as tools for system understanding and prognosis. The main steps of the modeling cycle - Model formulation, parameterization, simulation, analysis and communication - are presented on the basis of case studies and be experienced with the help of computer simulations. The acquired skills and knowledge are in a separate project to develop and demonstrate practical. The students have a generalizing understanding of ecological systems as well as practical skills in modeling.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in meteorology, hydrology, ecology and chemistry.	
Applicability	The module is compulsory elective for the Master Course Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MWE16	**Water Transport and Distribution**	**Dr. Dai**
Contents and qualification aims	The module overviews the methods and the instruments for planning, operation and maintenance of water transport and distribution systems. Students are able to developing the network of a distribution system, apply basic principles of economy in the selection of design options for the distribution systems, and apply current network and software to capture their use in data and inventory management of transmission and distribution systems.	
Module character	4 hours of lectures per week	
Prerequisite of attendance	Basic knowledge in hydrosciences, engineering sciences, mathematic, physic and skills of computer..	
Applicability	The module is compulsory elective for the Master Course Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), and a written term paper (40 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MWE17	**Scientific Writing**	**N.N.**
Contents and qualification aims	The Scientific Writing Resource is course material that teaches how to write effectively. The material is not about correctness (grammar, punctuation, etc), but about communicating what you intend to the reader. It can be used either in a science class or by individuals. It is intended for science students at the graduate level. Students will be able to communicate better not only with other researchers, but with the public, who funds your research. If scientists were better writers, the gap between the public and academy would shrink. The students gain skills to supervise projects self dependently and are prepared to hold other management functions.	
Module character	2 hours of lectures per week 4 hours of practical training per week	
Prerequisite of attendance	Basic knowledge in hydrosciences, agricultural and civil engineering, computer sciences; advanced knowledge in mathematics and statistics.	
Applicability	The module is compulsory for the Master Course Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), presentations and the project work (75 hours).	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MWE18	**Study Project**	**N.N.**
Contents and qualification aims	Qualification aims for water problems integrative solutions are needed with the participation of different technical disciplines. Therefore individual study projects might be supervised by more than one teacher. Additionally project management and presentation techniques are demonstrated as well as proper reporting. Students learn to act as a team and to solve a complex problem by proper handling of individual tasks. The students are able to implement their knowledge in engineering and natural sciences. The students gain skills to supervise projects self dependently and are prepared to hold other management functions.	
Module character	2 hours of lectures per week 4 hours of practical training per week	
Prerequisite of attendance	Basic knowledge in hydrosciences, agricultural and civil engineering, computer sciences; advanced knowledge in mathematics and statistics.	
Applicability	The module is compulsory for the Master Course Water Engineering.	
Prerequisite to achieve credit points	The module exam consists of a written examination (120 minutes), presentations and the project work (75 hours).	
Frequency of the module	The module is offered in winter term.	
Credit points	The module earns 5 cr.	
Work load	Work load is 150 hours.	
Duration of the module	The module takes one term.	

Module Number	Module Name	Professor in Charge
MWE19	**Practical training/Study Project**	**N.N.**
Contents and qualification aims	The Student must carry out practical training about one Problem belongs to subjects of the Master course of water resources management in one or more institution or incorporation, and he must present full study about this problem	
Module character	Practical Training/ Project Study: 6 hours tutorial per week	
Prerequisite of attendance	Basic Knowledge of Practical Training/ Project Study, the student must be in the 3rd Semester.	
Applicability	The module is suitable for the professional and research oriented studies in civil and environmental engineering .	
Prerequisite to achieve credit points	Having passed the module seminar and presentation before a commission	
Frequency of the module	The module is offered in summer term.	
Credit points	The module earns 15 cr.	
Work load	Work load is 450 hours.	
Duration of the module	The module takes one term.	

Module Number	**Module Name**	**Professor in Charge**
MWE20	**Master Thesis with Defense**	**N.N.**
Contents and qualification aims	The Student must work Master Thesis with Defense about one problem belongs to the subjects of the Master course of water resources management in one or more institution or incorporation, and he must present full study about this problem.	
Module character	Master Thesis with Defense: 6 hours tutorial per week	
Prerequisite of attendance	Basic Knowledge of Master Thesis with Defense, the student must be in 4th^{h} Semester	
Applicability	The module is suitable for the professional and research oriented studies in civil and environmental engineering	
Prerequisite to achieve credit points	Having passed the module presentation before a commission	
Frequency of the module	The module is offered in 4th semester	
Credit points	The module earns 30 cr. The final grade is generated with 100% as presentation in front of committee	
Work load	The work load is 900 hours	
Duration of the module	The module takes one term.	

Quality Management and Accreditation

The Quality Management is the act of overseeing all activities and tasks needed to maintain a desired level of excellence. This includes creating and implementing quality planning and assurance, as well as quality control and quality improvement.

University: Aleppo University

Faculty: Faculty of Civil Engineering

1- Specification of the Program

1-1- Basic Data

- **Program Name (MWE):**
  Program of Water Engineering
- **Type of the Program**:
  single
- **Name of the participated Program**:
  (none).
- **Duration of the Program:**
  4 Semesters.
- **Qualification (Certificate), which the student get at the end of the program**:
  Master of Civil Engineering (Specialist in Water Engineering).
- **Language used in the Program**:
  Arabic is the main language. Several modules are presented in English.
- **Place of Program application:**
  University Campus, Buildings of Faculty of Civil Engineering.
- **External Check Person:**
- **Date the latest acceptance of specification of the Program:**

2- Professional Data

2-1- Objectives of the course

- **Developing Course: it needs objectives:**

Objectives describe what learners will be able to do at the end of instruction, and they provide clear reasons for teaching. When writing objectives be sure to describe the intended result of instruction rather than the process o f instruction itself.

- **Reasons for objectives:**

In order to select and design instructional content, materials or methods and to have a sound basis by which success can be measured.
To give designers and instructors an objective method to determine how successful their educational material has been. By clearly stating the results the learners should accomplish. Instructors can identify whether students have gained the appropriate skills and knowledge.
Because objectives should be stated before teatchers begin to develop instructional materials. They provide students the means to organize their efforts toward accomplishing the desired behaviors.

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- Developing a course typically requires:
Understanding how people learn
Considering principles and models of course design
Writing learning goals and outcomes

- Strategy for developing courses:
Plan: create a time line, including all resources, activities, dates, and personnel training.
Do: implement the plan and collect data.
Check: analyze the results of the plan.
Act: act on what was learned and determine the next steps.

- How the Curriculum should be evaluated:
Questions may be included to evaluate:
The relevance of the content.
The appropriateness of the course design.
The effectiveness of the faculty.
The adequacy of the logistical arrangements such as registration, facilities, and food service.

- Course Evaluations:
Evaluation system is an important tool that helps improve teaching and learning at the Institute. All university instructors participate in course evaluations. All scientific staff has to be evaluated every year, and the results of evaluations have to be considered. The instructor must be absent from the location where this online evaluation is taking place. The process of gathering information about the impact of learning and of teaching practice on student learning, analyzing and interpreting this information, and responding to and acting on the results, is valuable for several reasons. They are beneficial because instructors can review how others interpret their teaching methods, thereby improving their instruction.
The information can be also used by administrators, along with other input, to make summative decisions and make formative recommendations way, to attempt to influence the outcome of this evaluation rating.
Course evaluations are implemented in one of two ways, either summative or formative.

- Guidelines for quality assurance within higher education:
Institutions should have a policy and associated procedures for the assurance of the quality and standards of their programs and awards. They should also commit themselves explicitly to the development of a culture, which recognizes the importance of quality, and quality assur-

ance, in their work. To achieve this, institutions should develop and implement a strategy for the continuous enhancement of quality.
The strategy, policy and procedures should have a formal status and be publicly available. They should also include a role for student.
A quality management principle is a comprehensive and fundamental rule for leading and organization, aimed at continually improving performance over the long term by focusing on customers while addressing the needs of all other stakeholders.

- Notification of message and Goal of the Program:

The Department of Water Engineering in the Faculty of Civil Engineering in Aleppo University undertake the preparation of an excellent absolvent in the fields of Water Engineering, qualified to continue the qualification and professional development, able to compete and cover the need of the labor market in these Engineering fields. In addition to, the Departments give a very good studying and research plan aims to development the scientific research and participation in professional and research projects. The department contributes in supporting and covering the needs of development plans of the country, during the operation with the related scientific, research and service sides.

- Goals of the program:

The academic plan in the **Master course of Water Engineering**, aims at providing the students the following items:

- High level information in science and computer techniques, and developing the skills in engineering sciences and its applications.
- Developing the ability of the students to achieve various water engineering studies, check and use it according to the engineering codes.
- Comparing between the engineering solutions, and choose the optimum ones.
- Developing the work skills and regulate the relationship between the work team which the best and have many specialists.
- Strengthening the research ability, developing, and working with the modest software's, equipment’s… etc.
- Developing the item of the scientific, social and cultural site of the student's characters.
- Continuous developing to get the high quality of the research, teaching…...etc.
- High level information in science and computer techniques, and developing the skills in engineering sciences and its applications.

2-2- Program Composition and its Contents

- **Admission conditions in the Program:**
  The admission will be done through the competition among the students, who have got the secondary school certificate – scientific branch, national level.
- **The conditions of success in the Program:**
  Presence of theoretical, tutorial, and laboratory lectures and present the required projects and scientific and laboratories reports.
- **Success from year to year**: Success in all modules in 1st and 2nd Semester each studying year.
- **Completion of Program**:

Condition of accomplish (get over) of studying years	
1st year	Success in modules of 1st and 2nd semesters, the student can hold max. 2 Modules.
2nd year	Success in modules of 3rd semesters, the student can hold max. 2 Modules from all foregone semesters. - Success in modules of foregone semesters and Defense of Master Thesis in front of the commission.

Conditions of the completion of the Program:

- **Brief description of the kind of Practical Training/ Project Study:**
  The Student must carry out practical training about one problem related to the subjects of Water Engineering in one or more institutions or incorporations, and he must present full study about this problem.
- **In which phase or phases of the program this Practical Training/ Project Study is carried out :** This Study or Project must be carried out in the 3rd semester.
- **Number of credits / or semesters for this Practical Training/ Project Study:**
  Offered semester with 10 cr.
- **Description of evaluation procedures**: The evaluation should be done by a commission, which is formed by the delegacy of Faculty of Civil Engineering; the student has to pass the module seminar and presentation in front of the commission.
- **Brief description of the kind of Bachelor Thesis**
  The Student has to carry out Master Thesis about one problem related to the subjects of Water Engineering in the 4th semester, and he must present a full study about this problem in front of the commission.

- **In which phase from the program the Bachelor Thesis with defense should be carried out:** This Master Thesis must be carried out in the 4th semester.

- **Number of Credits / or semester for this Bachelor Thesis with defense:**
  Offered in 4th semester with 30 cr.

- **Description of evaluation procedures:** the evaluation should be done by a commission, which formed by the delegacy of Faculty of Civil Engineering; the student must pass the module and presentation in front of the commission.

3- The Program description:

The program of Water Engineering based on theoretical lectures, laboratory meeting, scientific excursion and summer training approved in the study plan.

- Brief description of praxis experiences activity:

- Summer training in surveying works in field;
- Summer training in sanitary projects;
- Summer training in water engineering and irrigation projects;
- Scientific excursion to water engineering and sanitary projects

- In which phase or phases of the program the field experience should be introduced:

- Surveying works in 2nd semester;
- Summer training in sanitary projects in 3rd semester;
- Summer training in water engineering and irrigation projects in 3rd semester;
- Scientific excursion to water engineering and sanitary projects in 3rd semester

MODULE COMPENDIUM

Water & Soil Engineering and Environment (SGW)

Bachelor Programme

Al Baath University Homs

Faculty of Agriculture

2015

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Goals of the program
Bachelor course of water & Soil engineering and environment
AL-Baath University – Homs, SYRIA

The academic plan in the **Bachelor course of Water & Soil Engineering and Environment program**, aims at providing the students the following items:

64. High-level information in science and computer techniques, and developing the skills in engineering sciences and its applications.
65. Developing the ability of the students to achieve various water engineering and environmental studies, check and use it according to the engineering codes.
66. Comparing between the engineering solutions, and choose the optimum ones.
67. Developing the work skills and regulate the relationship between the work team which the best and have many specialists.
68. Strengthening the research ability, developing, and working with the modest software's, equipment's… etc.
69. Developing the item of the scientific, social and cultural of the student's characters.
70. Continuous developing to get the high quality of the research, teaching…...etc.

Modules

Bachelor Course of Water & Soil Engineering and Environment – BSGW

	Credits	%
Modules with Basics in Mathematics and Natural Sciences	45	25%
Modules with Basics in Engineering	30	17%
Modules with Basics in Hydro Sciences	20	11%
Modules with specialized Basics	25	14%
Elective Modules	15	8%
General Qualification	20	11%
Practical Training /Project	10	6%
Bachelor examination	15	8%
Total	**180**	**100%**

Module Semester	1	2	3	4	5	6	Total / ECTS
Basics in Mathematics and Natural Sciences	20	20	5				**45**
Basics in Engineering	5		10	15			**30**
Basics in Hydro Sciences		5	10	5			**20**
Specialized Basics		5	5	10	5		**25**
Elective Modules					15		**15**
General Qualification	5					15	**20**
Practical Training/ Project Study					10		**10**
Bachelor Thesis incl. Defense						15	**15**
Total	**30**	**30**	**30**	**30**	**30**	**30**	**180**

	Modules in Natural Sciences 25%		Modules inTechnical Sciences 25%		Modules in Economic & Social Sciences 25%		Mosules in Variable Sciences 25%

Module nr.	Course Semester	1	2	3	4	5	6	Total/ ECTS
	Basics in Mathematics and Natural Sciences	**20**	**20**	**5**	**0**	**0**	**0**	**45**
BSGW01	Mathematics	5						**5**
BSGW02	Statistics		5					**5**
BSGW03	General Physics	5						**5**
BSGW04	General chemistry	5						**5**
BSGW05	Analytical Chemistry		5					**5**
BSGW06	Plant physiology	5						**5**
BSGW07	Computer sciences		5					**5**
BSGW08	Soil Physics			5				**5**
BSGW09	Soil Science principles		5					**5**
	Basics in Engineering	**5**	**0**	**10**	**15**	**0**	**0**	**30**
BSGW10	Climate & Meteorology	5						**5**
BSGW11	Geographic information system AND REMOTE SENSING (GIS)			5				**5**
BSGW12	Soil Fertility and Plant Nu-trition				5			**5**
BSGW13	Water Relationships (soil-water- plant)				5			**5**
BSGW14	Soil Chemistry			5				**5**
BSGW15	Soil Conservation and Reclamation				5			**5**
	Basics in Hydro Scien-ces	**0**	**5**	**10**	**5**	**0**	**0**	**20**
BSGW16	Hydrology		5					**5**
BSGW17	Irrigation			5				**5**
BSGW18	Soil and Water Microbiolo-gy			5				**5**
BSGW19	Agricultural Drainage				5			**5**
	Specialized Basics	**0**	**5**	**5**	**10**	**5**	**0**	**25**
BSGW20	Soil Analysis			5				**5**
BSGW21	Irrigation Methods				5			**5**
BSGW22	Water Resources Mana-gement				5			**5**
BSGW23	Soil & Water Pollution					5		**5**
BSGW24	Agricultural geology		5					**5**
	Elective Modules	**0**	**0**	**0**	**0**	**15**	**0**	**15**
BSGW25	Soil Colloids					5		**5**
BSGW26	Fertilizers and fertilization					5		**5**
BSGW27	Soil Taxonomy					5		**5**
BSGW28	Water Chemistry					5		**5**

BSGW29	Waste Water					5		**5**
BSGW30	Organic Agriculture					5		**5**
	General Qualification	**5**	**0**	**0**	**0**	**0**	**15**	**20**
BSGW31	climate change						5	**5**
BSGW32	Economics						5	**5**
BSGW33	Agricultural Project mana-gement						5	**5**
BSGW34	Languages	5						**5**
BSGW35	**Practical Training/ Pro-ject Study**					10		**10**
BSGW36	**Bachelor Thesis incl. Defense**						15	**15**
	Total	**30**	**30**	**30**	**30**	**30**	**30**	**180**

Basics in Mathematics and Natural Sciences		
Module Number	**Module Name**	**Professor in Charge**
BSGW01	**Mathematics**	Prof. Dr
Contents and Qualification aims	The module deals with understanding the basics mathematics and probability which cover the module Principles of probabilities:(the probability, the random events, the conditional probability, autonomy of the events), Bays formula (the first and second, Random variable, distribution function, discrete and connected variable, expectation standard deviation. In addition to the Differential equations such as The normal Differential equations of first order(solved and not solved as for derivative) and The Differential equations of higher order, The partial Differential equations. The students' knowledge will be developed with probability distributions and finding the relationship between the variables and give the students enough knowledge's and ability in these fields.	
Module Character	Advanced Mathematics: 2 h lecture and 3h laboratory	
Prerequisite of attendance	Basic Knowledge of Advanced Mathematics (Differential equations and statistics and probability) are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences .	
Applicability	The module is one of 3 mandatory compulsory of the Mathematics and Natural Sciences of the bachelor of water and soil Engineering. the module is suitable for the professional and research oriented studies in soil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 1.	
Proposal references	• Alee, Mh., M, 1992 Mathematics (3), Faculty of Mechanical and Electrical Engineering, Tishreen University Publications, p. 483. Makhoul, K., 2005, differentially, Faculty of Science , AL-Baath University Publications, p. 484. • Naser, H. K., 2008, Analytical, Faculty of Science , AL-Baath University Publications, p.456.	

Statistics		
Module Number	**Module Name**	**Professor in Charge**
BSGW02	**Statistics**	Prof. Dr
Contents and Qualification aims	The module deals with understanding the basics of statistics and probability which cover the module Principles of probabilities:(the probability, the random events, the conditional probability, autonomy of the events), Bays formula (the first and second, Random variable, distribution function, discrete and connected variable, expectation standard deviation. In addition to the Differential equations such as The normal Differential equations of first order(solved and not solved as for derivative) and The Differential equations of higher order, The partial Differential equations. The students' knowledge will be developed with probability distributions and finding the relationship between the variables and give the students enough knowledge's and ability in these fields.	
Module Character	Advanced Mathematics: 2 h lecture and 3h laboratory	
Prerequisite of attendance	Basic Knowledge of Advanced Mathematics (Differential equations and statistics and probability) are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences .	
Applicability	The module is one of 3 mandatory compulsory of the Mathematics and Natural Sciences of the bachelor of Water and Soil Engineering. the module is suitable for the professional and research oriented studies in soil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Duration of the module	The module takes one term starting in Semester 1.	
Proposal references	- Bancrofft, T, A, &Anderson, R, L. 1952, Statistical Teory in Research, McGraw- Hill Book Co., Inc. New York. - Cochran, W. G. & Cox, G. M., 1957, Experimental Designs, and Ed., John Wiley & Sons . Inc., New York . - Elandt, R. 1964, Statystyka Matematyczna W Zastosowaniu do Doswiadczalictwa Rolniczego. Warszawam 595p.	

