

Appendix 1
Module descriptions

| module no. | module name | responsible lecturer |
|---|---|-----------------------------|
| BIWO-01 | Building Materials | Prof. Mechtcherine |
| contents and qualifications | <p>The module covers the microstructure and chemical composition of building materials, physical and mechanical properties of construction materials (timber, steel, concrete, masonry), the durability of construction materials, materials for strengthening and repair (polymers, polymer-modified mortars/concretes, fibre-reinforced polymer-based composites, shotcrete), cement-bound high-performance composites for new structures and rehabilitation (self-compacting concrete, fibre-reinforced concrete, textile-reinforced concrete, ultra high-strength concrete), modelling and numerical simulation of freshly poured, concrete-like materials (including the numerical simulation of mixing, carrying, pouring and compacting), theoretical modelling of the deformation and cracking behaviour of cement-based building materials, fracture mechanics of concrete, numerical simulation of the crack development due to thermal and moisture changes. On completion of the module students will be able to assess the microstructure and the properties of construction and repair materials and also apply the methods for their modelling and numerical simulation.</p> | |
| types of teaching and learning | 4 SWS* lecture and 2 SWS tutorial and also self-study | |
| prerequisites for participation | | |
| usability | <p>The module is a required module in the Master's programme Advanced Computational and Civil Engineering Structural Studies – ACCESS. It is a prerequisite for the required elective modules BIWE-01, BIWE-02, BIWE-03, BIWE-08, BIWE-10 and BIWE-11.</p> | |
| requirements for being awarded credits | <p>Students earn credits after having passed the module exam. The module exam consists of a written exam (180 min.).</p> | |
| credits and grades | <p>Students can earn 8 credits through the module. The module grade is equivalent to the grade given for the written exam.</p> | |
| availability of the module | The module is offered in the winter semester. | |
| workload | total workload 240 hours | |
| duration of the module | 1 semester | |

| module no. | module name | responsible lecturer |
|---|---|-----------------------------|
| BIWO-02 | Continuum Mechanics, Tensor Analysis | Dr. Löhnert |
| contents and qualifications | The module focuses on the fundamental concepts of continuum mechanics and the related variational principles. content of the module: Tensor Algebra, Tensor Analysis, Kinematics, Master Equations, Material Theory and Variational Principles. On completion of the module students will have an understanding of the fundamentals of continuum mechanics and also the necessary skills to apply the tensor analysis. | |
| types of teaching and learning | 4 SWS* lecture and 2 SWS tutorial and also self-study | |
| prerequisites for participation | | |
| usability | The module is a required module in Master's programme Advanced Computational and Civil Engineering Structural Studies – ACCESS. It is a prerequisite for the required elective modules BIWE-02, BIWE-08, BIWE-09 and BIWE-14. | |
| requirements for being awarded credits | Students can earn credit points after having passed the module exam. The module exam consists of a written exam (90 minutes) and an ungraded assigned paper with a total of 60 hours. | |
| credits and grades | Students can earn 8 credits through the module. The module grade is equivalent to the grade earned for the written exam if the assigned paper rated 'pass'. Otherwise, the module grade is the weighted average of the grade for the written exam and grade 5 for the assigned paper (§ 10 par. 1 sentence 5 PO); the weighting factors applied to the written exam and the assigned paper are two and one, respectively. | |
| availability of the module | The module is offered in the winter semester. | |
| workload | total workload 240 hours | |
| duration of the module | 1 semester | |