BSGW03	**General Physics**	NN
Contents and Qualification aims	The module deals with understanding the basics of the physical modeling in the water and soil and environment engineering, the models types, covering equations, the boundaries conditions, model execution and the calibration process, sensitivity analysis, verification model, validation model, prediction model, post- audit model, documenting and reporting the modeling study. The students' knowledge will be developed during tutorials and specialist software which give the students enough knowledge's and ability in these fields.	
Module Character	physical Modeling 2 h lecture and 3h laboratory	
Prerequisite of attendance	Basic Knowledge of phsical Modeling are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in Phzsics of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	- Aldyn S. 1989, General Physics, (1), AL-Baath University publishing, - Tylar F. A laboratory Manual of physics	

BSGW04	**General Chemistry**	NN
Contents and Qualification aims	The module deals with understanding the basics of the chemical processes in the water and soil and environment engineering, the covering equations. The students' knowledge will be developed during tutorials which give the students enough knowledge's and ability in these fields.	
Module Character	2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of chemistry science	
Prerequisite of attendance	Basic Knowledge the chemical processes are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the chemical processes of the bachelor of water and soil Engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	– Alyousef, Ahmad & Alsheikh Othman, Muna (2000): General chemistry (1), AL-Baath University publications, Faculty of Sciences. – Al-hezwani, Fayez (1998), General and nonorganic Chemistry. AL-Baath University publications, Faculty of Sciences. – Deeb, Muhammad & Jreikous, Hasan (1995): General Chemistry (1). Tishreen University publications, Faculty of Sciences. – Aoudi, Mahmoud & Al-Suleiman, Ali (2005), General Chemistry. AL-Baath University publications, Faculty of Agriculture..	

BSGW05	**Analytical Chemistry**	NN
Contents and Qualification aims	The module deals with understanding the basics of the anlytical chemical processes in the water and soil and environment engineering, the covering equations. The students' knowledge will be developed during tutorials which give the students enough knowledge's and ability in these fields.	
Module Character	The course covers theoretical and practical principles of quantitative analysis 2 h lecture and 3h laboratory	
Prerequisite of attendance	Basic Knowledge the analytical chemical processes are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the analytical chemical processes of the bachelor of water and soil Engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	- -Shamsham,S and Alkhatib.M.G, Analytical Chemistry., Albaath University-Homs. - - Peters.D.G,Hayes.G.M, and Hieftje.G.M, chemical separation andmeasurement. Theory and practice of Analytical Chemistry. 1974 U.S.A.	

BSGW06	**Plant physiology**	*NN*
Contents and Qualification aims	This course aims to study the importance of crop physiology and its role in improving crop yield and desirable traits in crops and their efficiency in utilizing in biomass. Accumulation, also the role of photosynthesis, evaporation, transpiration, and osmosis mineral nutrition in crop growth and development, besides the role of environmental factors in the various physiological processes. Analysis of crop growth accumulation and transportation of biomass to various plant parts.	
Module Character	2 h lecture and 3h laboratory	
Prerequisite of attendance	Gaining knowledge in relation to: 1- crop growth and development. 2- Photosynthesis, respiration, transpiration, Osmosis, mineral nutrition and their role in biomass accumulation and crop yield. 3- Nitrogen fixation in field crops. – 4- Measurement and analysis of growth and development.	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the plant physiology of the bachelor of water and soil Engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	Degne, H. E. and W. A. Willis (1983) Dry land Agriculture. American Soc. Of Agronomy, Inc. – Publisher, Madison, Wisconsin, U.S.A **Salisbury,A. and Ross ,C.W (1992).** *Plant physiology* .Belmont California: Wards Worth Publishing	

BSGW07	**Computer Science**	*NN:*
Contents and Qualification aims	The module deals with understanding the basics of the computer science in the water and soil and environment engineering, the covering equations. The students' knowledge will be developed during tutorials which give the students enough knowledge's and ability in these fields.	

2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of computer science	**Module Character**
Basic Knowledge the computer science are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	Prerequisite of attendance
The module is one of 3 mandatory compulsory of the Basics in the computer science of the bachelor of water and soil Engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	Applicability
Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	Prerequisite to active credit points
The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	Accredit points and grades
The module is offered annually.	Frequency of the module
The work load is 150 hours.	Worked load
Academia International (1999) Microsoft Word (2010) PC Basics (1999)	**Proposal references**

NN **Soil Physics**	BSGW08
The course covers the basic principles of the science of soil physics, as like: soil texture, soil structure, aggregation, the form pores within it, and permeability and the water movement in soil, the overall effort and all this forms the basis of any irrigation project or reclamation or land for farming.	**Contents and Qualification aims**
2 h lecture and 3h First principles, Soil texture, Soil Structure, Soil Density and porosity, Specific Surface, Soil moisture, Soil Water, Potential, Water movement in Soil , Soil Physic-mechanical, Properties, Soil Air, Soil Temperature	**Module Character**
Basic Knowledge the soil physics are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	Prerequisite of attendance
The module is one of 3 mandatory compulsory of the Basics in the soil physics of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	Applicability
Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	Prerequisite to active credit points
The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	Accredit points and grades
The module is offered annually.	Frequency of the module
The work load is 150 hours.	Worked load
- Baver, L. D. (1956): Soil Physics, Third Edition, JOHN WILEY, P. 489. - Hillel, D. (1982): Introduction to Soil Physics, Academic Press. New York, p.565 - Majumdar, S. P., and Singh, R. A. (2000): Analysis of Soil Physical Properties, AGROBIOS (INDIA) p194.	**Proposal references**

NN	**Soil Sciences Principles**	BSGW09
	The course covers, the concept of the basics of soil science, and study of factors forming, by the physical and chemical properties have. Relying on modern techniques in the treatment of the soil as a body naturally, a heterogeneous multi-phase, variable property in space and time, and the impact on their properties and try to find scientific methods to reduce the degradation, with the aim of maintenance and raise productivity. Soil and Forming factors, Soil Morphology Properties, Soil Mechanical Properties (Consistency…etc), Soil Physical (Texture and Particle-Size Analysis, Specific Surface, Soil density, Soil Structure and Aggregation, Soil Air and Aeration, Soil Physical- Hydrology, Soil Temperature, Chemistry of Soil Inorganic Component, Structure, Composition & Investigation Methods of Clay minerals., Soil Organic Matter and Humus., Soil Chemical-Physical Properties, Soil Colloids Soil Adsorption & Ionic Exchange, Soil Reaction & pH of soil.	**Contents and Qualification aims**
	2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of soil science principles	**Module Character**
	Basic Knowledge the soil science principles are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	Prerequisite of attendance
	The module is one of 3 mandatory compulsory of the Basics in the soil science principles of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	Applicability
	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	Prerequisite to active credit points
	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	Accredit points and grades
	The module is offered annually.	Frequency of the module
	The work load is 150 hours.	Worked load
	- ALFRED R. CONKLIN, Jr 2005 ,Introduction to Soil Chemistry , Analysis and Instrumentation A JOHN WILEY & SONS, INC., PUBLICATION - Fares F, 1992, Soil Sciences Principles, Damascus University publisher, p 450. - Foth, H. D. (1998). Fundamental of Soil Sciences. John Willey, USA. - Soil Taxonomy, A Basic System of Soil Classification for Soils: genesis and geomorphology. Cambridge University Press, 2005. - World reference base for soil resources, 2014.	**Proposal references**

NN **Climate and meteorology**	BSGW10
The module deals with understanding the basics of the climate an meteorology in the water and soil and environment engineering, the covering equations. The students' knowledge will be developed during tutorials which give the students enough knowledge's and ability in these fields.	**Contents and Qualification aims**
2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of climate and meteorology science	**Module Character**
Basic Knowledge the climate and meteorology are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	Prerequisite of attendance
The module is one of 3 mandatory compulsory of the Basics in the climate and meteorology of the bachelor of water and soil Engineering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	Applicability
Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	Prerequisite to active credit points
The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	Accredit points and grades
The module is offered annually.	Frequency of the module
The work load is 150 hours.	Worked load
- United States Committee for Global Atmospheric Research Program. Understanding Climatic Change. A Program for Action. Washington. D.C,: National Academy of Science. 1978. - Trewartha. G.T., and L. Horn. An Introduction to Climate. 5th ed. New York: McGraw Hill Book Co. , 1979. - Ludlum, D.M. Weather Record Book, United States and Canada. Wanshington,D.C,: Weatherwise Inc., 11971. - Hughes, P. American Weather Stories. Washington D.C,: U.S. Department of Commerce, 1976. - Griffiths, S.F., and D.M. Driscoll, Survey of Climatology. Columbus: Charles E. Merrill Publishing Co, 1982. Calder, Nigel. The Weather Machine. New York: Viking Press, 1974.	**Proposal references**

NN	**GEOGRAPHIC INFORMATION SYSTEMS AND REMOTE SENSING**	BSGW11
	The module deals with understanding the basics of the geography in the water and soil and environment engineering, the covering equations. The students' knowledge will be developed during tutorials which give the students enough knowledge's and ability in these fields.	**Contents and Qualification aims**
	2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of geography	**Module Character**
	Basic Knowledge the geographic Information Systems used to build operating models in GIS are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences Describe Remote Sensing concepts, physical fundaments and components. Know about main Remote Sensing Systems and programs (sensors, platforms, etc.)	Prerequisite of attendance
	The module is one of 3 mandatory compulsory of the Basics in tringhe geografy of the bachelor of water and soil Engineering for the professionineeal and research oriented studies in civil and environmental engineering.	Applicability
	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	Prerequisite to active credit points
	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	Accredit points and grades
	The module is offered annually.	Frequency of the module
	The work load is 150 hours.	Worked load
	- Al-Dweikat, Qasem Muhammad (2003), Geographic Information System; theory and application. Mouta University, Jordan. - Bahjat Muhammad, Younes Edris (2006), Geographic Information System; first volume, concepts and use guide. ArcViewGIS 3.2 - Aziz, Muhammad Al-Khouzama (2000), Geographic Information System; basics and applications for geographers, Al-Maaref Establishment, Alexandria. - . ESRI, USA, Arc GIS 9.3 - . ESRI, USA, Arc View 3.2 - . ESRI, USA, Spatial Analyst, Net Work Analyst, 3D Analyst.	**Proposal references**

NN **Soil Fertility & Plant Nutrition**	BSGW12
The module deals with essential nutrients in soil-plant system- Soil as plant nutrient medium - Growth and factors affecting it - Plant essential nutrients - Nutrients uptake - Macronutrients in soil-plant system -Micronutrients in soil-plant system - Soil organic matter and humus - Organic and mineral fertilizers	**Contents and Qualification aims**
2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of soil fertility and plant nutrition	**Module Character**
Basic Knowledge the soil fertility and plant nutriion are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	Prerequisite of attendance
The module is one of 3 mandatory compulsory of the Basics in the soil fertility and plant nutrition of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	Applicability
Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	Prerequisite to active credit points
The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	Accredit points and grades
The module is offered annually.	Frequency of the module
The work load is 150 hours.	Worked load
- Brady, N. C.(1996): The nature and properties of soils. 10th Edition. Prentice Hall of India, New Delhi. - Marschner, H. (1995): Mineral nutrition of higher plants. Academic Press Limited, London. - Mengel, K. & Kirkby, E. A. (1987): Principles of plant nutrition. 4th Edition. International Potash Institute. Bern, Switzerland. - Thompson, L. M. And Troeh, F. R. (1973): Soils and soils fertility. Mc Graw-Hill Inc, New York. - - Tisdale, S. I.; Nelson, W. L.; Beaton, J. D. And Halvin, J. L. (1993): Soil fertility and fertilizers. 5th Edition. Macmillan Publishing Co., Inc. New York.	**Proposal references**

NN: **Water Relationships (Soil- Water- Plant)**	BSGW13
Rapporteur addresses the relationship between soil, water and plants, through the study of soil texture, soil structure, soil porosity, aggregation and its distribution of moisture, total potential of the water, and water movement in soil and vegetation, and water stress on the plant Water in Soil & plant Soil Texture & Structure Soil Density & Porosity Soil Water Soil Water Potential Soil Water Movement Water relation of plant cells Water potential in plant Water movement in plant Plant Water deficit and stress	**Contents and Qualification aims**
2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of water relationships	**Module Character**
Basic Knowledge the water relationships are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	Prerequisite of attendance
The module is one of 3 mandatory compulsory of the Basics in the of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	Applicability
Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	Prerequisite to active credit points
The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	Accredit points and grades
The module is offered annually.	Frequency of the module
The work load is 150 hours.	Worked load
- Baver, L. D. (1956): Soil Physics, Third Edition, JOHN WILEY, P. 489. - Hillel, D. (1982): Introduction to Soil Physics, Academic Press. New York, p.565 - Foth, H. D. (1998). Fundamental of Soil Sciences. John Willey, USA. - Majumdar, S. P., and Singh, R. A. (2000): Analysis of Soil Physical Properties, AGROBIOS (INDIA) p194.	**Proposal references**

NN **SOIL CHEMISTRY**	BSGW14
Cares to be studied in terms of soil chemical INTRODUCTION TO THE CHEMICAL CONSTITUENTS IN SOIL ADSORPTION AND EXCHANGE REACTIONS IN SOILS SOIL-COLLOIDAL-CHEMISTRY SOIL PH - ACIDIC AND BASIC SOILS – BUFFERING OXIDATION and REDUCTION IN SOIL SOLUTION CHEMISTRY IN SOIL SOIL MINERALS SOLUBILITY OF SOIL COMPONENTS	**Contents and Qualification aims**
2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of soil chemistry	**Module Character**
Basic Knowledge the soil chemical processes are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	Prerequisite of attendance
The module is one of 3 mandatory compulsory of the Basics in the soil chemical processes of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	Applicability
Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	Prerequisite to active credit points
The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	Accredit points and grades
The module is offered annually.	Frequency of the module
The work load is 150 hours.	Worked load
- ALFRED R. CONKLIN, Jr 2005 ,Introduction to Soil Chemistry , Analysis and Instrumentation A JOHN WILEY & SONS, INC., PUBLICATION - Brady NC, Weil RR. , 2004, Elements of the Nature and Properties of Soils, 2nd ed. Uppe , Saddle River, NJ: Pearson Prentice-Hall, pp. 95–99. - Companion AL. Chemical Bonding. New York: McGraw-Hill, 1964. - Greenwood NN, Earnshaw A. Chemistry of the Elements. New York; Pergamum Press, 1985. - Pauling , 1960, The Nature of the Chemical Bond and Structure of Molecules and Crystals, An Introduction to Modern Structural Chemistry. Ithaca, NY: Cornell Univ. Press.	**Proposal references**

NN **Soil Conservation & Reclamation** BSGW15

Contents and Qualification aims

The course covers the reclamation of soil, which is aimed mainly at increasing agricultural production in soils planted in quantity and quality by developing the factors of agricultural production, especially that with respect to networks of irrigation and drainage, and improving soil physical properties and chemical and biological, also aims to introduce new areas of land in farming by expanding agricultural area of arable and enter new areas of agricultural expansion
Soil Conservation, Wind Erosion, Water Erosion, Soil deterioration

Factures deterioration, Desertification

- Methods Soil conservation for deterioration, concept of and land reclamation, fundamental contents of the concept of land reclamation:
- The problem of salinity and posed (the definition of saline soils - and how it is formed salinity - and methods of washing salts from the soil - needs washing saline soils)
- Reclamation of soils in the Syrian Arab Republic, such as: (plain Algabb - and the pilot project in the basin Balikh - and Euphrates basin minimum), Reclamation gypsum soils, Reclamation calcareous soils, Reclamation stony and sandy soils

Module Character

2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of soil conservation and reclamation

Prerequisite of attendance

Basic Knowledge the soil conservation and reclamation are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences

Applicability

The module is one of 3 mandatory compulsory of the Basics in the soil conservation and reclamation of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.

Prerequisite to active credit points

Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.

Accredit points and grades

The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.

Frequency of the module

The module is offered annually.

Worked load

The work load is 150 hours.

Proposal references

- *Cooley, Heather, Peter H. Gleick, and Gary Wolff. (June 2006.) "Desalination, With a Grain of Salt – A California Perspective." (Website). Pacific Institute. Retrieved on 2007-09-20.*
- *2- Alan D. Blaylock, 1994, Soil Salinity and Salt tolerance of Horticultural and Landscape Plants. University of Wyomimg*
- *Jump up ^ Government of Alberta, Salt tolerance of Plants*
- 3-R.Brinkman, 1980. Saline and sodic soils. In: Land reclamation and water management, p. 62-68. International Institute for Land Reclamation and Improvement (ILRI), Wageningen, The Netherlands.

- Al-Askar, Mahmoud 1992, Soil maintenance, Aleppo University publications.
- Balbaa, Abdulmunem, Naseem Maher Georgi 1994, Land Desertification: an Arab & International problem. Dar Almaaref Publications, Alexandria, Egypt.

NN: **Hydrology**	BSGW16
Addresses the hydrology of the water cycle in nature and the flow of surface water and contamination and the possibility of keeping it from pollution, and the origin of groundwater and forms Todaha and distribution, movement and their chemical composition and gaseous classified Water and the water cycle in nature. - Statistics and probability in hydrology. - Hydrology Surface. - Contamination of surface water and methods of keeping it from pollution. - Groundwater hydrology (groundwater). - Chemical analysis of water and assess the validity of water for various uses.	**Contents and Qualification aims**
2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of hydrology	**Module Character**
Basic Knowledge thehydrology are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	Prerequisite of attendance
The module is one of 3 mandatory compulsory of the Basics in the hydrology of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	Applicability
Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	Prerequisite to active credit points
The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	Accredit points and grades
The module is offered annually.	Frequency of the module
The work load is 150 hours.	Worked load
- J.L.Sharma ., and S.A.Bari , " Irrigation Engineering " , published by : SMT . SUMITRA HANDA, New Delhe , 1995. - LIMAS Jose ,(1985) ."Hydrolgie generale "Principes et applications Quebec-anada . - LIMAS Jose ,(1985) ."Hydrolgie generale "Principes et applications Quebec-anada . - Carder , D . J ., and Spener , G . W,.1971- Water conservation handbook. . West . Austral . Dept . Agr .,63 pp ., illus.	**Proposal references**

NN **Irrigation**	BSGW17
Processes of soil formation. General and specific processes of soil formation. Factors of soil formation. Soil survey methods, definition of mapping units. Soil profile description – soil morphological studies. Soil classification systems: Russian and French soil classification system, Soil taxonomy, FAO,. Classification of Syrian soils, Soil survey, and Land evaluation. – CHAPTER1: Soil & Water Relationships – CHAPTER2: Hydrologic Cycle – CHAPTER3: Water Requirements – CHAPTER4: Classification Of Water Irrigation – CHAPTER5: Irrigation Of Salt-affected Soils – CHAPTER6: Design Of Pipe Systems – CHAPTER7: Irrigation Methods	**Contents and Qualification aims**
2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of irrigation	**Module Character**
Basic Knowledge theirrigation are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	Prerequisite of attendance
The module is one of 3 mandatory compulsory of the Basics in the irrigation of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	Applicability
Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	Prerequisite to active credit points
The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	Accredit points and grades
The module is offered annually.	Frequency of the module
The work load is 150 hours.	Worked load
- Safar et al. (1997) – Irrigation Agricole (Théorie et Pratique), Publication de l'université D'Alep, 258 p. - Ollier et Poiree (1981) – Irrigation (Théorie, Technique), Paris, 503 p.	**Proposal references**

NN **Soil and water Microbiology**	BSGW18
The objective of this course is to introduce the kinds and significance of microorganisms present in soil and water and their role in environmental. Development of Soil and water Microbiology Relationship of Soil and water Microorganisms with Soil and water Properties Eukaryotic Microorganisms in Soil and water (Protozoa, Algae, Fungi) Prokaryotic Microorganisms in Soil and water: (Eubacteria, Cyanobacteria, Archaeobacteria) Carbon Cycle Nitrogen Cycle Phosphorus Cycle Sulphur Cycle Iron Cycle The Factors Influencing on Soil and water Microorganis The relationships Between Microorganisms in Soil and wate The Rhizosphere and Phyllosphere Microbial Products Influencing Plant Growth Biodegradation of Pesticides Biogas Production Biofertilizers Bioremediation	**Contents and Qualification aims**
2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of soil and waterbiology	**Module Character**
Basic Knowledge the soil and water biology are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	Prerequisite of attendance
The module is one of 3 mandatory compulsory of the Basics in the soil and waterbiology of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	Applicability
Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	Prerequisite to active credit points
The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	Accredit points and grades
The module is offered annually.	Frequency of the module
The work load is 150 hours.	Worked load
- Paul, E.A. (ed.). 2007. Soil Microbiology, Ecology and Biochemistry. 3rd Ed. Elsevier, Oxford, UK. - Al-issa ,A.2007.Soil Microbiology, Al-baath Uni, Syria , Homs - -. Sylvia, D.M., J.J. Fuhrmann, P.G. Hartel, and D.V. Zuberer. 2005. Principles and Applications of Soil Microbiology. Prentice Hall International, NJ, USA.	**Proposal references**

NN **Agricultural Drainage**	BSGW19
This course addresses the importance of agricultural drainage and water movement in the soil and , also studying the methods of Agricultural Drainage and their economic importance. – CHAPTER1: Drainage Importance – CHAPTER2: Water Flow in Soil – CHAPTER3: Drainage Coefficient – CHAPTER3: Drainage Coefficient – CHAPTER5: Drainage Channel – CHAPTER6: Mole Drainage – CHAPTER7: Drainage Wells – CHAPTER8: Maintenance & Conservation Of Drains – CHAPTER9: Economics Of Agricultural Drainage	**Contents and Qualification aims**
2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of agricultural drainage	**Module Character**
Basic Knowledge the agricultural drainage are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	Prerequisite of attendance
The module is one of 3 mandatory compulsory of the Basics in the agricultural drainage of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	Applicability
Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	Prerequisite to active credit points
The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	Accredit points and grades
The module is offered annually.	Frequency of the module
The work load is 150 hours.	Worked load
- Safar et al. (1997) – Drainage Agricole (Théorie et Pratique), Publication de l'université D'Alep, 316 p. - CONCARET JACQUES (1981) – Drainage Agricole (Théorie et Pratique), Publication de la chamber Régionale d'Agriculture de BOURGOGNE – FRANCE; 509 p.	**Proposal references**

NN **Soil Analysis** SGW20

Contents and Qualification aims

The decision methods of sampling for laboratory analysis (composite samples, or sample simple) or through measurements (samples pedological). The decision also addresses the best laboratory analysis methods used in soil science laboratories. To study the morphological properties of soil and physic-hydrology and chemical characterization of the soil.

1- Soil Sampling
2- Soil Morphology Properties
3- Studying the Soil Physical Properties in the Field
4- Particle Size and Aggregate Analysis
5- Density and Porosity Measurement
6- Soil Moisture Content
7- Soil Moisture Constant
8- Measurement Soil Water Potential
9- Infiltration Measurement
10- Oxygen Diffusion Measurement
11- Soil Temperature Measurement

Chapter tow: Analysis of Soil Chemical Properties:
aqueous extract- Methods of Measuring the pH of Soil- Estimate the Total Carbonates- Estimate the Lime Effective- Estimate the Organic Matter- Measurement the Soluble of Salts Total dissolved- Estimate the Cation exchanged, to identify the cations exchange Capacity, and estimate the gypsum in the soil, and to identify tests of irrigation water

Module Character

2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of soil analysis

Prerequisite of attendance

Basic Knowledge the soil analysis are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences

Applicability

The module is one of 3 mandatory compulsory of the Basics in the soil analysis of the bachelor course of water and soil engeneering. The module is suitable for the professional and research oriented studies in civil and environmental engineering.

Prerequisite to active credit points

Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.

Accredit points and grades

The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.

Frequency of the module

The module is offered annually.

Worked load

The work load is 150 hours.

Proposal references

- Hillel, D. (1982): Introduction to Soil Physics, Academic Press. New York, p.565
- Majumdar, S. P., and Singh, R. A. (2000): Analysis of Soil Physical Properties, AGROBIOS (INDIA) p194.
- Soil Taxonomy, A Basic System of Soil Classification for Soils: genesis and geomorphology. Cambridge University Press, 2005.
- World reference base for soil resources, 2014.

NN	**Irrigation Methods**	BSGW21
This course handing irrigation methods and their economic importance and sources of water and classification, volume and control of irrigation water salinity, and the study of the basic properties of surface irrigation methods and subsurface irrigation, sprinkler and drip. – CHAPTER1: Economics Of Irrigation Water Use – CHAPTER2: Water Resources & Classification Of Water Irrigation – CHAPTER3: Water Volume Control & Irrigation Efficiencies – CHAPTER4: Irrigation Of Salt-Affected Soils – CHAPTER5: Planning & Design Of Irrigation Protect – CHAPTER6: Surface Irrigation Methods – CHAPTER7: Sprinkler Irrigation – CHAPTER8: Drip Irrigation – CHAPTER9: Sub-Surface Drip Irrigation – CHAPTER10: Principles Character Of Irrigation Methods		**Contents and Qualification aims**
2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of irrigation methods		**Module Character**
Basic Knowledge the irrigation methods are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences		Prerequisite of attendance
The module is one of 3 mandatory compulsory of the Basics in the irrigation methods of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.		Applicability
Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.		Prerequisite to active credit points
The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.		Accredit points and grades
The module is offered annually.		Frequency of the module
The work load is 150 hours.		Worked load
- Safar Talaat (2007) – Irrigation Methods in Arid Regions, AL-Baath University Publications, 450 p. - Baladia Ryad (2010), Irrigation & Dranaige, Damascus University Publications, Page 520. - SAFAR Talaat et al (2003): Water Resources, Aleppo University Publications, 322 p. - Tiercelin (1997) – L'irrigation des parcs et jardins, CEMAGREF EDITIONS, Paris, 95 p.		**Proposal references**

NN **Water Resources Management**	BSGW22
This course looking to find the basic rules of sound management and planning for the development and rationalization of water resources so as to ensure conservation and sustainability, as well as his attention to study ways to develop these resources in the world, and methods of management A general introduction in the management of water resources. - The basic principles in the management of water resources. - Management of water resources at the level of large ponds - Management of water resources at the level of agricultural fields. - Management of water resources in other projects. - Challenges facing the integrated management of water resources.	**Contents and Qualification aims**
2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of water resources management	**Module Character**
Basic Knowledge the water resources management are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	Prerequisite of attendance
The module is one of 3 mandatory compulsory of the Basics in the water resources management of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	Applicability
Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	Prerequisite to active credit points
The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	Accredit points and grades
The module is offered annually.	Frequency of the module
The work load is 150 hours.	Worked load
- FAO, 1986- Watershed management . Field Manuel : gully control FAO , conservation guide n ˚13/2. - Johnson R.W.M.,1989– Integrated systems analysis, climate and implications for risk management.Workshop on systems analysis**.** - J.L.Sharma ., and S.A.Bari , “ Irrigation Engineering “ , published by : SMT . SUMITRA HANDA, New Delhe , 1995**.** - Larry W. Mays , (2001) ." Water Resources Engineering ". - Magdy H.Mowafy ., and Ahmed H. Elsayed, 1999- Lectures Notes On Hydrology. Water Engineering and water structures Dept –Faculty of Engineering – Zagazig University . Egypt**.**.	**Proposal references**

NN **Water & Soil Pollution**	BSGW23
The course is to educate the student about the sources of contamination of agricultural soil and water, Treatment of soil contaminated. The course aims also to provide the theoretical and practical knowledge about water quality control. And water quality standards for aquatic organisms Components of the ecosystem -Chemical and physical properties of the soil affecting the behavior of contaminants -Sources of contamination of agricultural soils -Soil contamination Trace elements -Criteria for the use of waste water and sewage sludge in agriculture -Treatment of soil contaminated with trace elements -Pesticide contamination -Water pollution (nutrients and bio-stimulants, suspended solids, salinity, toxins ……..) -Eutrophication -Water quality standards for aquatic organisms -Bioremediation and Biodegradation - Phytoremediation	**Contents and Qualification aims**
2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of water and soil pollution	**Module Character**
Basic Knowledge the water and soil pollution are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	Prerequisite of attendance
The module is one of 3 mandatory compulsory of the Basics in the water and soil pollution of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	Applicability
Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	Prerequisite to active credit points
The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	Accredit points and grades
The module is offered annually.	Frequency of the module
The work load is 150 hours.	Worked load
- Harrison, R.M. (ed.). 2001. Pollution: Causes, Effects and Control. 4th Ed. Royal Soc. of Chem., Cambridge, UK. - -Kammel, M, w. Hazzouri, A. Sattouf.2010. Soil and water Pollution, Aleppo Univ Puplication. Syria. - -Perk,M.2006. soil and water Contamination. ,from molecular to catchment scale. Taylor and Francis/ Balkema, Group, London, - -Yaron. B, Calvent. R, Prost. R. 2006.Soil Pollution.Processes and Dynamicas. Spring-Verlag Berlin.	**Proposal references**

NN **Agriculture Geology**	BSGW24
The student in this book deals with the earth's crust and its components of metals, rocks and the relationship of soil with rocks earth and thus achieve knowledge in the formation of agricultural soils as a result of erosion geological rocks of the land and basic idea about the	**Contents and Qualification aims**

maps.

2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of agriculture geology	**Module Character**
Basic Knowledge of Structure of the Earths, Chemical Composition, of Earth's Crust, Crystal and Minerals, Igneous Rocks, Sedimentary Rocks, Metamorphic Rocks, Weathering in soils, Soils Forming, Topographic and Geologic Maps	Prerequisite of attendance
The module is one of 3 mandatory compulsory of the Basics in the geology of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	Applicability
Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	Prerequisite to active credit points
The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	Accredit points and grades
The module is offered annually.	Frequency of the module
The work load is 150 hours.	Worked load
- Aljordy Ahmad, 2009, Geology, AL-Baath University publishing, p.270 - Carla W. M., (1993), Physical Geology, 3-d., Dubuque, Iowa: Wm. C. Broun publishers,> - Naylor R. S., (2002), Physical Geology, Northeastern University, Boston, - Mhamad Ahmed Mhamad, (2007), Physical Geology, Tishreen University publishing.	**Proposal references**

NN **Soil Colloids**	BSGW25
Understand basic types of soil colloids and their Properties. Comprehend the basic mechanisms responsible -for soil cation and anion exchange and their importance. General Properties of Soil Colloids - Types of Soil Colloids- Electrostatic Charges on Soil Colloids- - Soil Cation and Anion Exchange -Some applications of soil cation/anion -Principal Factors Governing Sorption in Soils	**Contents and Qualification aims**
2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of soil dolloides	**Module Character**
Basic Knowledge the soil colloides are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	Prerequisite of attendance
The module is one of 3 mandatory compulsory of the Basics in the soil colloides of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	Applicability
Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	Prerequisite to active credit points
The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	Accredit points and grades
The module is offered annually.	Frequency of the module
The work load is 150 hours.	Worked load
- Bolt, G.H., de Boodt, M.F., Hayes, M.H.B., McBride, M.B., de Strooper, E.B.A. (Eds.) Interactions at the Soil Colloid - Soil Solution Interface Based on the NATO Advanced Study Institute, State University of Ghent, Belgium, August 25-29, 1986 - Series: Nato Science Series E:, Vol. 190 - YU, T.R.; SUN, H.Y.; ZHANG, H. Specific adsorption of cations. In: YU, T.R. (Ed.) Chemistry of variable charge soils. New York: OxfordUniversity Press, 1997. p.140-174. - Zhang, M.K; L.P. Fang; C.Y. Huang. 2006. Competitive adsorption and mobility sequence of heavy metals in urban soils of southeastern China. Journal of Environmental Science-China, 18(2):329-333	**Proposal references**

NN	**Fertilizers & Fertilization**	BSGW26
	The module deals with different kinds of organic, mineral and bio fertilizers in addition to basics of fertilization. - Fertilizers requirement evaluation - Nitrogen fertilizers - Phosphorus fertilizers - Potassium fertilizers - Secondary nutrients fertilizers - Micronutrients fertilizers - Compound and mixed fertilizers - Fertilizers application principals and methods - Farmyard manure and compost - Non conventional organic fertilizers - Green and bio fertilizers - Fertilization in organic farming system	**Contents and Qualification aims**
	2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of fertilizers and fertilization	**Module Character**
	Basic Knowledge the fertilizers and fertilization are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	Prerequisite of attendance
	The module is one of 3 mandatory compulsory of the Basics in the fertilizers and fertilization of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	Applicability
	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	Prerequisite to active credit points
	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	Accredit points and grades
	The module is offered annually.	Frequency of the module
	The work load is 150 hours.	Worked load
	- Fink, A. (1982): Fertilizers and fertilization. Verlag Cherie. Florida. Basel - Hagin, J. And Tucker, B. (1982): Fertilization of dry lands and irrigated soils. Springer-Vaerlag. New York. - Magdoff, F. And Weil, R. R. (2004): Soil organic matter in sustainable agriculture. CRC press. Boca Raton London New York Washington, D. C. - Marschner, H. (1995): Mineral nutrition of higher plants. Academic Press Limited, London. - Thompson, L. M. And Troeh, F. R. (1973): Soils and soils fertility. Mc Graw-Hill Inc, New York. - - Tisdale, S. I.; Nelson, W. L.; Beaton, J. D. And Halvin, J. L. (1993): Soil fertility and fertilizers. 5th Edition. Macmillan Publishing Co., Inc. New York.	**Proposal references**

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NN **Soil Taxonomy**	BSGW27
Processes of soil formation. General and specific processes of soil formation. Factors of soil formation. Soil survey methods, definition of mapping units. Soil profile description – soil morphological studies. Soil classification systems: Russian and French soil classification system, Soil taxonomy, FAO,. Classification of Syrian soils, Soil survey, and Land evaluation. Introduction and Pedogenesis process. Soil-forming processes: (bio) geochemical and hydrological & soil organic matter dynamics. Russian soil classification system. French soil classification system. USDA soil taxonomy. Global soil classification systems: Soil Taxonomy and World Reference Base. Soil survey and Land evaluation. Soil of Syria.	**Contents and Qualification aims**
2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of soil taxonomy	**Module Character**
Basic Knowledge the soil taxonomy are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	Prerequisite of attendance
The module is one of 3 mandatory compulsory of the Basics in the soil taxonomy of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	Applicability
Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	Prerequisite to active credit points
The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	Accredit points and grades
The module is offered annually.	Frequency of the module
The work load is 150 hours.	Worked load
- Keys to Soil Taxonomy Tenth Edition, 2006. - Making and Interpreting Soil Surveys. 2th Edition, 1999. - Soil Taxonomy, A Basic System of Soil Classification for - Soils: genesis and geomorphology. Cambridge University Press, 2005. - World reference base for soil resources, 2014.	**Proposal references**

NN **Water Chemistry**	BSGW28
Cares to be studied in terms of water chemical and Standard specifications for water (drinking. water - irrigation water - sewage water - industrial wastewater . Gas laws Qualities of pure water. Analysis of the water as a way to get to know its validity. Chemical Kinetics. Chemical balance. The chemical reaction. Standard specifications for water (drinking. water - irrigation water - sewage water - industrial wastewater).	**Contents and Qualification aims**
2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of water chemistry	**Module Character**
Basic Knowledge the water chemical are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	Prerequisite of attendance
The module is one of 3 mandatory compulsory of the Basics in the water chemical processes of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	Applicability
Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	Prerequisite to active credit points
The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	Accredit points and grades
The module is offered annually.	Frequency of the module
The work load is 150 hours.	Worked load
- Chemistry of Ozone in Water and Waste water Treatment From Basic Principles to Applications, Author(s): Clemens von Sonntag and Urs von Gunten, Publication Date: 01 Sep 2012 • ISBN: 9781843393139 Pages: 320 • Hardback. - AWWA Staff, Darshan Singh Sarai2005. - Basic Chemistry for Water and Waste water Operators. American Water Works Association, 2005 - Science - 196 pages.	**Proposal references**

NN **Waste water**	BSGW29
The aim of this course is to equip the students with knowledge of types and extent of municipal waste generation and to convert into useful products. Wastewater Characteristics Chemical Characteristics Biological Characteristics Agricultural Wastewater Aspects of Using Agricultural wastewater Sanitary Wastewater Industrial Wastewater Characteristics Industrial Wastewater Treatment House Drainage Rural Sanitation Natural Methods of Wastewater Disposal Advanced Wastewater Treatment Solid Waste Disposal	**Contents and Qualification aims**
2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of waste water	**Module Character**
Basic Knowledge the waste water are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	Prerequisite of attendance
The module is one of 3 mandatory compulsory of the Basics in the waste water of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	Applicability
Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	Prerequisite to active credit points
The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	Accredit points and grades
The module is offered annually.	Frequency of the module
The work load is 150 hours.	Worked load
- - Christian.R.A,Karian,G.L.2013 Wastewater Treatment:Concepts and Design Approach 2nd Edition .PHILearning. - -Duncan.M,Nigel.H.2003.Handbook of water and Wastewater MicrobiologyAcademic Press.UK - -Haandel.A.(2012).Handbook of Biological Wastewater Treatment : Design and Optimization of Activated sludge System.IWA publishing	**Proposal references**

NN **Organic Agriculture**	BSGW30
The module deals with principals and basics of production in organic agriculture system.-Soil and it's properties affecting plant growth. - Farmyard manure - Compost -Green fertilizers - Biofertilizers - Nutritional requirements evaluation - Blights control - Weeds control - Principals of organic vegetables and fruits production - Principals of organic animal production – - Basics and lows organizing organic agriculture and licenses	**Contents and Qualification aims**
2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of organic agricultural	**Module Character**
Basic Knowledge the organic agricultural are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	Prerequisite of attendance
The module is one of 3 mandatory compulsory of the Basics in the organic agricultural of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	Applicability
Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	Prerequisite to active credit points
The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	Accredit points and grades
The module is offered annually.	Frequency of the module
The work load is 150 hours.	Worked load
- Al-Jalaa, Abdulmunem Muhammad (2003): Organic Agriculture – Basics and rules of production and features. Ein Shams University Publications, Faculty of Agriculture. - Magdoff, F. And Weil, R. R. (2004): Soil organic matter in sustainable agriculture. CRC press. Boca Raton London New York Washington, D. C. - Marschner, H. (1995): Mineral nutrition of higher plants. Academic Press Limited, London. - Thompson, L. M. And Troeh, F. R. (1973): Soils and soils fertility. Mc Graw-Hill Inc, New York. • - Tisdale, S. I.; Nelson, W. L.; Beaton, J. D. And Halvin, J. L. (1993): Soil fertility and fertilizers. 5th Edition. Macmillan Publishing Co., Inc. New York.	**Proposal references**