| module no. | module name | responsible lecturer |
|---|--|-----------------------------|
| BIWO-03 | Energy Methods, FEM | Prof. Kaliske |
| contents and qualifications | content of the module: calculus of variations, principle of minimum potential energy, Ritz and Galerkin approximate methods, energy stability criteria and their application, Hamilton's principle, Lagrange equations, application to steady-state/transient vibrations, principle of minimum complementary energy, displacement forms of FEM, general variational principles and hybrid finite elements, geometrically nonlinear FEM, physically nonlinear FEM and numerical simulation of crack formation. On completion of the module students will be able to apply the energy methods, the foundation for the finite element method and also the linear and nonlinear finite element method. | |
| types of teaching and learning | 4 SWS* lecture and 2 SWS tutorial and also self-study | |
| prerequisites for participation | | |
| usability | The module is a required module in Master's programme Advanced Computational and Civil Engineering Structural Studies – ACCESS. It is a prerequisite for the required elective modules BIWE-02, BIWE-03, BIWE-09 and BIWE-13. | |
| requirements for being awarded credits | Students earn credits after having passed the module exam. The module exam consists of a written exam (120 minutes) and an ungraded assigned paper with a total of 40 hours. | |
| credits and grades | Students can earn 8 credits through the module. The module grade is equivalent to the grade earned for the written exam if the assigned paper rated 'pass'. Otherwise, the module grade is the weighted average of the grade for the written exam and grade 5 for the assigned paper (§ 10 par. 1 sentence 5 PO); the weighting factors applied to the written exam and the assigned paper are two and one, respectively. | |
| availability of the module | The module is offered in the winter semester. | |
| workload | total workload 240 hours | |
| duration of the module | 1 semester | |
| module reading list | Chandrupatla, Belegundu: Introduction to Finite Elements in Engineering, Prentice-Hall Zienkiewicz, Taylor: The Finite Element Method, Butterworth-Heinemann | |

| module no. | module name | responsible lecturer |
|---|---|-----------------------------|
| BIWO-04 | Numerical Methods | Prof. Scherer |
| contents and qualifications | content of the module: engineering design and analysis of algorithms for the numerical solution of continuous mathematical problems, direct methods that give the exact solution to a problem in a finite number of steps and for an infinite computer accuracy, iterative methods to compute approximations that converge to the exact solution of a problem, linear algebra and analytical geometry, solutions for linear and nonlinear equations, equation systems, extremum and eigenvalue problems, numerical integration, interpolation, regression and implementation of the algorithms in software solutions. On completion of the module students are able to apply basic and advanced numerical methods to solve engineering and scientific issues of civil engineering. Students will have the necessary programming knowledge to implement the numerical methods. | |
| types of teaching and learning | 2 SWS* lecture and 2 SWS tutorial and also self-study | |
| prerequisites for participation | | |
| usability | The module is a required module in Master's programme Advanced Computational and Civil Engineering Structural Studies – ACCESS. It is a prerequisite for the required elective module BIWE-12. | |
| requirements for being awarded credits | Students can earn credit points after having passed the module exam. The module exam consists of a written exam (90 minutes) and an ungraded assigned paper with a total of 30 hours. | |
| credits and grades | Students can earn 4 credit points through the module. The module grade is equivalent to the grade earned for the written exam if the assigned paper rated 'pass'. Otherwise, the module grade is the weighted average of the grade for the written exam and grade 5 for the assigned paper (§ 10 par. 1 sentence 5 PO); the weighting factors applied to the written exam and the assigned paper are two and one, respectively. | |
| availability of the module | The module is offered in the winter semester. | |
| workload | total workload 120 hours | |
| duration of the module | 1 semester | |

| module no. | module name | responsible lecturer |
|---|---|-----------------------------|
| BIWO-05 | Mentoring Programme on Academic Competence | Prof. Kaliske |
| contents and qualifications | content of the module: programme design, didactics, solving subject-related problems and general academic competence. Students learn how to early identify and overcome barriers to learning and they know the methods to prevent dropping out; moreover, they are able to complete studies within standard period of study and they acquire the competence to use scientific methods. | |
| types of teaching and learning | 2 SWS mentoring and also self-study | |
| prerequisites for participation | | |
| usability | The module is a required module in Master's programme Advanced Computational and Civil Engineering Structural Studies – ACCESS. It is a prerequisite for the required elective modules BIWE-01 to BIWE-14. | |
| requirements for being awarded credits | Students can earn credit points after having passed the module exam. The module exam is an ungraded final report of mentoring sessions. | |
| credits and grades | Students can earn 2 credits through the module. The module is rated as passed or failed. | |
| availability of the module | The module is offered in the winter semester. | |
| workload | total workload 60 hours | |
| duration of the module | 1 semester | |