NN **Climate change**	BSGW31
Chapter 1: Earth and greenhouse effect Introduction about climate change Methods of determining climate change Chapter 2: recent climate change : the earth responds Atmospheric temperature water vapor and precipitation snow and level rise Chapter 3:ecological effects of climate change Effects on fresh water systems Drought and soil moisture Effects on terrestrial habitats Loss of biodiversity Chapter 4: climate change and agriculture Effects of agriculture on climate change Effects of climate change on agriculture Chapter 5:climate change and human Direct effects of heat stress Infectious diseases Policy – politics and economics of climate change	**Contents and Qualification aims**
2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of climate change	**Module Character**
Basic Knowledge the climate change are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	Prerequisite of attendance
The module is one of 3 mandatory compulsory of the Basics in the climate changeof the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	Applicability
Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	Prerequisite to active credit points
The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	Accredit points and grades
The module is offered annually.	Frequency of the module
The work load is 150 hours.	Worked load
• ***John .T.Hardy*** (2003): Climate change • ***Omer Chouinard, Juan Baztan , Jean-Paul Vanderlinen*** (2001) : Zones costières et changement climatique	**Proposal references**

NN **Economics**	BSGW32
Chapter 1 Economic terms and the development of economy idea. Chapter 2 Economic theories (production, value, supply, and demand Distribution Chapter 3 Money and Bank and the national income- population, and development. Chapter 4 Arab and International Economic organization. Chapter 5 Economic of Agricultural production. Chapter 6 Agricultural finance and planning and Agricultural Policy. Chapter 7 Agricultural cooperation. Chapter 8: Agricultural Development and its Theories. Chapter 9 Agricultural Marketing and Agricultural Prices.	**Contents and Qualification aims**
2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of economics	**Module Character**
Basic Knowledge the economics are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	Prerequisite of attendance
The module is one of 3 mandatory compulsory of the Basics in the economics of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	Applicability
Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	Prerequisite to active credit points
The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	Accredit points and grades
The module is offered annually.	Frequency of the module
The work load is 150 hours.	Worked load
• Futayyeh, M. S., 1981, Principles Agricultural Economics, Aleppo University publictions . P. 405. • Bishop, E. C. & Tousaint, W. D., 1958, Introduction to Agricultural Economic Analysis , New York, John Wiley and Sons, Inc.	**Proposal references**

NN **Agricultural Project Management**	BSGW33
This course includes Introduction to Project Management, Commercial and Financial Feasibility, Project Control Techniques, Technical Feasibility Chapter 1: Introduction to Project Management / Basics of Project Management / Project Life Cycle and its Classification / Project Management Process and Project Selection / Technical Feasibility Chapter 2: Commercial and Financial Feasibility / Market Potential Analysis / Financial Feasibility / Project Financing / Financial Analysis / Risk Analysi Chapter 3: Project Control Techniques / Process of project management / Detailed project report (DPR) / Project selection criteria Chapter 4: Technical Feasibility / Project Control Through Networks / Economic and Social Cost Benefit Analysis / Human Aspects in Project Management / Project Termination	**Contents and Qualification aims**
2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of agricultural project management	**Module Character**
Basic Knowledge the agricultural drainage are agriculture project management and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	Prerequisite of attendance
The module is one of 3 mandatory compulsory of the Basics in the agricultural project management of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	Applicability
Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	Prerequisite to active credit points
The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	Accredit points and grades
The module is offered annually.	Frequency of the module
The work load is 150 hours.	Worked load
• Project Management in Agricultural Extension Published by National Institute of Agricultural Extension Management, Rajendranagar, Hyderabad – 500 030, Andhra Pradesh, India), First Published: 2008. • Projekt management Methoden Best Practices von Scrum bis PRINCE2(R): Sebastian Kammerer, Micheal Lang, Micheal Amberg, 1 Auflage 2012, Deutschland.	**Proposal references**

NN **Practical Training/ Project Study**	BSGW34
The Student must carry out practical training about one Problem belongs to subjects of Water & soil engineering and Environment in one or more institution or incorporation, and he must present full study about this problem.	**Contents and Qualification aims**
Practical Training/ Project Study: 10 Hours tutorial per week	**Module Character**
Basic Knowledge of Practical Training/ Project Study, the student must be in the 5th Semester.	Prerequisite of attendance
The module is suitable for the professional and research oriented studies in civil and environmental engineering	Applicability
Having passed the module seminar and presentation in front of a scientific commission	Prerequisite to active credit points
The module earns 6 Cr. The final Grade is generated with 100% as presentation in front of committee.	Accredit points and grades
The module is offered annually.	Frequency of the module
The work load is 180 hours.	Worked load
The module takes one term starting in Semester 5.	
	Proposal references

– *Degree: PhD Specialty*	**Bachelor Thesis with Defense**	BSGW35
The Student must work Bachelor Thesis with Defense about one Problem belongs to the subjects of Water engineering and Environment in the semester, he must present full study about this problem.		**Contents and Qualification aims**
Bachelor Thesis with Defense: 18 Hours tutorial per week		**Module Character**
Basic Knowledge of Bachelor Thesis with Defense, the student must be in 6 Semester.		Prerequisite of attendance
the module is suitable for the professional and research oriented studies in civil and environmental engineering		Applicability
Having passed the module presentation in front of a scientific commission.		Prerequisite to active credit points
The module earns 9 Cr. The final Grade is generated with 100% as presentation in front of committee .		Accredit points and grades
The module is offered in 6 semester		Frequency of the module
The work load is 270 hours.		Worked load
		Proposal references

MODULE COMPENDIUM

Water & Soil Engineering and Environment (SGW)

Master Programme

Al Baath University Homs

Faculty of Agriculture

2015

EDUWAT: 511251-TEMPUS-1-2010-1-DE-TEMPUS-SMHES
Development of a Modern Higher Education System for Water Engineering in Syria

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein	Tempus

Goals of the program
Master course of water & Soil engineering and environment
AL-Baath University – Homs, SYRIA

The academic plan in the **Master course of water & Soil engineering and environment program**, aims at providing the students the following items:

71. High level information in science and computer techniques, and developing the skills in engineering sciences and its applications.
72. Developing the ability of the students to achieve various water engineering and environmental studies, check and use it according to the engineering codes.
73. Comparing between the engineering solutions, and choose the optimum ones.
74. Developing the work skills and regulate the relationship between the work team which the best and have many specialists.
75. Strengthening the research ability, developing, and working with the modest software's, equipment's… etc.
76. Developing the item of the scientific, social and cultural of the student's characters.
77. Continuous developing to get the high quality of the research, teaching…...etc.

Modules

Master course of water & Soil engineering and environment

	Credits	**%**
Modules in Advanced Applied Ma-thematics	10	8%
Modules in Engineering	25	21%
Modules in Hydro Sciences	15	13%
Modules with Specialization/	10	17%
Elective Modules	10	
Modules for general Qualification	10	8%
Practical Training /Project	10	8%
Master Thesis plus Defense	30	25%
Total	**120**	**100%**

Module Semester	**1**	**2**	**3**	**4**	**Total / ECTS**
Advanced Applied Mathematics	10				**10**
Engineering	10		15		**25**
Hydro Sciences	5		10		**15**
Specialization Modules		10			**10**
Elective Modules		10			**10**
General Qualification	5		5		**10**
Practical Training/ Project Study		10			**10**
Master Thesis plus Defense				30	**30**
Total	**30**	**30**	**30**	**30**	**120**

	Modules in Natural Sciences 10% - 25%		Modules inTechnical Sciences 10 - 25%		Modules in Economic & Social Sciences 5% - 15%		Modules in Variable Sciences 55% - 70%

Module Nr.	Course Semester	1	2	3	4	Total/ ECTS
	Mathematics and Natural Sciences	**10**	**0**	**0**	**0**	**10**
MSGW01	Biology	5				**5**
MSGW02	Advanced statistics	5				**5**
	Engineering	**10**	**0**	**15**	**0**	**25**
MSGW03	Advanced soil physics	5				**5**
MSGW04	Advanced soil chemistry	5				**5**
MSGW05	Advanced soil biology			5		**5**
MSGW06	Advanced soil fertility			5		**5**
MSGW07	Advanced soil taxonomy			5		**5**
	Hydro Sciences	**5**	**0**	**10**	**0**	**15**
MSGW08	Advanced water relationships			5		**5**
MSGW09	Advanced irrigation and drainage			5		**5**
MSGW10	Advanced hydrology	5				**5**
	Specialization modules	**0**	**10**	**0**	**0**	**10**
MSGW11	Advanced soil conservation		**5**			**5**
MSGW12	Advanced soil reclamation		**5**			**5**
	Elective modules		**10**			**10**
MSGW13	Water harvesting in dray areas		5			**5**
MSGW14	Agricultural pollution in dray areas		5			**5**
MSGW15	Biofertilization in dray areas		5			**5**
MSGW16	Waste water management		5			**5**
MSGW17	Biodiversity in dray areas		5			**5**
	General Qualification	**5**	**0**	**5**	**0**	**10**
MSGW18	Agriculture Project planning and controlling	5				**5**
MSGW19	advanced Water resources management			3		**3**
MSGW20	Research Methodology & Scientific writing			2		**2**
MSGW21	**Practical Training/Project study**		10			**10**
MSGW22	**Master Thesis plus Defense**				30	**30**
	Total	**30**	**30**	**30**	**30**	**120**

Module Number	**Module Name**	**. Professor in Charge**
MSGW01	**Biology**	NN
Contents and Qualification aims	The objective of this course is to equip the students about the chemical basic of the life , Genetic, Organisms belong to Prokaryotic and Eukaryotic ,Sorts of metabolisms , energy production and ecology of population Introduction about biology The cell The Tissues(structures and functions) The chemical basic of life Genetics Organisms belong to Prokaryotic(Bacteria) and Eukaryotic (Protozoa . fungi Algae) and viruses Diversity of life Metabolism Ecology of population	
Module Character	2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of biology	
Prerequisite of attendance	Basic Knowledge the biology are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the biology of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	- Moder . s.s, Baldwin.A., Roush.R, Songer.S, Thompson . M (2007) . Essentials of Biology . Second Edition) Mc Graw- Hill . - Thrope. N.O. (1994). Cell Biology. John Wiley and Sons. New York. - -Alberts, B. *et al*., (1994). Molecular Biology of the Cell (3rd Editioni). Garland Puplishing, Inc. New York. - -Hopkins, C.R. (1987). Structure and Function of Cell. W.B. Saunderscom . - -De Robertis, E.D.P. *et al*., (1980). Cell Biology 7th Edition. W.B. Saunders. Com	

Module Number	**Module Name**	. **Professor in Charge**
MSGW02	**Advanced Statistics**	NN
Contents and Qualification aims	This course includes the definition of General Statistics concepts and its application. **Chapter 1 :** Statistical concepts **Chapter 2**: Measurements of central tendency **Chapter 3:** Measurements of dispersion **Chapter 4:** Student – T- Distribution **Chapter 5:** Correlation and Regression - Agricultural Statistics **Chapter 6**: Factorial experiments from one degree , 2d , and three degree **Chapter 7:** Multi-linking **Chapter 8:** Factorial experiments **Chapter** 9: Split plot	
Module Charac-ter	2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of advanced statistics	
Prerequisite of attendance	Basic Knowledge the advanced statistics are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the advanced statistics of the master course of water resources mana-gement. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% writ-ten exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal refe-rences	- Bancrofft, T, A, &Anderson, R, L. 1952, Statistical Teory in Re-search, McGraw- Hill Book Co., Inc. New York. - Cochran, W. G. & Cox, G. M., 1957, Experimental Designs, and Ed., John Wiley & Sons . Inc., New York . - Elandt, R. 1964, Statystyka Matematyczna W Zastosowaniu do Doswiadczalictwa Rolniczego. Warszawam 595p**.**	

Module Number	**Module Name**	. **Professor in Charge**
MSGW03	**Advanced Soil physics**	**NN**
Contents and Qualification aims	Throughout this course covers, we shall be considering the soil from the view point of soil physics, which can description as the branch of soil science dealing with the physical properties of the soil. On the one hand, the fundamental study of soil physics aims at achieving a basic understanding of the mechanisms governing the behavior of the soil and its role in the biosphere. Including the cycles of water and transportable materials in the field. Introduction and First Principles - General Physical Characteristics of Soil - The Solid Phase - Soil Texture (Particle- Size Distribution Analysis) - Specific Surface - Soil Structure and Aggregation - The Gaseous Phase - Soil Air and Aeration - The Liquid Phase - Soil Water: Content and Potential - Flow of Water in Saturated Soil - Flow of Water in Unsaturated Soil - Composite Properties and Behavior - Soil Compaction. - Soil Temperature. - Water Balance.	
Module Character	2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of advanced soil physics	
Prerequisite of attendance	Basic Knowledge the advanced soil physics are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the advanced soil physicsof the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	- Baver, L. D. (1956): Soil Physics, Third Edition, JOHN WILEY, P. 489. - Hillel, D. (1982): Introduction to Soil Physics, Academic Press. New York, p.565 - Majumdar, S. P., and Singh, R. A. (2000): Analysis of Soil Physical Properties, AGROBIOS (INDIA) p194.	

MSGW04	**Advanced Soil Chemistry**	NN
Contents and Qualification aims	Cares to be studied in terms of soil chemistry INTRODUCTION TO THE CHEMICAL CONSTITUENTS IN SOIL ADSORPTION AND EXCHANGE REACTIONS IN SOILS SOIL-COLLOIDAL-CHEMISTRY SOIL PH - ACIDIC AND BASIC SOILS – BUFFERING OXIDATION REDUCTION IN SOIL SOLUTION CHEMISTRY IN SOIL SOIL MINERALS SOLUBILITY OF SOIL COMPONENTS	
Module Character	2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of advanced soil chemistry	
Prerequisite of attendance	Basic Knowledge the water project management are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the advanced soil chemistry of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	- -ALFRED R. CONKLIN, Jr 2005 ,Introduction to Soil Chemistry , Analysis and Instrumentation A JOHN WILEY & SONS, INC., PUBLICATION. - Kim H. Tan,1989. Principles of Soil Chemistry, Third Edition, CRC Press Amazon.com. - IUPAC. Compendium of Chemical Terminology, 2nd ed. (the "Gold Book"). Compiled by A. D. McNaught and A. Wilkinson. Blackwell Scientific Publications, Oxford (1997). XML on-line corrected version: http://goldbook.iupac.org (2006-) created by M. Nic, J. Jirat, B. Kosata; updates compiled by A. Jenkins. ISBN 0-9678550-9-8. doi:10.1351/goldbook.	

MSGW05	**Advanced Soil Biology**	**NN**
Contents and Qualification aims	Soil as a medium for microbial growth, the relation of microbes to important mineral transformations in soil, the importance of biological equilibrium and significance of soil microbes to environmental quality. The objective of this course is to equip the students regarding microbial behavior in soil and application in agriculture and the environment. The Biosphere - Soil Atmosphere -- Soil ,the Natural Medium for Plant Growth - Soil Microorganisms - Nitrogen Fixation in Free – living Bacteria - Nitrogen Fixation in Associative Symbiotic Bacteria -*Rhizobium* and Legume Root Nodulation –Actinorhizal Plants - Nitrogen Fixation by Cyanobacteria - Organic Matter Decomposition- Enzymic Activities in Soil - Nitrification-Denitrification-Fungal Symbioses with Roots - Bioaccumulation- Biodegradation and Bioremediation of Pollutants	
Module Character	2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of advanced soil chemistry	
Prerequisite of attendance	Basic Knowledge the advanced soil biology are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the advanced soil biology of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	- Al-issa ,A.2007.Soil Miccrobiology, Al-baath Uni, Syria , Homs - Burns, R.G. and R.P. Dik. 2002. Enzymes in the Environment. Marcel Dekker, Inc. NY, USA. - Harrison, R.M. (ed.). 2001. Pollution: Causes, Effects and Control. 4th Ed. Royal Soc. of Chem., Cambridge, UK. - Maier, R.M., I.L. Pepper, and C.P. Gerba. 2009. Environmental Microbiology. 2nd Ed. Academic Press Inc., San Diego, CA, USA. - Sylvia, D.M., J.J. Fuhrmann, P.G. Hartel, and D.V. Zuberer. 2005. Principles and Applications of Soil Microbiology. Prentice Hall International, NJ, USA.Paul, E.A. (ed.). 2007	

<table>
<tr><th>MSGW06</th><th>Advanced Soil Fertility</th><th>NN</th></tr>
<tr><td>Contents and Qualification aims</td><td colspan="2">The module deals with movement and bioavailability of essential nutrients.
Soil fertility concept
- Sources of nutrients gains and losses in soil
- Nutrients movement in soil
-Cycles of nutrients in soil
- Plant bioavailability of macronutrients
- Plant bioavailability of secondary nutrients
- Plant bioavailability of micronutrients
- Role of soil organic matter and humus in soil fertility
- Management of soil fertility in sustainable agriculture system</td></tr>
<tr><td>Module Character</td><td colspan="2">2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of advanced soil fertility</td></tr>
<tr><td>Prerequisite of attendance</td><td colspan="2">Basic Knowledge the advanced soil fertility are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences</td></tr>
<tr><td>Applicability</td><td colspan="2">The module is one of 3 mandatory compulsory of the Basics in the advanced soil fertility of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.</td></tr>
<tr><td>Prerequisite to active credit points</td><td colspan="2">Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.</td></tr>
<tr><td>Accredit points and grades</td><td colspan="2">The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.</td></tr>
<tr><td>Frequency of the module</td><td colspan="2">The module is offered annually.</td></tr>
<tr><td>Worked load</td><td colspan="2">The work load is 150 hours.</td></tr>
<tr><td>Proposal references</td><td colspan="2">- Brady, N. C.(1996): The nature and properties of soils. 10th Edition. Prentice Hall of India, New Delhiuh.
- Kabata-Pendias, A. And Pendias, H. (1992): Trace elements in soils and plants. 2nd Edition. CRC Press. Boca Raton Ann Arbor.
- Marschner, H. (1995): Mineral nutrition of higher plants. Academic Press Limited, London.
- Mengel, K. & Kirkby, E. A. (1987): Principles of plant nutrition. 4th Edition. International Potash Institute. Bern, Switzerland.
- -Stevenson, F. Y. (1986): Cycls of soils carbon, Nitrogen, Phosphorous, Sulfur and micronutrients. John Wiley and Sons. New York. Brisbana, Toronto.
• Thompson, L. M. And Troeh, F. R. (1973): Soils and soils fertility. Mc Graw-Hill Inc, New York.</td></tr>
</table>

MSGW07	**Advanced Soil Taxonomy**	NN
Contents and Qualification aims	Processes of soil formation. General and specific processes of soil formation Soil profile description – soil morphological studies. Diagnostic horizons, Pedons, Epipedons, Polypedons, Soil classification systems:, Global soil classification systems, USDA soil taxonomy. Description, distribution, use and management of reference soil groups. Classification of Syrian soils. – Introduction and Course Overview – Factors and Processes of soil formation. – Diagnostic horizons, Pedons, Epidons, Polypedons. – Soil profile description – soil morphological studies. – Soil classification systems:, Global soil classification systems, USDA soil taxonomy. – Description, distribution, use and management of reference soil groups – Soils of Syria	
Module Character	2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of advanced soil taxonomy	
Prerequisite of attendance	Basic Knowledge the advanced soil taxonomy are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the advanced soil taxonomy of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	– Keys to Soil Taxonomy Tenth Edition, 2006. – Making and Interpreting Soil Surveys. 2th Edition, 1999. – Soil Taxonomy, A Basic System of Soil Classification for Soils: genesis and geomorphology. Cambridge University Press, 2005.	

MSGW08	**Advanced Water Relationships**	NN
Contents and Qualification aims	Water in Soil & plant - Soil Texture & Structure - Soil Density & Porosity - Soil Water - Soil Water Potential - Soil Water Movement - Water relation in plant cells - Water potential in plant Water movement in plant - Plant Water deficit and stress Water in Soil & plant Soil Texture & Structure Soil Density & Porosity Soil Water Soil Water Potential Soil Water Movement Water relation in plant cells Water potential in plant Water movement in plant Water stress in plant	
Module Character	2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of advanced water relationship	
Prerequisite of attendance	Basic Knowledge the water relationship are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the advanced water relationshipof the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	- Kramer .P J . 1969 . plant and Soil Water Relationships a modern synthesis . Mcgawa –Hill . new York . - Minasny .b . Mcbratney . A . B . Bristow . k. l. 1999. Comparison of different approaches to the development of pedon transfer function for water –reterntion curse . Geoderrma 93 . - Milburn J. A . 1979 . water flow in plant longman Group ltd. London .	

MSGW09	**Advanced Irrigation & Drainage**	**NNn**
Contents and Qualification aims	Processes of soil formation. General and specific processes of soil formation. Factors of soil formation. Soil survey methods, definition of mapping units. Soil profile description – soil morphological studies. Soil classification systems: Russian and French soil classification system, Soil taxonomy, FAO,. Classification of Syrian soils, Soil survey, and Land evaluation. Irrigation in Arid & Semi-arid regions - Soil-Water-Plant Relationships - Flow of Water in Soil - Canal Engineering - Planning an Irrigation Project - Irrigation Methods - Drainage in Arid & Semi-arid regions - Drainage Coefficient - Methods of Drainage - Evaluation of farm Drainage System	
Module Character	2 h lecture and 3h laboratory per week The module deals with main concepts and theories related to different parts of advanced soil chemistry	
Prerequisite of attendance	Basic Knowledge the water project management are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the advanced soil chemistry of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	- Safar Talaat (2010) – Irrigation & Drainage, AL-Baath University Publications, 300 p. - Safar Talaat (2009) – Irrigation & Drainage, AL-Baath University Publications, 228 p. - SOGREAH (1976) – Irrigation Gravitaire Par Canaux, Ministrère de la cooperation, FRANCE, 295 p. - CLEMENT et al. (1979) – Irrigation par Aspersion Eyrolles – Editeur Paris, 182 p - MEMENTO Goutte á Goutte (1981) – Guide Pratique de la Micro–Irrigation, CTIFL– INRA, 204 p - Tiercelin (1997) – L' irrigation des parcs et jardins, CEMAGREF EDITIONS, Paris, 95 p..	

MSGW10	**Advanced Hydrology**	NN
Contents and Qualification aims	Addresses the science of groundwater hydrology and water cycle in nature and the flow of surface water and contamination and the possibility of keeping it from pollution, and the origin of groundwater and forms Todaha and distribution, movement and their chemical composition and gaseous classified. The hydrological cycle - Methods for estimating the elements of water balance. (Rainfall - runoff - evaporation and transpiration evaporation .... etc.) - Mathematical modeling of the components of the water balance (surface and groundwater).	
Module Character	2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of advanced soil chemistry	
Prerequisite of attendance	Basic Knowledge the advanced hydrology are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the advanced hydrology of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	- J.L.Sharma ., and S.A.Bari , “ Irrigation Engineering “ , published by : SMT . SUMITRA HANDA, New Delhe , 1995. - LIMAS Jose ,(1985) ."Hydrolgie generale “Principes et applications Quebec-anada . - LIMAS Jose ,(1985) ."Hydrolgie generale “Principes et applications Quebec-anada . - - Carder , D . J ., and Spener , G . W,.1971- Water conservation handbook. . West . Austral . Dept . Agr .,63 pp ., illus.	

MSGW11	**Advanced Soil Conservation**	NN
Contents and Qualification aims	The course covers the reclamation of soil, which is aimed mainly at increasing soil physical properties and chemical and biological, also aims to introduce new areas of land in farming by expanding agricultural area of arable and enter new areas of agricultural expansion. Soil Conservation Wind Erosion Water Erosion Soil deterioration Factures deterioration Desertification and its control Methods Soil conservation for deterioration	
Module Character	2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of advanced soil conservation	
Prerequisite of attendance	Basic Knowledge the advanced soil conservation are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the advanced soil conservation of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	- Al-Askar, Mahmoud 1992, Soil Conservation, Aleppo University Publications. - Balbaa, Naseem Maher Georgi 1994, Land Desertification: an Arab and international problem, Dar Al-Maaref Publications, Alexandria, Egypt. - Nahal, Ibrahim, Rahma, Adib, Shalabi Muhammad, 1996. Vegetation and soil conservation, Aleppo University publication.	

MSGW12	**Advanced Soil reclamation**	NN
Contents and Qualification aims	The course covers the problems and disadvantages of soils and methods of assessment, and the means and reclaim The major salts in soil and their effect on plant Classification of saline soil Methods of saline soil reclamation Methods of alkaline soil reclamation Methods of acid soil reclamation	

	Methods of Rocky soil reclamation Gypsic soil and its Classification. Carbonate soil and its Classification. Improvement of sandy and clay soils properties Degree bearing crops for acidity and alkalinity and salinity of soil and content of gypsum and calcium carbonate.
Module Character	2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of advanced soil redamation
Prerequisite of attendance	Basic Knowledge the advanced soil redamation are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences
Applicability	The module is one of 3 mandatory compulsory of the Basics in the advanced soil redamation of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.
Frequency of the module	The module is offered annually.
Worked load	The work load is 150 hours.
Proposal references	.Kim H. Tan,1989. Principles of Soil Chemistry, Third Edition, CRC Press Amazon.com. IUPAC. Compendium of Chemical Terminology, 2nd ed. (the "Gold Book"). Compiled by A. D. McNaught and A. Wilkinson. Blackwell Scientific Publications, Oxford (1997). XML on-line corrected version: http://goldbook.iupac.org (2006-) created by M. Nic, J. Jirat, B. Kosata; updates compiled by A. Jenkins. - Sylvia, D.M., J.J. Fuhrmann, P.G. Hartel, and D.V. Zuberer. 2005. Principles and Applications of Soil Microbiology. Prentice Hall International, NJ, USA. Christian.R.A,Karian,G.L.2013 Wastewater Treatment: Concepts and Design Approach 2nd Edition .PHILearning .-Duncan.M,Nigel.H.2003.Handbook of water and Wastewater Microbiology Academic Press.UK

MSGW13	**Water harvesting in dry areas**	*NN*
Contents and Qualification aims	This course examines topics harvest and dissemination of water in terms of the definition technologies for water harvesting and the various methods of design and investment and the problems encountered in water harvesting and uses of water harvesting in agriculture, both plant and animal A general introduction of water harvesting. - Methods of harvesting and dissemination of water. - Design and deployment of technologies for water harvesting - Water harvesting and agricultural production (plant and animal). - Problems encountered in water harvesting and deployment	
Module Character	2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of advanced soil che-	

	mistry
Prerequisite of attendance	Basic Knowledge the water project management are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences
Applicability	The module is one of 3 mandatory compulsory of the Basics in the advanced soil chemistry of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.
Frequency of the module	The module is offered annually.
Worked load	The work load is 150 hours.
Proposal references	-Mohammad.M.A (1998)." Hydrogeology" .Aleppo University publications. -Al asaad.A &Ezdeen.H.(1992)" Hydrology(2)- Hydrogeology. Teshreen University publications. -Tod. D.(1980) ."Ground water hydrology". John wiley New York.

MSGW14	**Agriculture Pollution**	NN
Contents and Qualification aims	The Course includes : soil pollutant resources due to food industrial and agricultural activities and methods of soil remediation to avoid the negative impact on environment - Concept to agricultural Pollution - Agricultural Pollution sources - Soil Pollution - Water Pollution - Air Pollution - food contamination - Bioremediation technologies - Phytoremediation technologies	
Module Character	2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of agriculture polution	
Prerequisite of attendance	Basic Knowledge the agriculture pollution are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the agriculture pollution of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	- Alloway BJ (1995) Heavy Metals in Soils, Second Edition. Blackie, New York. Pages 122-151 Voet E, Guinee JB, Haes H (2000) Heavy metals: A problem solved? Methods and models to evaluate policy strategies for heavy metals. Kluwer Academic publishers, the Netherlands. ISSBN 0-7923-6192-X Harrison, R.M. (ed.). 2001. Pollution: Causes, Effects and Control. 4th Ed. Royal Soc. of Chem., Cambridge, UK. -Kammek,M,w.Hazzouri,A.Sattouf.2010.Soil and water Pollution. Aleppo Univ Puplication.Syria. -Perk,M.2006. soil and water Contamination. ,from molecular to catchment scale.Taylor and Francis/ Balkema,Group,London,UK.	

MSGW15	**Biofertilizers In Dry Area**	NN
Contents and Qualification aims	The objective of this course is studying the role of biofertilizers for sustainable agriculture ,and its importance for soil fertility and the environment. and contribution of biofertilizers in productivity of The living Soil - Biofertilizers for Sustainable Agriculture - Organisms Involved in Organic Matter Formation - Microbial Inoculants for Nitrogen Fixation (*Azotobacter , Beijerinckia , Azospirillium,* Cyanobacteria,*Frankia , Rhizobium*) - Mechanism and Estimation of Nitrogen Fixation - Biological Mobilization of Phosphorus (Effect of PSMS and VAM) - Biological Mobilization of Potassium (Effect of KSB) - Biological Approach for Secondary and Micronutrients Acquisition - Vermiculature (Vermicastings as Inoculant) - Constraints in Biofertilizers Use -Quality Control of Biofertilizers -Perspective (Promotional Strategies, Future Thrusts)Agricultural crops	
Module Character	2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of biofertilizers ind dry areas	
Prerequisite of attendance	Basic Knowledge the biofertilizers in dry areas are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the biofertilizers in dry areasof the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Worked load Frequency of the module	The module is offered annually. The work load is 150 hours.	
Proposal references	-Shrma.A.K 2002. Biofertilisers for sustainable Agriculture. Agrobios(India) - Al-issa ,A.2007.Soil Miccrobiology, Al-baath Uni, Syria , Homs - Hurst, C.J., R.L. Crawford, G.R. Knudsen, M.J. McInernery, and L.D. Stetzenbach. 2002. Manual of Environmental Microbiology. American Society for Microbiology, Washington DC, USA -. Sylvia, D.M., J.J. Fuhrmann, P.G. Hartel, and D.V. Zuberer. 2005. Principles and Applications of Soil Microbiology. Prentice Hall International, NJ, USA.	

MSGW16	**Waste water Management**	NN
Contents and Qualification aims	The aim of this course is to equip the students with knowledge of types and extent of municipal waste generation and to convert into useful products. Wastewater Characteristics - Chemical Characteristic - Biological Characteristics - Agricultural Wastewater Aspects of Using Agricultural Wastewater - Sanitary Wastewater - -Industrial Wastewater Characteristics - -Industrial Wastewater Treatment - House Drainage -Rural Sanitation- -Natural Methods of Wastewater Disposal - Advanced Wastewater Treatment -Solid Waste Disposal	
Module Character	2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of waste water management	
Prerequisite of attendance	Basic Knowledge the waste water management are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the waste water management of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	- Christian.R.A,Karian,G.L.2013 Wastewater Treatment: Concepts and Design Approach 2nd Edition .PHILearning. - -Duncan.M,Nigel.H.2003.Handbook of water and Wastewater MicrobiologyAcademic Press.UK - -Haandel.A.(2012).Handbook of Biological Wastewater Treatment : Design and Optimization of Activated sludge System.IWA publishing	

MSGW17	**Biodiversity in arid and semi-arid region**	NN
Contents and Qualification aims	the materials includes the definition of biodiversity and its ecological importance, the raisons endangered , especially in the Mediterranean ecosystem Concept of biodiversity History of biodiversity Element of biodiversity Ecological diversity ecosystems Landscape disturbance in Mediterranean –type ecosystems From biodiversity to Eco diversity –Holistic conservation of the biological and cultural diversity of Mediterranean landscape Ecological indicators of landscape degradation Biodiversity and conservation biology of coastal transition zones from Mediterranean to desert ecosystems Living components of biodiversity organisms How can High Animal diversity be supported in low production deserts	
Module Character	2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of biodiversity	
Prerequisite of attendance	Basic Knowledge the biodiversity are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the biodiversity of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	(Moshe Shachak , James Gosz): Biodiversity in dray lands to word a unified (P.W.Rundel, G.Montenergro,F.M.Jaksic): Landscape Disturbance and biodiversity in Mediterranean type ecosystems (K. J. Gaston, J. I. Spicer**):** Biodiversity introduction	

MSGW18	**Agricultural Project Planning & Controlling**	NN.
Contents and Qualification aims	This course includes Introduction to Integrated Agricultural Projects, planning preparation and evaluation of investment agriculture projects, (Financial, Economic, Environmental and Social Analysis…..etc). Chapter 1: Agricultural planning: 1. The Importance of Agricultural Planning 2. Kinds of Agricultural Planning 3. Purposes of Agricultural Planning 4. Principles, basis and conditions of Agricultural Planning Chapter 2: Agricultural project management Chapter 3: Agricultural Project Organization Chapter 4: planning, preparing and evaluation Agricultural Projects Chapter 5: evaluating and Analyzing of Agricultural Projects Chapter 6: planning and organizing Agricultural Projects	
Module Character	2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of agricultural planning and controlling	
Prerequisite of attendance	Basic Knowledge the agricultural planning and controlling are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the agricultural planning and controlling of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	Project Management in Agricultural Extension Published by National Institute of Agricultural Extension Management, Rajendranagar, Hyderabad – 500 030, Andhra Pradesh, India), First Published: 2008. • Projektmanagement Methoden Best Practices von Scrum bis PRINCE2(R): Sebastian Kammerer, Micheal Lang, Micheal Amberg, 1 Auflage 2012, Deutschland.	

MSGW19	**Advanced water resources management**	NN
Contents and Qualification aims	This course looking at ways of planning and sound management of water resources with the aim of development and sustainability, in addition to his care in ways that determine the quantities of water resources and water budgets of rivers and areas ... etc.. It also addresses other topics Kaljdoy economic and social projects, management of water resources .Mathematical modeling of appropriate topics of water resources management. The Science of Water Resources Management. - Methods of integrated management of water resources at various levels. - Ways to manage water resources at the level of large ponds and agricultural fields. - - Mathematical models of water resources. - Methods of capacity building for integrated and sustainable management of water resources. - Challenges facing the integrated management of water resources.	
Module Character	2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of water resources management and hydrology	
Prerequisite of attendance	Basic Knowledge the water resources management and hydrology are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the water resources managemenr and hydrology of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	FAO, 1986- Watershed management . Field Manuel : gully control FAO , conservation guide n ˚13/2. Johnson R.W.M.,1989– Integrated systems analysis, climate and implications for risk management.Workshop on systems analysis. J.L.Sharma ., and S.A.Bari , “ Irrigation Engineering “ , published by : SMT . SUMITRA HANDA, New Delhe , 1995. Larry W. Mays , (2001) ." Water Resources Engineering ". • Magdy H.Mowafy ., and Ahmed H. Elsayed, 1999- Lectures Notes On Hydrology. Water Engineering and water structures Dept – Faculty of Engineering – Zagazig University . Egypt..	

MSGW20	**Research Methodology & Scientific Writing**	NN
Contents and Qualification aims	The students are expected to identify their research interests as early as possible and select the materials and methods for their work; practice on these methods before actually applying, modify, if necessary, according to the research requirements of the work. In this attempt students shall follow the scientific ways by undertaking an extensive library study also, collecting references directly or indirectly related to the proposed work; this shall prepare the students to embark upon writing of the introduction, highlighting the justification for the suggested topic of research: - An Introduction to Research Methodology: history, concept, characteristics - Scientific Research Methodology: Constructive/ deductive, empirical, descriptive, historical, dialectic,-. Agricultural Scientific Research Methodology:- Hypotheses: definition, formulation, conditions, importance, - The Identification of Research Problem: definition, sources, cards preparation, arrangement, utilizes- Preparing the Research Proposal:- Source of Information- Citing and Documenting References - Principal of Scientific Research -Ethicist of Scientific Research: : principals, honesty, principals of ethicist related to; scientific research practices, data collection and taking notes, dealing with data, risk	
Module Character	2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of a research methodology	
Prerequisite of attendance	Basic Knowledge the research methodology are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the research methodology of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	Bogdan, R. C. (1982) "Qualitative research for education: an introduction to the theory and methods", Boston: Allyan and Bacon, Inc Bartlett, T., and Smallwood, S. (2004Best, J. W. Khan, J. V. (1998) "Research in education", (8th ed.), Allyan and Bacon, Inc. • Easterby-smith, M.; Thorpe, R. and Lowe, A. (1995) "Management Research: An Introduction", SAGE Publications: London.	

MSGW21	**Practical Training/ Project Study**	NN
Contents and Qualification Aims	The Student must carry out practical training about one problem belongs to subjects of Master Course in one or more institution or incorporation, and he must present full study about this problem.	
Module Character	Practical Training/ Project Study: 10 Hours tutorial per week	
Prerequisite of attendance	Basic Knowledge of Practical Training/ Project Study, the student must be in the 2 rd Semester.	
Applicability	the module is suitable for the professional and research oriented studies in civil and environmental engineering	
Prerequisite to active credit points	Having passed the module seminar and presentation before a commission.	
Accredit points and grades	The module earns 10 Cr. The final Grade is generated with 100% as presentation in front of committee.	
Frequency of the module	The module is offered annually.	
Worked load	The workload is 300 hours	
Proposal references		

MSGW22	**Master Thesis with Defense**	NN
Contents and Qualification aims	The Student must work Bachelor Thesis with Defense about one Problem belongs to the subjects of Master Course of Harbor Structures and Coastal Engineering in one or more institution or incorporation, and he must present full study about this problem	
Module Character	Master Thesis with Defense: 30 Hours tutorial per week .	
Prerequisite of attendance	Basic Knowledge of Master Thesis with Defense, the student must be in 4 Semester	
Applicability	the module is suitable for the professional and research oriented studies in civil and environmental engineering	
Prerequisite to active credit points	Having passed the module presentation before a commission.	
Accredit points and grades	The module earns 30 Cr. The final Grade is generated with 100% as presentation in front of committee.	
Frequency of the module	The module takes one term starting in Semester 4.	
Worked load	The work load is 900 hours	
Proposal references		

MODULE COMPENDIUM

Water Engineering (WE)
Bachelor Programme

Al Baath University Homs

Faculty of Civil Engineering

2015

EDUWAT: 511251-TEMPUS-1-2010-1-DE-TEMPUS-SMHES
Development of a Modern Higher Education System for Water Engineering in Syria

In Cooperation with
Higher Institute for Water Management
Homs – Syria

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Objectives:

The academic curriculum of the **Bachelor course of Water Engineering program**, aims to providing the students with the following items:

78. Fundamental understanding of science and mathematics with highly-developed problem-solving skills
79. Broadening and deepening Knowledge and understanding of engineering sciences and its applications.
80. High level knowledge in water sciences and related computer techniques
81. Developing the ability of the students to conduct various water engineering and environmental studies according to the engineering codes.
82. Select and appraise an optimum solution for water engineering problems using appropriate tools based on analytical and systematic thinking. .
83. Ability to work effectively within multidisciplinary teams. .
84. Strengthening the research ability and developing their skills in applying related software , using laboratory equipment's… etc.
85. Ability to improve self learning to get the high quality of the research and advanced technologies.