| module no. | module name | responsible lecturer |
|---|---|-----------------------------|
| BIWO-06 | Mentoring Programme on Methods Competence | Prof. Kaliske |
| contents and qualifications | content of the module: methods competence, general academic skills and skills for solving subject-related problems. Students know how to early identify and overcome barriers to learning; moreover, they are able to complete the subject-related tasks assigned to them within reasonable time and to identify and evaluate own mistakes. Moreover, they acquired interdisciplinary methods competence. | |
| types of teaching and learning | 2 SWS mentoring and also self-study | |
| prerequisites for participation | | |
| usability | The module is a required module in Master's programme Advanced Computational and Civil Engineering Structural Studies – ACCESS. It is a prerequisite for the required modules BIWO-07 and BIWO-08. | |
| requirements for being awarded credits | Students can earn credit points after having passed the module exam. The module exam is an ungraded final report of mentoring sessions. | |
| credits and grades | Students can earn 2 credits through the module. The module is rated as passed or failed. | |
| availability of the module | The module is offered each summer semester. | |
| workload | total workload 60 hours | |
| duration of the module | 1 semester | |

| module no. | module name | responsible lecturer |
|---|--|-----------------------------|
| BIWO-07 | Applications Computer-Oriented Engineering Methods | Prof. Kaliske |
| contents and qualifications | content of the module: current research topics in civil engineering, materials science and computer-assisted mechanics. On completion of the module students will be able employ computer-assisted modelling in structural analysis, in general, or, in particular, in structural strengthening. | |
| types of teaching and learning | 4 SWS lecture and also self-study | |
| prerequisites for participation | The competencies covered in module BIWO-06 are essential for this module. | |
| usability | The module is a required module in Master's programme Advanced Computational and Civil Engineering Structural Studies – ACCESS. | |
| requirements for being awarded credits | Students can earn credit points after having passed the module exam. The module exam consists of a written exam (120 min.). | |
| credits and grades | Students can earn 6 credit points through the module. The module grade is equivalent to the grade given for the written exam. | |
| availability of the module | The module is offered in the winter semester. | |
| workload | total workload 180 hours | |
| duration of the module | 1 semester | |

| module no. | module name | responsible lecturer |
|---|---|-----------------------------|
| BIWO-08 | Application-Oriented Research Project | Prof. Kaliske |
| contents and qualifications | content of the module: definite tasks of civil engineering, materials science and computer-assisted mechanics, in particular tasks that require interdisciplinary solutions. On completion of the module students are able to use their knowledge, abilities and skills independently, individually or in a team to solve practical tasks, to document all portions of their work in a logical and consistent manner and to present their results for discussion. Moreover, they can carry out interdisciplinary work in a team and work out concepts for development, implementation and presentation. | |
| types of teaching and learning | project and seminar (including self-study) with a total of 560 hours; of which not more than 4 SWS are for the seminar | |
| prerequisites for participation | The competencies covered in module BIWO-06 are essential for this module. | |
| usability | The module is a required module in Master's programme Advanced Computational and Civil Engineering Structural Studies – ACCESS. | |
| requirements for being awarded credits | Students can earn credit points after having passed the module exam. The module exam consists of a project of 4 weeks duration. | |
| credits and grades | Students can earn 24 credits through the module. The module grade is equivalent to the grade given for the project. | |
| availability of the module | The module is offered in the winter semester. | |
| workload | total workload 720 hours | |
| duration of the module | 1 semester | |