Modules

Bachelor Course in Water Engineering BWE

	Credits	%
Modules with Basics Sciences	45	25%
Modules with Basics in Engineering Modules with Basics in Hydro Sciences	50	28%
Modules with specialized Basics	25	14%
Elective Modules	15	8%
General Qualification	20	11%
Practical Training /Project	10	6%
Bachelor examination	15	8%
Total	**180**	**100%**

Module Semester	**1**	**2**	**3**	**4**	**5**	**6**	**Total / ECTS**
Basics Sciences	20	5	10				**45**
Basics in Engineering	5	10	10	10			**35**
Basics in Hydro Sciences		5	5		5		**15**
Specialized Basics			5	15		5	**25**
Elective Modules					15		**15**
General Qualification	5			5		10	**20**
Practical Training/ Project Study					10		**10**
Bachelor Thesis incl. Defense						15	**15**
Total	**30**	**30**	**30**	**30**	**30**	**30**	**180**

	Modules in Natural Sciences 25%		Modules inTechnical Sciences 25%		Modules in Economic & Social Sciences 25%		Modules in Variable Sciences 25%

Module nr.	**Course Semester**	**1**	**2**	**3**	**4**	**5**	**6**	**Total/ ECTS**
	Basic Sciences	**20**	**15**	**10**				**45**
BWE01	Mathematics	5						**5**
BWE02	Descriptive Geometry	5						**5**
BWE03	Probability & Statistics		5					**5**
BWE04	Physics		5					**5**
BWE05	Chemistry for Engineers			5				**5**
BWE06	Informatics/Computer sciences	5		5				**10**
BWE07	Mechanics 1+2	5	5					**10**
	Basics in Engineering	**5**	**10**	**10**	**10**			**35**
BWE 08	Surveying			5				**5**
BWE09	Geoinformatics/GIS				5			**5**
BWE10	Engineering Geology	5						**5**
BWE11	Soil Mechanics			5				**5**
BWE12	Building Materials		5					**5**
BWE13	Strength of Materials		5					**5**
BWE14	Reinforced Concrete/Steel structures				5			**5**
	Basics in Hydro Sciences		**5**	**5**		**5**		**15**
BWE15	Hydraulics		5	5				**10**
BWE16	Hydrobiology					5		**5**
	Specialized Basics			**5**	**15**		**5**	**25**
BWE17	Structure mechanics				5			**5**
BWE18	Hydrology & Hydrometry			5				**5**
BWE19	Sanitation and waste water treatment				5			**5**
BWE20	Water supply system				5			**5**
BWE21	Water Resources management						5	**5**

	Elective Modules*					**15**		**15**
BWE22	Irrigation & Drainage					5		**5**
BWE23	Hydrogeology					5		**5**
BWE24	Water storage					5		**5**
BWE26	Soil and water pollution					5		**5**
BWE27	Watershed management & monitoring					5		**5**
BWE27	Microbiology					5		**5**
	General Qualification	**5**			**5**		**10**	**20**
BWE29	Law and legislation				5			**5**
BWE30	Engineering Economics						5	**5**
BWE31	Water project management						5	**5**
BWE32	Languages	5						**5**
BWE33	**Practical Training/ Project Study**					10		**10**
BWE34	**Bachelor Thesis incl. Defense**						15	**15**
	Total	**30**	**30**	**30**	**30**	**30**	**30**	**180**

Module Number	Module Name	Professor in Charge
BWE01	**Mathematics**	*NN:*
Contents and Qualification aims	This course includes the definition of general mathematics for engineers and its importance **Analysis:** Functions, limits, continuity. The function (the inverse functions, dogmatic, inverse dogmatic). The differential and derivative- partial derivatives. Indefinite integrals and its mapping. **2- Algebra:** The complex number. The matrices – determinant and operations on it. Linear equations system.	
Module Character	2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of mathematics	
Prerequisite of attendance	Basic Knowledge the mathematics are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the mathematics of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	W Bolton،W. Bolton2011. Mathematics for Engineering, Routledge W.E. Schiesser 1994. Computational Mathematics in Engineering and Applied Science, CRC press	

Module Number	**Module Name**	**Professor in Charge**
BWE02	**Descriptive Geometry**	Degree: PhD *Specialty*
Contents and Qualification aims	This course includes the basics of descriptive geometry and engineering drawings Principles and methods of projection. Geometric constructions. Illustration of point and line in Monge's Geometry. Illustration of plane in Monge's Geometry. Mutual situation of lines and planes. Methods of descriptive geometry. Illustration of multi faces. Drawing of three plans of Geometric forms and deduction of third plan with indication of two plans. Isometric projection. Illustration of point and line in numeric Projection. Situations of lines and planes in space. Methods of numeric projection and measures. Illustration of multi faces and curved planes. Applications of numeric projection Slopes and earthy planes in irrigation structures. Walls used in irrigation structures.	
Module Character	2 hours literature + 4 hours practical The module deals with main concepts and theories related to different parts of descriptive geometry	
Prerequisite of attendance	Basic Knowledge the descriptive geometry are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the descriptive geometryof the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	Kathryn Holliday-Darr 1998. Applied Descriptive Geometry, Thomson Publishing	

Module Number	**Module Name**	**Professor in Charge**
BWE03	**Probability & Statistics**	
Contents and Qualification aims	This course covers fundamentals of probability, random processes, statistics, and data analysis are covered, Probability: Sample space, outcome, events, axioms of probability. Addition and multiplication rules. The law of total probability, conditional probability, independence, Bayes Theorem. Applications including reliability and randomized response in surveys. Random variables: Discrete and continuous random variables. Probability mass functions, density functions and cumulative distribution functions. Expected value, variance and moments Discrete Probability distributions: Bernoulli trials, binomial, geometric, hyper geometric, Poisson. Covariance, correlation, independence. Continuous probability distributions: The exponential, normal, log-normal and uniform distributions. Data analysis: measures of location and spread; symmetry and skewness. Basic graphical methods, normal probability plots, factorial effect plots. Sample and population. Design of experiments: factorial designs and graphical analysis. Inference: Sampling distributions. The Central Limit Theorem. Point estimation, confidence intervals. Significance tests and p-values. Practical applications. Instruction in the use of R for simple data analysis	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of ح probability and statistics	
Prerequisite of attendance	Basic Knowledge the probability and statistics are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the probability and statistics of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Work load	The work load is 150 hours.	
Proposal references	Jay Devore 2012. Probability and Statistics for Engineering and the Sciences, Brooks/Cole	

Module Number	Module Name	Professor in Charge
BWE04	**Physics**	
Contents and Qualification aims	This course includes the definition of Engineering Physics concepts and its applications and how physics is applied in the real world Thermal expansion. Fundamental laws of ideal gases. Kinetic theory of gases. Fundamental of thermodynamic. Radioactivity. Fluid dynamic. Geometrical optic Refraction Reflection Lenses Interference and diffraction.	
Module Character	2 hours literature + 2 hours practical at the Physics Lab The module deals with main concepts and theories related to different parts of physics	
Prerequisite of attendance	Basic Knowledge the physics are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engi-neering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the physics of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Basic Knowledge are Water Engineering and Irrigation, Soil Enginee-ring, Environmental Engineering, and Agriculture Engineering, Ba-chelor of Sciences	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% writ-ten exam and 40% term paper.	
Frequency of the module	The module is offered annually in the summer semester	
Worked load	The work load is 150 hours.	
Proposal referen-ces	A Hendricks،L Subramony and C Van Blerk 2008. Physics for Engineers, Juta & Co, Ltd.	

Module Number	**Module Name**	**Professor in Charge**
BWE05	**Chemistry for Engineers**	
Contents and Qualification aims	This course teaches basic chemical principles and its applications Elementary precepts in Chemistry. Atomic structure. Chemical Elements – periodical Classification of Elements. Portland cement. Hydration of cement. Types of cement. Chemical corrosion in concrete. Admixtures. Air bonding Materials (Lime – Gypsum). Metallic Elements. Types of style – heat treatment. Metal corrosion – ways of protection. Glass.	
Module Charac-ter	2 hours literature + 2 hours practical at the Chemistry Lab	
Prerequisite of attendance	Basic Knowledge the chemistry are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engi-neering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the chemistry of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal refe-rences	• .K. Ambasta 2008. Chemistry for Engineers, University Science Press.	

Module Number	**Module Name**	**Professor in Charge**
BWE06/1	**Informatics/Computer aided design**	
Contents and Qualification aims	This course includes the learning AutoCAD program. Introduction to AutoCAD (starting the program and screen layout). Basic drawing operations and commands. Improved drawing operations and commands. Modification and editing operations and commands. Dimensioning. Organizing the drawings with layers. Blocks. Printing command.	
Module Character	2 hours literature + 2 hours practical at the Computers Lab The module deals with main concepts and theories related to different parts of computer aided design	
Prerequisite of attendance	Basic Knowledge the computer aided design are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the agricultural drainage of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	S P Regall 2010. Computer Aided Analysis and Design, I. K. International Pvt Ltd	

Module Number	**Module Name**	**Professor in Charge**
BWE06/2	**Informatics/Programming**	
Contents and Qualification aims	This course includes learning the basics of Visual Basic programming language. Introduction to VB Environment. The Codes in VB. Standard VB Tools. Procedures. Data Tables.	
Module Character	2 hours literature + 2 hours practical at the Computers Lab The module deals with main concepts and theories related to different parts of agricultural drainage	
Prerequisite of attendance	Basic Knowledge the programming are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the programming of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	Christopher Frenz 2002. Visual Basic and Visual Basic .NET for Scientists and Engineers, Apress	

Module Number	Module Name	Professor in Charge
WE07/1	**Mechanics 1**	
Contents and Qualification aims	Covers static force analysis. Introduces Reticular trusses with applications . Basic principles in Statics. Axioms & laws of Statics. The restraints & Supports & Reactions. Forces Composition & dispersion Analyzing and lining. Point balance – applications on concurrent forces group. Parallel forces groups & Duplexes located in one plane. Statically establishment for structural systems &their geometric settlements. Reticular trusses (theory – solving –assembly). Statically Established Plane frames (organs methods) Friction & its applications –Sliding & its applications – march friction. Distributed forces located on the same plane.	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of mechanics ةث	
Prerequisite of attendance	Basic Knowledge the mechanics are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the mechanics of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	F Beer, Jr. Johnston, E. Russell, R Flori 2007. Mechanics for Engineers, Statics, McGraw-Hill Education	

Module Number	**Module Name**	**Professor in Charge**
BWE07/2	**Mechanics 2**	
Contents and Qualification aims	This Study of the dynamic behavior of structures. Center of Gravity for Lines & Surfaces& Material Bodies , Second Degree Moments for Surfaces & Material Bodies (Masses Moments). Inertia for Surfaces &Masses. Applications on Center Of Gravity & Inertia (Dams –Embankments). Overturn & Sliding (Dams –Embankments). Fixing & Free degrees for the Structural Systems and Presumptive Work Concept applying for their balance. Chains & Cables Balance.	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of mechanics	
Prerequisite of attendance	Basic Knowledge the engineering geology are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the mechanics of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	J. N. Fawcett, J. S. Burdess 1989. Basic Mechanics with Engineering Applications	

Module Number	Module Name	Professor in Charge
BWE08	**Surveying**	
Contents and Qualification aims	This course Introduces the instruments of surveying and their use . the student will understand theory and practice of surveying and leveling Introduction to Survey. Theory of errors & Least Squares Theory. Cadastral Instruments + linear Section drawing. Mathematical Processing for Cadastral Measurements. (Direct & indirect) Geometrical Leveling Applications on Direct Leveling Works. Horizontal Angles Measurement. Series Method. Closed Polygon. Opened Polygon. Calculate THE Area Leveling (calculating). Cadastral SURVEY (Dividing Areas). Introduction to the principles of topographical mapping	
Module Character	2 hours literature + 4 hours practical at the Surveying Lab and Site The module deals with main concepts and theories related to different parts of surveying	
Prerequisite of attendance	Basic Knowledge the surveying are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the surveying of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	J. Uren‹W.F. Price 2010. Surveying for Engineers, Palgrave Macmillan	

Module Number	Module Name	Professor in Charge
BWE09	**Geoinformatics/GIS**	
Contents and Qualification aims	This course provides an introduction to several areas of Earth Sciences that impact the engineer, including geological materials, earth surface processes, natural disasters and understanding Geological maps . Earth structure. Rock minerals. Tectonic movement of the earth crust. Earthquakes. Erosion and external geodynamics. Ground water. Soil exploration. Crystals and minerals. Rocks (igneous, sedimentary, metamorphic). Geological maps.	
Module Character	2 h lecture and 3h laboratory The module deals with main concepts and theories related to different parts of geoinformatics	
Prerequisite of attendance	Basic Knowledge the geoinformatics are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the geoinformatics of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	Allan Brimicombe 2010. GIS Environmental Modelling and Engineering, CRC Press	

Module Number	Module Name	Professor in Charge
BWE10	**Engineering Geology**	
Contents and Qualification aims	This course provides an indroduction to several areas of erth sciences that impact the engineer , inclouding geological materials, earth surface processe s, natural disasters and understanding geological maps	
Module Character	2 hours literature + 2 hours practical at the Geology Lab The module deals with main concepts and theories related to different parts of engineering geology	
Prerequisite of attendance	Basic Knowledge the engineering geology are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the engineering geology of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	D G Price‹M Freita 2009. Engineering Geology: Principles and Practice, Springer Shop	

Module Number	Module Name	Professor in Charge
BWE11	**Soil Mechanics**	
Contents and Qualification aims	This course investigates the behaviour of soil under mechanic stress and deformation interacting with flow of water. Introduction to geotechnical engineering. Soil composition and classification & Characteristics. Stress in soil mass. Flow of water in soil. Effective stress concept. Compressibility of soil (Consolidation) & subsidence.	
Module Charac-ter	2 hours literature + 2 hours practical + 2 hours practical at the Soil Lab The module deals with main concepts and theories related to different parts of soil mechanics	
Prerequisite of attendance	Basic Knowledge the soil mechanics are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the soil mechanics of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal refe-rences	D.L. Shah، A.V. Shroff 2003. Soil Mechanics and Geotechnical Engineering, CRC Press	

Module Number	**Module Name**	**Professor in Charge**
BWE12	**Building Materials**	NN
Contents and Qualification aims	This course provides an introductory overview of the various materials used in construction Basic properties of Materials. Natural rocks and stones. Mineral bonding Materials. Aggregates. Cement Concrete (designing –properties–types). Admixtures in concrete. Metallic Materials (Iron). Hydrocarbon bonding Materials. Timber. Sound – Thermal insulating Materials. Ceramic and cement slab. Brick..	
Module Character	2 hours literature + 2 hours practical + 2 hours practical at the Building Materials Lab The module deals with main concepts and theories related to different parts of building materials	
Prerequisite of attendance	Basic Knowledge the building materials are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the building materials of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	Errol Van Amsterdam 2000. Construction Materials for Civil Engineering, jutaonline	

Module Number	**Module Name**	**Professor in Charge**
BWE13	**Strength of Materials**	
Contents and Qualification aims	This course covers external and internal forces in structures. It also covers the stress and strain relationships in materials. The basics in Materials Resistance. Tension & Compression on straight linear element. The Plane &3D Stress Situation at a Point. Shear: Hook's law – the Allowable Shear Strain- Potential Rivets Energy –welded Joints. Torsion: Moment Torsion Plan – (Stresses & Deformations) for circular rod subjected to Torsion – Strength & Rigidity conditions for rod subjected to Torsion. strain case – basics strains Potential Energy. Simple Bending: Define The internal Forces, drawing the plans, Calculate the Strains, Calculate strength – Potential Energy. Elastic Axle: Non statically prescribed Beams (the first, second degree) Composite Resistance: Inclined bending – determining the inclined strains , determining the neutral Axle – Deformations – The effect of the Axial Forces & Bending Moment-Effect of Decentralization – Effect of Torsion& Bending Moments together.	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of strenghth materials	
Prerequisite of attendance	Basic Knowledge thestrenghth materials are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the strenghth materials of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	R.K Bansal 2000. Engineering Mechanics and Strength of Materials, Laxmi Publications	

Module Number	**Module Name**	**Professor in Charge**
BWE14	**Reinforced Concrete/**	
Contents and Qualification aims	This course includes Essentials of structural design in reinforced concrete including building code requirements and standard practice for the design of basic structural elements. **1- Reinforced Concrete Structures:** The physical & Mechanical Characteristics of The Reinforced Concrete. The Reinforced Concrete studying Methods (Classical –restrictive) Design of the Elements Subjected to central compression. Design of the Elements subjected to central Tension. Design of the Elements subjected to Bending moment. Welding & lengths of (fixing &overlaying) steel rods confirming. Design of the Elements Subjected to decentralized compression. Design of the Elements Subjected to decentralized Tension. Cracks & Deformation. Studying Concrete sections against Shear stress. Studying Concrete sections against Torsion stress. Studying Simple & Continuous Beams. Slabs...	
Module Character	4 hours literature + 4 hours practical The module deals with main concepts and theories related to different parts of engineering geology	
Prerequisite of attendance	Basic Knowledge the engineering geology are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the engineering geology of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	Raju N. Krishna 2007. Reinforced Concrete Design: Principles And Practice, New Age International	

Module Number	Module Name	Professor in Charge
BWE15/	**Hydraulics**	
Contents and Qualification aims	This course includes Statics and dynamics of fluids, principles of continuity, momentum and energy, pipe flow Liquids: the physical characteristics. The Study of Liquids Balance. Concepts of Fluid Movement. Mobilization of Idealistic Fluid (non viscid). losses in the regular liquids flow. Fluid Flow through openings.	
Module Character	2 hours literature + 2 hours practical + 2 hours at the Hydraulics lab The module deals with main concepts and theories related to different parts of fluid mechanics	
Prerequisite of attendance	Basic Knowledge the fluid mechanics are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the fluid mechanics of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	P.N. Modi and S.N. Seth, “Hydraulics and Fluid Mechanics”, Standard Book House, Delhi, India. S. Ramamnitham, “Hydraulics and Fluid Mechanics”, Dhanpat Rai & Sons, Delhi, India. Shames, “Mechanics of fluids”, Mc Eraw-Hill, Auckland, N. Land. V.L. Streeter, “Fluid Mechanics”, Mc Graw-Hill, N.Y.,USA. R.J. Garde, “Fluid Mechanics” RPH, Roorkee, India	

Module Number	Module Name	Professor in Charge
BWE15/2	**Hydraulics**	
Contents and Qualification aims	This course includes the fundamentals of flow, control, disposal of water, and flow through open and closed conduits, orifices, and weirs Hydraulic Equations for the Kinetic Energy / Bernoulli / in the case of steady flow & uniform flow for real liquids. The losses of push by friction in the case of steady flow . Arithmetic model for disturbed flow. Energy Longitudinal losses in the case of disturbed flow . Energy Local losses in the case of disturbed & steady flow in pressed tubes. Steady & Uniform & Distrubed Flow in Compressed cylinder Tubes. Liquid flow through openings & Weirs. Steady flow through the streams & open channels.	
Module Character	2 hours literature + 2 hours practical + 2 hours at the Hydraulics lab The module deals with main concepts and theories related to different parts of hydraulics	
Prerequisite of attendance	Basic Knowledge the hydraulics are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the hydraulics of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	Fundamentals of Hydraulic Engineering Systems, 4th Edition. By R.J. Houghtalen, A. Osman Akan, and Ned H.C. Hwang, (2010). Prentice Hall, Boston. Practical Hydraulics, A.L. Simon (1976). John Wiley & Sons, New York. Open Channel Flow, by F.M. Henderson, (1966). MacMillan, New York. Open-Channel Flow, by Subhash C. Jain, (2001), John Wiley & Sons, New York.	

Module Number	**Module Name**	**Professor in Charge**
BWE16	**Hydrobiology**	
Contents and Qualification aims	This course includes Biological, physical and chemical feature of fresh water. Biological, physical and chemical feature of lakes, rivers and inland waters Classification of lakes (Eutrophic, Mesotrophic and. Oligotrophic). Plant diversity: Phytoplankton and Phytobenthon. Inter relationships of algae. Fungi and bacteria in environment. Primary productivity - factor affecting productivity, trophic levels, saprobian index. Eutrophication and pollution - their causes and consequences. Indicator algae. Oxidation ponds, sewage disposal and management.	
Module Character	2 hours literature + 2 hours at the lab The module deals with main concepts and theories related to different parts of hydrobiology	
Prerequisite of attendance	Basic Knowledge the hydrobiology are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the hudrobiology of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	• Schwoerbl 2013. Methods of Hydrobiology: (Freshwater Biology), Elsevier	

Module Number	**Module Name**	**Professor in Charge**
BWE17	**Structure Mechanics**	
Contents and Qualification aims	This course is a detailed introduction to the classical methods of analysis of structure Kinetic Buildings Analysis. Energy Methods. Forces Method. Deformation Method. Derived methods from Forces Method. The three moments Method	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of structure mechanics	
Prerequisite of attendance	Basic Knowledge the structure mechanics are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the structure mechanics of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	Keith D. Hjelmstad 2005. Fundamentals of Structural Mechanics, Springer	

Module Number	Module Name	Professor in Charge
BWE18	**Hydrology & Hydrometry**	
Contents and Qualification aims	This course includes Fundamental concepts of hydrology in engineering; quantitative estimation of stream-flow magnitude and frequency and Hydrometrical data analysis.. Hydrology & the Hydrological Cycle. Climatic Factors and climate change. Water measurements. Hydrological Phenomenon's Probabilities. The Catchment area. Surface Runoff. Studying The Sedimentary in water streams Ground Water. Introduction in hydrometry, including aims, objectives and examples. Flow measurement methods. Precipitation measurements, including rain gauges and radar methods. Emerging new technologies in hydrometry, such as remote sensing and sensor networks. Hydrometrical data analysis.	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of hydrology and hydrometry	
Prerequisite of attendance	Basic Knowledge thehydrology and hydrometry are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the hydrology ans hydrometry of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	Herschy, R.W. Streamflow Measurement, 2nd edition, E and FN Spon, 1995. Shaw, E., Beven, K.J., Chappell, N.A. Lamb, R., Hydrology in Practice, Fourth Edition. CRC Press. 2010. Herschy, R.W. Hydrometry: principles and practice, 2nd edition, Chichester, 1999.	

Module Number	Module Name	Professor in Charge
BWE19	**Sanitation and Waste Water Treatment**	
Contents and Qualification aims	Selection and use of wastewater and sludge treatment processes, disposal methods, sustainable wastewater treatment including anaerobic treatment of wastewater reuse Rationale of applying natural systems for wastewater management. Role of anaerobic pre-treatment in sanitation strategies. Anaerobic reactor technology. Nutrient cycles. Waste stabilization ponds. sludge treatment processes Wastewater reuse and discharge.	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of sanitation and waste water treatmet y	
Prerequisite of attendance	Basic Knowledge thesanitation and waste water treatment are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the sanitation and waste water treatment of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	Andreas N. Angelakis‹Joan B. 2014. Evolution of Sanitation and Wastewater Technologies through the Centuries, Pergamon Press	

Module Number	**Module Name**	**Professor in Charge**
BWE20	**Water Supply System**	
Contents and Qualification aims	This course includes different aspects and components of water supply systems. Water Supply Systems: Structure and legislation Management of Demand and Water Loss Surface Water Collection: Estimation of yield reservoir storage, probability of design failure. Water resources reservoirs. Pumps and Pumping Stations Water Distribution Networks and Service Storage Distribution Network Design: Principles, modeling, analysis Modeling and Operational Control: Hydraulic and water quality Informatics Support to Water Distribution Systems.	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of water supply systems	
Prerequisite of attendance	Basic Knowledge the engineering geology are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the ater supply systems of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	Twort A.C., Ratnayaka D.D. & Brandt M.J., 2000 . Water Supply, 5th Edition, Edward Arnold Ltd/IWA Publishing,. Savic D. & Banyard J.K., (Eds), 2011. Water Distribution Systems, ICE Publishing,. De Moel P.J., Verberk J.Q.J.C. & van Dijk, J.C. 2006. Drinking water: principles and practices, , World Scientific Publishing Co. Pte. Ltd,. - Babbitt, Donald & Cleasby, Water Supply Engineering, 6th Edition, McGraw-Hill.	

Module Number	**Module Name**	**Professor in Charge**
BWE21	**Water Resources Management**	
Contents and Qualification aims	This course aims to introduce the basic of integrated water management.. Demand water management Scop of integration in WRM Strategies and concepts of integrated water resources management The socio-economical and political framework Introduction to water governance frameworks at local, national and regional (transboudary watershed) scales	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of water resources management	
Prerequisite of attendance	Basic Knowledge the water resources management are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the water ressources of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	GWP, 2000, Integrated Water Resources Management, TAC background paper No.4, GWP Stockholm UNESCO 2009 IWRM guidelines at River Basin Level	

Module Number	Module Name	Professor in Charge
BWE22	**Irrigation & Drainage**	
Contents and Qualification aims	This course includes the definition of Chemistry for engineers and its applications. Water for Irrigation: Sources of water, utilization in various sectors, irrigation potential. Irrigation System and Control.. Irrigation Requirement: Measurement & estimation of evapotranspiration, irrigation scheduling, effective rainfall, irrigation requirement, and irrigation efficiency. Irrigation Methods: Surface, sub-surface, sprinkler irrigation and micro irrigation, furrow and flood basin irrigation sprinkler system,, design and operation of sprinkler systems, micro irrigation: components, design and evaluation design and operation micro irrigation system, filtration and flushing, fertigation; automation of irrigation system. Drainage of Agricultural Lands: , drainage investigation and scope for improvement, drainage coefficient and its determination. Surface Drainage System: Types and design Subsurface Drainage System: Types, steady and unsteady state flow through subsurface drains, installation and design of subsurface drains, filter design for tiles drains, integrated planning for irrigation and drainage in command areas. - Salinity control	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of irrigation and drainage	
Prerequisite of attendance	Basic Knowledge the irrigation and drainage are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the irrigation and drainage of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	• World Bank Publications, 1998 . Planning the Management, Operation, and Maintenance of Irrigation and drainage systems . A Guide for the Preparation of Strategies and Manuals,	

Module Number	Module Name	Professor in Charge
BWE23	**Hydrogeology**	
Contents and Qualification aims	This course is designed to provide students the opportunity to learn, practice, and retain the concepts and tools necessary for practicing hydrogeology Hydrogeologic cycle, water budgets. Aquifer properties. monitoring well installation Groundwater flow. Flow of groundwater to wells. Aquifer tests . Regional groundwater flow, case studies. Groundwater-surface water interactions, case studies. Geochemistry of groundwater. Groundwater pollution (e.g., nitrate, heavy metals, organics). Contaminant transport, case studies. Geochemical tracers, stable isotopes, case studies.	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of hydrogeology	
Prerequisite of attendance	Basic Knowledge the hydrologeology are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the hudrologeology of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	Fetter, C. W., Applied Hydrogeology, Merril Publishing Co., Columbus, OH, 592 pp., 4nd ed., 2001.	

Module Number	**Module Name**	**Professor in Charge**
BWE24	**Water Storage**	
Contents and Qualification aims	At the end of this course the student is expected to have the necessary knowledge in the field of water storage Available water resources: Water issues – Groundwater - Surface water - Other resources. Collection, movement and storage of the water. Water capture. Supply pipes. Water storage systems. Drinking water reservoirs.	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of water storage	
Prerequisite of attendance	Basic Knowledge the water storage are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the water storage of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	Gerald John Stadler. Analysis of a water storage reservoir system University of Wisconsin--Madison	

Module Number	**Module Name**	**Professor in Charge**
BWE25	**Climate change**	
Contents and Qualification aims	At the end of the course the student is expected to have the necessary knowledge in the water storage	
Module Character	2 hours literature + 2 hours practical + 2 hours at the Hydraulics lab The module deals with main concepts and theories related to different parts of climate change	
Prerequisite of attendance	Basic Knowledge the climate change are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the climate change of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	Climate Change: The Science of Global Warming and Our Energy Future by Edmond Mathez, Hardcover: 344 pages, Publisher: Columbia University Press (1stedition, 2009), ISBN: 0231146426. Climate Change: Picturing the Science by Gavin Schmidt, Joshua Wolfe, and Jeffrey D. Sachs, Hardcover: 320 pages, Publisher: W. W. Norton & Company (1st edition, 2009), ISBN: 0393331253.	

Module Number	Module Name	Professor in Charge
BWE26	**Soil and Water Pollution**	
Contents and Qualification aims	The course will illustrate the pollution transport through soils and its behavior and impacts Introduction to environmental pollution. Pollution impact and prevention. Types of water pollutants. Eutrophication and toxic substances. Potential Consequences, Risks, and Uncertainties of Climate Change. ground water pollution. Soil pollution: The nature of soils & sediments - High priority contaminants. Soil and sediment pollutants: sources and distribution - types and extent of substance uptake in soils and sediment. Behavior and effects of soil contamination..	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of soil and water pollutioncn	
Prerequisite of attendance	Basic Knowledge the soil and water pollution are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the soil and water pollution of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	Buell P, Girard J. Chemistry fundamentals, an environmental perspective, 2nd ed. Sudbury, Massachusetts: Jones & Bartlett Publishers; 2003. Hill MK. Understanding environmental pollution. Cambridge, United Kingdom: Cambridge University Press; 1999. Manahan SE. Environmental chemistry, 7th ed. Boca Raton, FL: Lewis Publishers; 2000.	

Module Number	Module Name	Professor in Charge
BWE27	**Watershed Management & Monitoring**	**NN**
Contents and Qualification aims	By the end of the module, students should have a sound knowledge base Principles and Basic Concepts of Watershed Management Introduction to Watershed Management: What is a watershed? - History of watershed management. Watershed hydrology (surface runoff/quality/flooding, etc.) Watershed Monitoring. Watersheddevelopment..	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of water management and momnitoring	
Prerequisite of attendance	Basic Knowledge the water management and monitoring are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the water management and monitoring of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	Sharda V.N., Sikka A.K. and Juyal G.P. (2006) Participatory Integrated Watershed Management: A Field Manual, Central Soil and Water Conservation Research and Training Institute, 218, Kaulagarh Road, Dehradun – 248195.	

Module Number	Module Name	Professor in Charge
BWE28	**Microbiology**	**NN**
Contents and Qualification aims	Theory and application of fundamental principles of microbiology, ecology, and aquatic biology Basics of Microbiology. Identify critical cellular components and functionalities that enable microbes to survive and thrive in various environments. Microbial Growth & Metabolism. Metabolic Diversity.	
Module Character	2 hours literature + 2 hours practical at the Lab The module deals with main concepts and theories related to different parts of microbioogy	
Prerequisite of attendance	Basic Knowledge the microbiology are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the microbiology of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	MT Madigan, JM Martinko, and J Parker. (2006) Brock Biology of Microorganisms (8th Edition). Prentice Hall, Inc: Upper Saddle River, NJ. RM Maier, IL Pepper, and CP Gerba. (2009) Environmental Microbiology (2nd edition). Academic Press: New York.	

Module Number	Module Name	Professor in Charge
BWE29	**Law and Legislation**	**NN**
Contents and Qualification aims	The module introduces the laws and legislation of water using and environment in Syria, Arab lands and in the world. The students will be developed during some tests and seminars and representation.	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of law and legislation	
Prerequisite of attendance	Basic Knowledge the law and kegislation are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agri-culture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the law and legislation of the master course of water resources manage-ment. The module is suitable for the professional and research orien-ted studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal referen-ces		

Module Number	Module Name	Professor in Charge
BWE30	**Engineering Economy**	**NN**
Contents and Qualification aims	This course introduce students to the economic analysis of enginee-ring projects Introduction to engineering Economy. Estimating techniques and cost concepts. Time-cost relationships. Comparing alternative. Depreciation calculating methods. Evaluating Project based on B/C ratio.	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of engineering econo-my	
Prerequisite of attendance	Basic Knowledge the engineering economy are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agri-culture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the engineering economy s of the master course of water resources ma-nagement. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal referen-ces	Engineering Economic Analysis, Eighth Edition, Donald G. Newnan, Jerome P. Lavelle, Ted G. Eschenbach. White, J., Case, K., Pratt, D., Agee, M. “Principles of Engineering Economic Analysis”, 4th edition, John Wiley, 1998.	

Module Number	Module Name	Professor in Charge
BWE31	**Water Project Management**	*NN*
Contents and Qualification aims	This course will introduce the students to the basic of project management with special focus on water projects. Basics of Project Identification, Project Appraisal, Project Planning And Scheduling, Project Implementation, Project Evaluation And Post Audit Watershed Project Management	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of water project mnagements	
Prerequisite of attendance	Basic Knowledge the water project management are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the water project management of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	• K. Nagarajan 2004. Project Management, New Age International • Thomas E. Davenport 2002. The Watershed Project Management Guide, CRC Press	

Module Number	Module Name	Professor in Charge
BWE32	**Languages**	**NN**
Contents and Qualification aims	This module is designed to provide the students with a foreign language skills (English – French – German)	
Module Character	4 hours literature	
Prerequisite of attendance	Basic Knowledge the languages are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the languages of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	•	

Module Number	Module Name	Professor in Charge
BWE33	**Practical Training/ Project Study**	**NN**
Contents and Qualification aims	Practical training can provide valuable work experience by sharpening and adding to the skills learned in university. The Student must carry out practical training about one Problem belongs to subjects of Water engineering and management in one or more institution or incorporation, and he must present full stu-dy/report about this problem.	
Module Character	Practical Training/ Project Study: 12 Hours tutorial per week The module deals with main concepts and theories related to different parts of fluid mechanics	
Prerequisite of attendance	Basic Knowledge of Practical Training/ Project Study, the student must be in the 5 th Semester.	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the practical training of the master course of water resources manage-ment. The module is suitable for the professional and research orien-ted studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module seminar and presentation in front of a scientific commission.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module takes one term starting in Semester 5.	
Worked load	The work load is 150 hours.	
Proposal referen-ces	•	

Module Number	Module Name	Professor in Charge
BWE34	**Bachelor Thesis with Defense**	*NN*
Contents and Qualification aims	The Student must work Bachelor Thesis in some subjects of Water engineering and Environment in the semester, the thesis should show that: a. The subject matter is clearly defined. b. There is a clearly formulated main question. c. The main question is based on relevant academic concepts and theories. These concepts and theories are explained in a theoretical framework. **d.** The main question leads to relevant hypotheses.	
Module Character	Bachelor Thesis with Defense	
Prerequisite of attendance	the student must be in 6 Semester.	
Applicability		
Prerequisite to active credit points	Having passed the module presentation in front of a scientific commission.	
Accredit points and grades	The module earns 15 Cr. The final Grade is generated with 100% as presentation in front of committee.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours The module takes one term starting in Semester 6.	
Proposal references		

MODULE COMPENDIUM

Water Engineering (WE)
Master Programme

Al Baath University Homs

Faculty of Civil Engineering

2015

EDUWAT: 511251-TEMPUS-1-2010-1-DE-TEMPUS-SMHES
Development of a Modern Higher Education System for Water Engineering in Syria

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Goals of the program

Master course of Water Engineering

The academic plan in the **Master course of Water Engineering program**, aims at providing the students the following items:

86. High level information in science and computer techniques, and developing the skills in engineering sciences and its applications.
87. Developing the ability of the students to achieve various water engineering and environmental studies, check and use it according to the engineering codes.
88. Comparing between the engineering solutions, and choose the optimum ones.
89. Developing the work skills and regulate the relationship between the work team which the best and have many specialists.
90. Strengthening the research ability and developing and working with the modest software's, equipment's… etc.
91. Developing the item of the scientific, social and cultural of the student's characters.
92. Continuous developing to get the high quality of the research, teaching…...etc.