| module no. | module name | responsible lecturer |
|---|--|-----------------------------|
| BIWE-01 | Structural Analysis of Reinforced Concrete Structures | Prof. Marx |
| contents and qualifications | content of the module: maintenance principles for bridges and buildings, e.g., inspection, testing, examination and condition assessment of existing reinforced concrete structures, load testing and monitoring of steel-reinforced structures, calculation of the load-bearing capacity and reserve strength of existing buildings and bridges using special computation methods, strengthening methods for massive structures and their calculation (shotcrete, steel lamellae, CFRP lamellas, textile-reinforced concrete, external prestressing). On completion of the module students are able to assess the load-bearing capacity of existing structures and to derive and calculate the necessary repair and strengthening measures. | |
| types of teaching and learning | 2 SWS* lecture and 1 SWS tutorial and also self-study | |
| prerequisites for participation | The competencies covered in modules BIWO-01 and BIWO-05 are prerequisite to this module. | |
| usability | The module is one of the required elective modules in the Master's programme Advanced Computational and Civil Engineering Structural Studies – ACCESS of which students must choose seven. | |
| requirements for being awarded credits | Students earn credits after having passed the module exam. The module exam consists of a written exam (90 min.). | |
| credits and grades | Students can earn 4 credit points through the module. The module grade is equivalent to the grade given for the written exam. | |
| availability of the module | The module is offered each summer semester. | |
| workload | total workload 120 hours | |
| duration of the module | 1 semester | |
| module reading list | Eurocode 2: Design of Concrete Structures Fib bulletin 14: Externally bonded FRP-reinforcement for RC structures Fib bulletin 17: Management, maintenance and strengthening of concrete structures | |

| Module number | Module name | Lecturer |
|---|--|--|
| BIWE-02 | Form Finding of Lightweight Structures | Prof. Beckh structural-design@tu-dresden.de |
| Qualification objectives | Students will master selected form finding methods for lightweight structures in theory and in practical application, focusing on shells structures, cable nets and membrane structures. They will become familiar with the theoretical background of these selected techniques and will be able to utilize them in practice. | |
| Content | The module will cover various strategies and form finding methods for lightweight structures subject to membrane forces. The course comprises an introduction to the conceptual design, static calculation and structural design of lightweight structures as well as an introduction to theoretical foundations of different form finding methods. In addition, the exercises will present examples of practical application. | |
| Teaching and learning formats | Lecture 2 hours per week and practical 1 hour per week plus independent study. The lecture and practical will be taught in English. | |
| Prerequisites for participation | Participants must have knowledge of the material taught in the construction materials, continuum mechanics, tensor calculation, energy methods and finite element method (FEM) modules as well as the studies mentoring program and methodological competence. | |
| Usability | This module is an elective compulsory module in the Advanced Computational and Civil Engineering Structural Studies – ACCESS master's degree program, of which seven must be selected. | |
| Requirements for earning credit points | Credit points are awarded upon passing the module examination. The module examination comprises a 90-minute written test. A term project which requires about 60 hours to write and receives a "pass" or "fail" grade serves as the preliminary graded academic work. | |
| Credit points and grades | Students can earn 4 credit points from the module. The module grade corresponds to the grade of the written test. | |
| Frequency of the module | The module is offered each year in the summer semester. | |
| Workload | The workload comprises about 120 hours. | |
| Duration of the module | 1 semester. | |
| Supplementary references | Sigrid Adriaenssens, Philippe Block, Diederik Veenendaal: Shell Structures for Architecture: Form Finding and Optimization. Taylor and Francis. 2014 | |

| module no. | module name | responsible lecturer |
|---|---|-----------------------------|
| BIWE-03 | Timber and Lightweight Structures | Prof. Stroetmann |
| contents and qualifications | <p>content of the module: mechanical and Physical Fundamentals von timber and its derivatives and their consequences for use in construction, situation of resources and transformation processes of the raw wood for timber structures, wood modification, timber joints and structural behaviour, composite structures with concrete, fibres and textiles, selected examples of wooden structures demonstrating the current state of timber construction technology and its specific aspects, historical timber structures, reconstruction and rehabilitation, stability, fatigue and operational strength of steel structures, cable structures – cable types and connectors (concept and detailed design and calculation), structural systems made of textile membranes and foils combined with structural steel elements. On completion of the module students will be well prepared for concept design, detailed design and calculation of timber and lightweight structures.</p> | |
| types of teaching and learning | 2 SWS* lecture and 1 SWS tutorial and also self-study | |
| prerequisites for participation | The competencies covered in modules BIWO-01, BIWO-03 and BIWO-05 are prerequisite to this module. | |
| usability | The module is one of the required elective modules in the Master's programme Advanced Computational and Civil Engineering Structural Studies – ACCESS of which students must choose seven. | |
| requirements for earning for being awarded credits | Students earn credits after having passed the module exam. The module exam consists of a written exam (150 min.). | |
| credits and grades | Students can earn 4 credit points through the module. The module grade is equivalent to the grade given for the written exam. | |
| availability of the module | The module is offered each summer semester. | |
| workload | total workload 120 hours | |
| duration of the module | 1 semester | |

| module no. | module name | responsible lecturer |
|---|--|-----------------------------|
| BIWE-05 | Glass Structures | Dr. Engelmann |
| contents and qualifications | content of the module: aspects of façade engineering, mechanical and physical fundamentals of annealed and tempered glass, safety concepts for structural glass, design and construction using glass, numerical simulation of glass as a construction material, numerical simulation of mechanically fixed and adhesively bonded structures and also all-glass structures, analytical methods and modelling. On completion of the module students will be well prepared for the structural use of glass and also the safety concept and the structural analysis following building codes and ordinances. | |
| types of teaching and learning | 2 SWS* lecture and 1 SWS tutorial and also self-study | |
| prerequisites for participation | The competencies covered in module BIWO-05 are essential for this module. | |
| usability | The module is one of the required elective modules in the Master's programme Advanced Computational and Civil Engineering Structural Studies – ACCESS of which students must choose seven. | |
| requirements for earning for being awarded credits | Students can earn credit points after having passed the module exam. The module exam consists of a written exam (90 min.). | |
| credits and grades | Students can earn 4 credit points through the module. The module grade is equivalent to the grade given for the written exam. | |
| availability of the module | The module is offered each summer semester. | |
| workload | total workload 120 hours | |
| duration of the module | 1 semester | |
| module reading list | The Institution of Structural Engineers: Structural use of glass in buildings. ISBN 1 874 266 5147 Schittich et al: Glass construction manual. ISBN 3 764 381 221 | |

| module no. | module name | responsible lecturer |
|---|---|-----------------------------|
| BIWE-07 | Building Physics | Prof. Grunewald |
| contents and qualifications | <p>content of the module: indoor climate (human comfort and indoor air quality, pollutants, environmental and indoor climate loads, user behaviour, thermal protection in the summer and in hot climates), coupled heat, air and moisture transfer processes in building envelope systems (hygrothermal analysis of structural details, aspects of durability, damage potentials and protective measures, protection of built heritage and the built environment), integration in building physics simulation – energy & hygrothermal performance (development of building physics models of buildings, passive and active measures to store energy and moisture in structural components, energy optimisation of buildings with respect to their environment). On completion of the module students are able to apply internationally available and the Institute's software models to solve the tasks stated above.</p> | |
| types of teaching and learning | 2 SWS* lecture and 1 SWS tutorial and also self-study | |
| prerequisites for participation | The competencies covered in module BIWO-05 are essential for this module. | |
| usability | The module is one of the required elective modules in the Master's programme Advanced Computational and Civil Engineering Structural Studies – ACCESS of which students must choose seven. | |
| requirements for being awarded credits | Students earn credits after having passed the module exam. The module exam consists of a written exam (180 min.). | |
| credits and grades | Students can earn 4 credit points through the module. The module grade is equivalent to the grade given for the written exam. | |
| availability of the module | The module is offered each summer semester. | |
| workload | total workload 120 hours | |
| duration of the module | 1 semester | |
| module reading list | <p>for program downloads and literature visit http://www.bauklimatik-dresden.de/ http://www.eere.energy.gov/buildings/energyplus/ http://www.designbuilder.co.uk/</p> | |