Modules of Master Course of Water Engineering MWE

	Credits	%
Modules in Advanced Applied Mathematics	10	8%
Modules in Engineering	15	13%
Modules in Hydro Sciences	25	21%
Modules with Specialization	10	17%
Elective Modules	10	
Modules for general Qualification	10	8%
Practical Training /Project	10	8%
Master Thesis plus Defense	30	25%
Total	**120**	**100%**

Module **Semester**	**1**	**2**	**3**	**4**	**Total / ECTS**
Advanced Applied Mathematics	10				**10**
Engineering	5		10		**15**
Hydro Sciences	10		15		**25**
Specialization		10			**10**
Elective Modules		10			**10**
General Qualification	5		5		**10**
Practical Training/ Project Study		10			**10**
Master Thesis plus Defense				30	**30**
Total	**30**	**30**	**30**	**30**	**120**

	Modules in Natural Sciences 10% - 25%		Modules inTechnical Sciences 10 - 25%		Modules in Economic & Social Sciences 5% - 15%		Modules in Variable Sciences 55% - 70%

Module nr.	Course Semester	1	2	3	4	Total/ECTS
	Advanced Applied Mathematics	**10**	**0**	**0**	**0**	**10**
MWE01	Advanced Mathematics	5				**5**
MWE02	System analysis	5				**5**
	Engineering	**5**	**0**	**10**	**0**	**15**
MWE03	Advanced hydromechanics	5				**5**
MWE04	Dam construction			5		**5**
MWE05	Hydrometry			5		**5**
	Hydro Sciences	**10**	**0**	**15**	**0**	**25**
MWE06	Aquatic ecology	5				**5**
MWE07	Water quality	5				**5**
MWE08	IWRM			5		**5**
MWE09	GW modelling			5		**5**
MWE10	SW modelling			5		**5**
	Specialization modules	**0**	**10**	**0**	**0**	**10**
MWE11	Waste water treatment		5			**5**
MWE12	Advanced Irrigation and Drainage Engineering		5			**5**
	Elective modules		10			**10**
MWE13	Flood and drought protection		5			**5**
MWE14	Integrated water resources mana-gement		5			**5**
MWE15	Sewage Network Modelling		5			**5**
MWE16	Drinking water treatment		5			**5**
MWE17	Water supply system modelling		5			**5**
	General Qualification	**5**	**0**	**5**	**0**	**10**
MWE18	Project planning and controlling	5				**5**
MWE19	Water and energy			3		**3**
MWE20	Research Methodology & Scientific writing			2		**2**
MWE21	**Practical Training/Project study**		10			**10**
MWE22	**Master Thesis plus Defense**				30	**30**
	Total	**30**	**30**	**30**	**30**	**120**

Definition of modules

MWE01	**Advanced Mathematics**	*NN*
Contents and Qualification aims	This course will presents Applied Statistics and analysis of time series **Part A** • Data: display and interpretation - Univariate measures of location, scale, asymmety and shape; robust measures. Graphical summaries such as scatter plots, histograms, stem-and-leaf displays and box plots . • Probability - Main rules of probability. Conditional probability. Bayes' theorem. • Random variables - Distribution and density functions for common discrete and continuous distributions. Corresponding means and variances. • Estimation methods - Based around river flow data. The method of moments and maximum likelihood. Meaning and construction of confidence intervals. • Hypothesis testing - On extremes and means. • Regression - Least-squares and mean sea level data. Robust iterative least squares method . • Extreme events - Return Periods. The generalized extreme value distribution. Gumbel distribution.introduction to time series - Sample autocorrelations. Stochastic processes. Stationarity. • Multiple time series - Cross-correlations. Examples based on pollutant and alkalinity data. Filtering.	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of advanced mathematics	
Prerequisite of attendance	Basic Knowledge the advanced mathematics are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the advanced mathematics of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	Robert H. Shumway 1988. Applied statistical time series analysis, Prentice-Hall. Erwin Kreyszig 2010. Advanced Engineering Mathematics, John Wiley & Sons**,**	

MWE02	**System Analysis**	*egree: PhD* *Specialty*

Contents and Qualification aims	This course will explores recent and important contributions of System Analysis and Control Theory to the technical application of IWRM • A participatory and integrated planning procedure for decision making in water resource systems • The data-based mechanistic approach in hydrological modelling • Bayesian networks as a participatory modelling tool for groundwater protection • Exploring water conservation behaviour through participatory agent-based modelling • Decision support systems for integrated water resources management with an application to the Syrian basins • Water reservoirs management under uncertainty by approximating networks and learning from data • Optimising irrigation management at the plot scale to participate at the regional scale water resource management • Multi-objective optimization of water distribution system design under uncertain demand and pipe roughness
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of system analysis
Prerequisite of attendance	Basic Knowledge the system analysis are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences
Applicability	The module is one of 3 mandatory compulsory of the Basics in the system analysis of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.
Frequency of the module	The module is offered annually.
Worked load	The work load is 150 hours.
Proposal references	Andrea Castelletti and Rodolfo Soncini Sessa 2013.Topics in System analysis and IWRM. Elsevier David W. Watkins, Jr 2013. Water Resources Systems Analysis through Case Studies Data and Models for Decision Making

Module Number	Module Name	Professor in Charge
MWE03	**Advanced Hydromechanics**	

Contents and Qualification aims	The course illustrate the Theory and Fundamentals of Hydromechanics and its applications
Module Character	• 2 hours literature + 2 hours practical • Fundamental Equations • Ideal Fluid Flows - Irrotational Flows • Two-Dimensional Flows (1) Basic equations and flow analogies • Two-Dimensional Flows (2) Basic flow patterns • Complex potential, velocity potential & Joukowski transformation • Joukowski transformation, theorem of Kutta-Joukowski & lift force on airfoil • Theorem of Schwarz-Christoffel, free streamlines & applications • Real fluid flows: introduction • Turbulence: an introduction • Boundary layer theory. Application to laminar boundary layers Turbulent boundary layers
Prerequisite of attendance	Basic Knowledge of Advanced hydromechanics are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences .
Applicability	The module is one of 3 mandatory compulsory of the advanced hydromechanics of the bachelor of water and soil Engineering. the module is suitable for the professional and research oriented studies in soil and environmental engineering.
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.
Frequency of the module	The module is offered annually.
Worked load	The work load is 150 hours.
Duration of the module	The module takes one term starting in Semester 1.
Proposal references	• Emmanuil G. Sinaiski 2011. Hydromechanics: Theory and Fundamentals, John Wiley & Sons

MWE04	**Dam Construction**	*egree: PhD Specialty*
Contents and Qualification aims	This course explains components and site requirements for the design and construction of earth and rock fill dams • Purpose and types of dams; • design criteria; • construction sequence; • compaction; seepage; filter design; factors • influencing the design of earth dams; • stability and deformation under static and earthquake loading; slope protection; • field instrumentation • Spillway and outlet capacity; Freeboard	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of dam construction	
Prerequisite of attendance	Basic Knowledge the dam construction are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the dam construction of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	Robert B. Jansen 198. Advanced Dam Engineering for Design, Construction, and Rehabilitation, Springer	

MWE05	**Advanced Hydrometry**	***Specialty***
Contents and Qualification aims	This course is concerned with the measurements of all the variables in the hydrological (water) cycle and hydrological information. New and emerging methods for hydrological measurements are also introduced The measurement of flow. Dealing with both traditional techniques and innovative new methods and instruments, Measurement of water levels and bed levels, of discharge, and of sediment transport; The use of flow measuring structures, hydrological networks, and the organization of surveys	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of advanced hydrometry	
Prerequisite of attendance	Basic Knowledge theadvanced hydrometry are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the advanced hydrometry of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	Reginald W. Herschy 2009. Hydrometry: Principles and Practice, Wiley	

MWE06	**Aquatic Ecology**	*Degree: PhD Specialty*
Contents and Qualification aims	This course focuses on physical, chemical, and biological processes occurring in lakes, streams, and wetlands. Students will learn about the physical and chemical aspects of aquatic systems and the life cycles and adaptations of aquatic organisms • Properties of Water, Hydrologic Cycle • Watersheds, Stream Flow & Physical Structure • Chemistry of Streams • Biological Communities of Streams • Large Rivers • Lake Origins & Morphometry • Light and Physical Structure of Lakes • Chemistry of Lakes • Biological Communities of Lakes: Plankton • Biological Communities of Lakes: Littoral, Benthos & Fish • Wetlands: Origins, Hydrology, and Physical Structure • Chemistry of Wetlands • Biological Communities of Wetlands: Primary Producers • Biological Communities of Wetlands: Consumers Management of Aquatic Systems	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of aquatic ecology	
Prerequisite of attendance	Basic Knowledge the aquatic ecology are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the aquatic ecology of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	S. R. Mishra, Devendra Nath Saksena 1992. Aquatic Ecology, Ashish Publishing House,	

MWE07	**Water Quality**	
Contents and Qualification aims	Water sources and use. Introduction to environmental fate. Water quality management. Characteristics of water: water analysis, physical parameters, chemical and bacteriological parameters. Simple mathematical models for physical systems: introduction to treatment systems, reaction kinetics, reactors, conservation of mass, and transport in the natural environment. Biodegradable waste disposal in streams, sedimentation and biological treatment theory, and design principles	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of water quality	
Prerequisite of attendance	Basic Knowledge the water quality are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	

Applicability	The module is one of 3 mandatory compulsory of the Basics in the water quality of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.
Frequency of the module	The module is offered annually.
Worked load	The work load is 150 hours.
Proposal references	Claude E. Boyd 2000. Water Quality: An Introduction, Springer Science & Business Media,

MWE08	Managed Aquifer Recharge	
Contents and Qualification aims	Introduction to Managed Aquifer Recharge Drivers and Constraints Economics of Managed Aquifer Recharge in Relation to Alternatives How to Establish a MAR Project MAR Considerations for Regulators Planning for Emerging MAR OpportunitiesThe fundamentals of managing recharge projects in aquifers.	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of managed aquifer research	
Prerequisite of attendance	Basic Knowledge the managed aquifer research are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the managed aquifer research of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	• Peter Dillon, Paul Pavelic, Declan Page, Helen Beringen and John Ward 2009. Managed aquifer recharge,National Water Commission	

MWE09	Groundwater Modelling	*egree: PhD Specialty*
Contents and Qualification aims	This course aims to provide students with principles and procedures of groundwater modelling and the use of computer models for groundwater resources management and protection. Purpose of groundwater modelling Building Conceptual model Design of numerical model; Methods of solving Model inputs Model calibration and validation Model prediction and simulation of scenarios Introduction to MODFLOW Exercises and case study	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of groundwater modelling	
Prerequisite of attendance	Basic Knowledge the groundwater modelling are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the groundwater modeling of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	• Jacob Bear, Arnold Verruijt 1987. Modeling Groundwater Flow and Pollution, Springer Science • Mary P. Anderson, William W. Woessner 1992. Applied Groundwater Modeling: Simulation of Flow and Advective Transport, Academic Press	

MWE10	**Surface water Modelling**	***gree: PhD Specialty***
Contents and Qualification aims	The course aims to outline the principles of surface water modelling and to introduce a variety of different mathematical modelling approaches and the software introduction to hydrodynamic modelling (including numerical schemes, dimensionality, boundary conditions and the construction of computational meshes and grids). Hydrological modelling with particular reference to catchments and their sensitivity to climate change, introduction to different modelling systems. model validation and the statistical evaluation of model performance.	
Module Character	2 hours literature + 2 hours at the lab The module deals with main concepts and theories related to different parts of surface water modelling	
Prerequisite of attendance	Basic Knowledge the surface water modelling are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the surface water modelling of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	Wenrui Huang 2007 . surface water modelling , Coastal Education & Research Foundation (U.S.)	

MWE11	**Waste Water Treatment**	
Contents and Qualification aims	This course provides a survey of engineering approaches to treatment of water with an emphasis on fundamental principles and models. Theory and conceptual design of systems for treating municipal drinking water and wastewater are discussed. Physical, and chemical processes are presented, including sedimentation, filtration, disinfection, coagulation, and biological treatment Wastewater Mathematics Activated Sludge Process Natural Treatment Systems Sedimentation and filtration biological treatment Disinfection Solids Handling	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of waste water treatment	
Prerequisite of attendance	Basic Knowledge the waste water treatment are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the waste water treatment of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	Petr Hlavinek, Igor Winkler, Jiri Marsalek, Ivana Mahrikova 2011. Advanced Water Supply and Wastewater Treatment: A Road to Safer Society and Environment, Springer Science & Business Media	

MWE12	**Advanced Irrigation and Drainage Enginee-ring**	
Contents and Qualification aims	Introduction Irrigation & Drainage Development Plant-Water-Soil-Atmosphere rela-tions Irrigation System DesignDrainage System Design Water table contro Soil salinity control Irrigation performance indicators	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of irrigation and drai-nage	
Prerequisite of attendance	Basic Knowledge the irrigation and drainage are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agri-culture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the irrigation and drainage of the master course of water resources mana-gement. The module is suitable for the professional and research ori-ented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal referen-ces	Hector M. Malano, Paul van Hofwegen 1999. Management of Irrigati-on and Drainage Systems, CRC Press William R. Johnston, James B. Robertson, Albert J. Clemmens1991. Management, Operation, and Maintenance of Irrigation and Drainage Systems, American Society of Civil Engineers, •	

MWE13	
MWE14	Integrated water resources management
MWE15	Sewage Network Modelling
MWE16	Drinking water treatment
MWE17	Water supply system modelling
MWE18	Sewage system modelling

MWE13	**Flood and Drought Protection**	*egree: PhD Specialty*
Contents and Qualification aims	Floods and droughts continue to present dynamic challenges world-wide. Due to climate and landscape change, there is an increasing need to emphasize prevention, preparedness, mitigation and risk management to address these events and protect our safety, quality of life, economy and environment. – Introduction to flood management Beneficial use of floods Flood Risk Analysis Flood Warning and Drought Monitoring prevention, preparedness, mitigation Emergency Response risk management	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of flood and draought mnagements	
Prerequisite of attendance	Basic Knowledge the flood and drought management are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the flood and drought management of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	Siegfried Demuth 2006. Climate Variability and Change--hydrological Impacts, IAHS	

MWE14	**Integrated Water Resources Management**	***NN***
Contents and Qualification aims	Improve water resources management through the implementation of applicable and effective integrated management tools and techniques Factors that affect the use of water resources (demand, availability, quality, quantity) Water pollution and impact on water quality and health Climate change and water resources Management of the Water Resources (Water catchment management, water conservation, strategic planning of water resources at national, regional and local levels to meet user demand, environmental protection and sustainable management needs) Policies, goals , strategies and Institutional Arrangement for IWRM The management of water abstraction The threats to the quality of water resources, the identification of risk and the measures taken to protect them	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of integrated water resources mnagements	
Prerequisite of attendance	Basic Knowledge the integrated water resources management are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the integrated water resources management of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	• UNESCO, 2009 . Integrated Water Resources Management in Action • Global Water Partnership (GWP) 2009 . an A HANDBOOK FOR INTEGRATED WATER RESOURCES MANAGEMENT IN BASINS	

MWE15	**Sewage Network Modelling**	
Contents and Qualification aims	This course will help students to determine: which model is most appropriate for the particular circumstances, what data to put into the model; and pitfalls to watch out for. Generic Modelling Process Initial Planning Static Data Acquisition Time Varying Data Acquisition Model Build, Test And Check Model Validation Model Application Solution Modelling Audit and Review Programme	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of sewage network modelling	
Prerequisite of attendance	Basic Knowledge the sewage network modeling are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the sewage network modeling of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	William James 1996. Advances in Modeling the Management of Stormwater Impacts, CRC Press,	

MWE16	**Drinking Water Treatment**	
Contents and Qualification aims	The course presents the theory of major drinking water treatment processes Water Quality Standards Types of Treatment Monitoring Water Quality Source Water Protection Distribution to Customers	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of drinking water treatment	
Prerequisite of attendance	Basic Knowledge the drinking water treatment are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the drinking water treatment of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	H. Masschelein 1992. Unit Processes in Drinking Water Treatment, CRC Press	

MWE17	**Water Supply system Modelling**	
Contents and Qualification aims	INTRODUCTION . WATER REQUIREMENTS . CAPACITY OF WATER SUPPLY SYSTEM WATER SUPPLY SOURCES GROUND WATER SUPPLIED SURFACE WATER SUPPLIES INTAKES RAW WATER PUMPING FACILITIES WATER SYSTEM DESIGN Modeling WATER SYSTEM DESIGN PROCEDURE	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of water supply system modelling	
Prerequisite of attendance	Basic Knowledge the water supply system modeling are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the water supply system modeling of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	Committee on Public Water Supply Distribution Systems: Assessing and Reducing Risks, Water Science and Technology Board, Division on Earth and Life Studies, National Research Council 2006. Drinking Water Distribution Systems: Assessing and Reducing Risks, National Academies Press	

MWE18	**Project Planning and Controlling**	
Contents and Qualification aims	This course covers the process of planning, scheduling, and understanding control measures and systems to effectively manage a project Planning fundamentals Scope management and planning methodologies Project estimation and budgeting Time scheduling and phasing Resource allocation, aggregation and levelling Planning software Project monitoring and controlling Project termination Project evaluation and reporting	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of irrigation and drainage	
Prerequisite of attendance	Basic Knowledge the irrigation and drainage are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the irrigation and drainage of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	David G. Carmichael 2006. Project Planning, and Control**,** Routledge,	

MWE19	**Water and Energy**	
Contents and Qualification aims	This course explain how Water and energy are closely interlinked and interdependent. Energy generation and transmission requires utilization of water resources, particularly for hydroelectric, nuclear, and thermal energy sources. UN and the Water-Energy Nexus; Water and Energy Scenarios and Challenges (Syrian Case); The Water and Energy Nexus: Opportunities and Choices; Making the Case for Partnerships; Building Partnerships–partnerships in practice.	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of water and energy	
Prerequisite of attendance	Basic Knowledge the water and energy are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the water and energy of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 900 hours.	
Proposal references	• Gustaf Olsson 2012. Water and Energy: Threats and Opportunities, IWA Publishing,	

MWE20	**Research Methodology & Scientific Writing**	
Contents and Qualification aims	The aim of the course is to give the students the theoretical and practical skills to plan, conduct, analyze and present a scientific assignment in the area water engineering and to give insight and understanding ofresearch methodology, ethics and sustainability An introduction to research design as a part of the designerly thinking, • Research methods: qualitative, quantitative and mixed measures, • Information searching techniques • Research paper/research proposal preparation and methods to use information: issues of copy-write, citation and reference systems. • Presentation techniques: oral presentation, layout, printing process, Internet, overhead, PowerPoint..	
Module Character	2 hours literature + 2 hours practical The module deals with main concepts and theories related to different parts of research methodology	
Prerequisite of attendance	Basic Knowledge the research methodology are Water Engineering and Irrigation, Soil Engineering, Environmental Engineering, and Agriculture Engineering, Bachelor of Sciences	
Applicability	The module is one of 3 mandatory compulsory of the Basics in the research methodology of the master course of water resources management. The module is suitable for the professional and research oriented studies in civil and environmental engineering.	
Prerequisite to active credit points	Having passed the module exam. The module exam consists of a written examination (120 minutes) and some written tests.	
Accredit points and grades	The module earns 5 Cr. The final Grade is generated with 60% written exam and 40% term paper.	
Frequency of the module	The module is offered annually.	
Worked load	The work load is 150 hours.	
Proposal references	• Wayne Goddard, Stuart Melville 2004. Research Methodology: An Introduction, Juta and Company Ltd,	

Practical Training/ Project Study	
Module Nr.	**MWE21**
Contents and Qualification aims	The purpose is to provide the students with an opportunity to demonstrate their capacity to engage in the practice of water engineering as a profession. Groups of students are encouraged to identify and resolve a problem within the scope of their chosen area of water management utilizing knowledge gained from their academic and employment experiences. A written report and a verbal presentation are requirements.
Module Character	Practical Training/ Project Study: 10 Hours tutorial per week
Prerequisite of attendance	Basic Knowledge of Practical Training/ Project Study, the student must be in the 5 th Semester.
Applicability	the module is suitable for the professional and research oriented studies in civil and environmental engineering
Prerequisite to active credit points	Having passed the module seminar and presentation vor acomission.
Accredit points and grades	The module earns 10 Cr. The final Grade is generated with 100% as presentation in front of committee.
Frequency of the module	The module is offered annually.
Worked load	The work load is 300 hours .
Duration of the module	The module takes one term starting in Semester 2.

Master Thesis with Defense	
Module Nr.	**MWE22**
Contents and Qualifica-tion aims	The Student must work Master Thesis with Defense about one Problem belongs to the subjects of Water engineering and Environment in the semester, he must present full study about this problem.
Module Character	Master Thesis with Defense: 30 Hours tutorial per week .
Prerequisite of attendan-ce	Basic Knowledge Master Thesis with Defense, the student must be in 4 Semester.
Applicability	The module is suitable for the professional and research ori-ented studies in civil and environmental engineering
Prerequisite to active credit points	Having passed the module presentation for a comission.
Accredit points and gra-des	The module earns 30 Cr. The final Grade is generated with 100% as presentation in front of committee.
Frequency of the module	The module is offered in 4 semester
Worked load	The work load 900 hours
Duration of the module	The module takes one term starting in Semester 4.