| module no. | module name | responsible lecturer |
|---|---|-----------------------------|
| BIWE-08 | Multiscale Methods | Dr. Löhnert |
| contents and qualifications | content of the module: multiscale modelling of composites and materials with defects and cracks, representative volume elements and unit cells, scale transitions/bridging using homogenisation and localisation, hierarchical and simultaneous multiscale methods, averaging techniques, Voigt/Reuss approximations and Hashin/Shtrikman bounds, micromechanical solution by Eshelby, Effective Field Theory and Effective Medium Theory (self-consistent method), numerical homogenisation with homogenous, periodical and mixed boundary conditions. On completion of the module students will be able to use analytical and numerical multiscale modelling of composites and materials with defects and cracks. | |
| types of teaching and learning | 2 SWS* lecture and 1 SWS tutorial and also self-study | |
| prerequisites for participation | The competencies covered in modules BIWO-01, BIWO-02 and BIWO-05 are prerequisite to this module. | |
| usability | The module is one of the required elective modules in the Master's programme Advanced Computational and Civil Engineering Structural Studies – ACCESS of which students must choose seven. | |
| requirements for being awarded credits | Students earn credits after having passed the module exam. The module exam consists of a written exam (90 minutes) and an ungraded assigned paper with a total of 40 hours. | |
| credits and grades | Students can earn 4 credit points through the module. The module grade is equivalent to the grade earned for the written exam if the assigned paper rated 'pass'. Otherwise, the module grade is the weighted average of the grade for the written exam and grade 5 for the assigned paper (§ 10 par. 1 sentence 5 PO); the weighting factors applied to the written exam and the assigned paper are two and one, respectively. | |
| availability of the module | The module is offered each summer semester. | |
| workload | total workload 120 hours | |
| duration of the module | 1 semester | |

| module no. | module name | responsible lecturer |
|---|--|-----------------------------|
| BIWE-09 | Computational Dynamics | Prof. Graf |
| contents and qualifications | content of the module: computational structural dynamic analysis, such as single-degree-of-freedom system in the time and frequency domain, multi-degree-of-freedom systems, natural vibrations, modal analysis, modal superposition, damping models, displacement method and linear dynamics, element formulations, transformation relations, substructuring and condensation techniques, numerical simulation in the time domain, central difference method, analysis of time integration methods, continuous systems, applications, earthquake analysis and impact problems. On completion of the module students will be able to solve dynamic problems of load-bearing structures by applying advanced computational methods. | |
| types of teaching and learning | 2 SWS* lecture and 1 SWS tutorial and also self-study | |
| prerequisites for participation | The competencies covered in modules BIWO-02, BIWO-03 and BIWO-05 are prerequisite to this module. | |
| usability | The module is one of the required elective modules in the Master's programme Advanced Computational and Civil Engineering Structural Studies – ACCESS of which students must choose seven. | |
| requirements for being awarded credits | Students earn credits after having passed the module exam. The module exam consists of a written exam (120 min.). | |
| credits and grades | Students can earn 4 credit points through the module. The module grade is equivalent to the grade given for the written exam. | |
| availability of the module | The module is offered each summer semester. | |
| workload | total workload 120 hours | |
| duration of the module | 1 semester | |
| module reading list | Clough, Penzien: Dynamics of Structures, McGraw-Hill Argyris, Mlejnek: Dynamics of Structures, North-Holland Meskouris: Structural Dynamics, Ernst & Sohn | |

| module no. | module name | responsible lecturer |
|---|--|-----------------------------|
| BIWE-10 | Modelling of Pavement Structures for Dimensioning and Forecast Calculations | Prof. Wellner |
| contents and qualifications | content of the module: fundamentals of road loads (climate, traffic loads), modelling of loads (temperature variations, models to calculate essential temperature conditions as climate data, comparison with data measured in the field, modelling of tire-pavement interaction, modelling of vehicle parameters, comparison with field measurements), materials modelling (granular materials, asphalt, concrete), modelling of the layered compound, structure of the numerical simulation model – material description, element approaches, structural model, multiphysics (numerical, multiphysics structural analysis, validation using lab tests and large-scale tests). On completion of the module students will be able to use analytical and numerical methods for modelling and simulating pavement behaviour. | |
| types of teaching and learning | 2 SWS* lecture and 1 SWS tutorial and also self-study | |
| prerequisites for participation | The competencies covered in modules BIWO-01 and BIWO-05 are prerequisite to this module. | |
| usability | The module is one of the required elective modules in the Master's programme Advanced Computational and Civil Engineering Structural Studies – ACCESS of which students must choose seven. | |
| requirements for being awarded for being awarded credits | Students earn credits after having passed the module exam. The module exam consists of a written exam (120 minutes) and an ungraded assigned paper with a total of 40 hours. | |
| credits and grades | Students can earn 4 credit points through the module. The module grade is equivalent to the grade earned for the written exam if the assigned paper rated 'pass'. Otherwise, the module grade is the weighted average of the grade for the written exam and grade 5 for the assigned paper (§ 10 par. 1 sentence 5 PO); the weighting factors applied to the written exam and the assigned paper are two and one, respectively. | |
| availability of the module | The module is offered each summer semester. | |
| workload | total workload 120 hours | |
| duration of the module | 1 semester | |
| module reading list | Highways, The Location, Design, Edited by C. A. O'Flaherty, 2002, ISBN 0 7506 5090 7 | |

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| | Design and Performance of Road Pavements, D. and P. Croney, ISBN 0 07 014451 6 |
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| module no. | module name | responsible lecturer |
|---|---|-----------------------------|
| BIWE-11 | Cable-Stayed Bridges | Prof. Dr.-Ing. Stroetmann |
| contents and qualifications | <p>content of the module: forces acting on cable-stayed bridges, dimensioning, dynamics, details, manufacture and installation of cable stays, calculation of cable-stayed, reinforced concrete and steel bridges taking into account the nonlinear theory and the aerodynamic stability of the cables, stiffening girder and pylons, design and construction of cable-stayed bridges, practical examples of concrete, composite and hybrid cable-stayed bridges, design and dimensioning of cable-stayed bridges to Eurocode, design loads in bridge construction, stiffening girders and decks in reinforced concrete, steel and steel compound bridges and also selected bridge construction details. Students know the basics of planning, concept and detailed design and the calculation of cable-stayed bridges. Upon the successful completion of the module students are able to apply the fundamentals of concept and detailed design and calculation of cable-stayed bridges. Moreover, they will know the processes of manufacturing and assembly for installing these bridges.</p> | |
| types of teaching and learning | 2 SWS* lecture and 1 SWS tutorial and also self-study | |
| prerequisites for participation | The competencies covered in modules BIWO-01 and BIWO-05 are prerequisite to this module. | |
| usability | The module is one of the required elective modules in the Master's programme Advanced Computational and Civil Engineering Structural Studies – ACCESS of which students must choose seven. | |
| requirements for being awarded for being awarded credits | Students can earn credit points after having passed the module exam. The module exam consists of a written exam (90 min.). | |
| credits and grades | Students can earn 4 credit points through the module. The module grade is equivalent to the grade given for the written exam. | |
| availability of the module | The module is offered each summer semester. | |
| workload | total workload 120 hours | |
| duration of the module | 1 semester | |
| module reading list | Svensson, H.: Cable-Stayed Bridges - 40 years of experience worldwide. Published by Ernst & Sohn, Berlin 2012 | |

| module no. | module name | responsible lecturer |
|---|--|-----------------------------|
| BIWE-12 | Safety Concepts | Prof. Kaliske |
| contents and qualifications | <p>content of the module: safety of load-bearing structures, forecast and risk assessment, limit states and failure structures, concepts for the description of uncertainty and safety, level 3 analysis (stochastic concepts for the assessment of structural safety, integral formulas for the probability of failure, system and element failure, series and parallel systems), level 2 analysis (approximation methods for the computation of the probability of failure, safety index, first order/ second order reliability method), level 1 analysis (semi-probabilistic safety concepts, partial safety factors, application of standards), time series and load processes, model-based and model-free analytical methods. On completion of the module students are able to apply advanced computational methods in order to assess the safety of load-bearing structures.</p> | |
| types of teaching and learning | 2 SWS* lecture and 1 SWS tutorial and also self-study | |
| prerequisites for participation | The competencies covered in modules BIWO-04 and BIWO-05 are prerequisite to this module. | |
| usability | The module is one of the required elective modules in the Master's programme Advanced Computational and Civil Engineering Structural Studies – ACCESS of which students must choose seven. | |
| requirements for being awarded for being awarded credits | Students earn credits after having passed the module exam. The module exam consists of a written exam (90 minutes) and an ungraded assigned paper with a total of 40 hours. | |
| credits and grades | <p>Students can earn 4 credit points through the module. The module grade is equivalent to the grade earned for the written exam if the assigned paper rated 'pass'. Otherwise, the module grade is the weighted average of the grade for the written exam and grade 5 for the assigned paper (§ 10 par. 1 sentence 5 PO); the weighting factors applied to the written exam and the assigned paper are two and one, respectively.</p> | |
| availability of the module | The module is offered each summer semester. | |
| workload | total workload 120 hours | |
| duration of the module | 1 semester | |

| module no. | module name | responsible lecturer |
|---|--|-----------------------------|
| BIWE-13 | BIM-Based Virtual Engineering Laboratory | Prof. Scherer |
| contents and qualifications | content of the module: relational and object-oriented data structures of building information modelling (BIM), multi-models and link models, filtering of engineering information, visualisation methods for engineering information, integration of numerical tools (web services), grid/cloud access (web services), optimisation and system identification strategies in grid/cloud, modelling strategies for holistic engineering problems. On completion of the module students can take a holistic approach to complex engineering problems. They take a more holistic approach to problem modelling and break them into sub-problems in order to identify suitable software tools and their interaction thus establishing and using the most appropriate integrated information and simulation system for analysis, optimisation for different aspects and system identification, e.g., for structural health monitoring. | |
| types of teaching and learning | 2 SWS* lecture and 1 SWS tutorial and also self-study | |
| prerequisites for participation | The competencies covered in modules BIWO-03 and BIWO-05 are prerequisite to this module. | |
| usability | The module is one of the required elective modules in the Master's programme Advanced Computational and Civil Engineering Structural Studies – ACCESS of which students must choose seven. | |
| requirements for earning for being awarded credits | Students earn credits after having passed the module exam. The module exam consists of a written exam (90 min.). | |
| credits and grades | Students can earn 4 credit points through the module. The module grade is equivalent to the grade given for the written exam. | |
| availability of the module | The module is offered each summer semester. | |
| workload | total workload 120 hours | |
| duration of the module | 1 semester | |
| module reading list | Chuck Eastman: BIM Handbook, Wiley, 2011 | |

| module no. | module name | responsible lecturer |
|--|---|-----------------------------|
| BIWE-14 | Material Models for Soils | Prof. Herle |
| contents and qualifications | content of the module: essential aspects of soil mechanics, linear and nonlinear elasticity, perfect plasticity, boundary stress conditions, critical states, Cam clay models and hypoplasticity. On completion of the module students will be able to use material models for soils for advanced geotechnical analyses. | |
| types of teaching and learning | 2 SWS* lecture and 1 SWS tutorial and also self-study | |
| prerequisites for participation | The competencies covered in modules BIWO-02 and BIWO-05 are prerequisite to this module. | |
| usability | The module is one of the required elective modules in the Master's programme Advanced Computational and Civil Engineering Structural Studies – ACCESS of which students must choose seven. | |
| prerequisites for earning credits | Students earn credits after having passed the module exam. The module exam consists of a written exam (90 minutes) and an ungraded assigned paper with a total of 30 hours. | |
| credits and grades | Students can earn 4 credit points through the module. The module grade is equivalent to the grade earned for the written exam if the assigned paper rated 'pass'. Otherwise, the module grade is the weighted average of the grade for the written exam and grade 5 for the assigned paper (§ 10 par. 1 sentence 5 PO); the weighting factors applied to the written exam and the assigned paper are two and one, respectively. | |
| frequency of the module | The module is offered each summer semester. | |
| workload | total workload 120 hours | |
| duration of the module | 1 semester | |
| module reading list | D. Muir Wood: Geotechnical Modelling D. Muir Wood: Soil Behaviour and Critical State Soil Mechanics | |