Technische Universität
Faculty of Computer Science
Faculty of Mathematics
Center for Molecular and Cellular Bioengineering

Regulations for the consecutive Master's Programme Computational Modelling and Simulation

From 20th April 2018

On the basis of § 36 paragraph 1 of the Act on the Autonomy of Institutions of Higher Education in the Free State of Saxony in the version of the announcement of 15 January, 2013 (SächsGVBl. p. 3), Technische Universität Dresden issues the following study regulations as statutes.

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§ 1
Scope of application

On the basis of the Act on the Autonomy of Institutions of Higher Education in the Free State of Saxony and the examination regulations, these study regulations regulate the objectives, content, structure and course of study for the consecutive Master's programme in Computational Modelling and Simulation at Technische Universität Dresden.

§ 2
Objectives of Study

(1) Students are able to model complex natural or technical systems and to predict or optimise system behaviour by means of computer simulation of these models. After completing their studies, they will master the methodological and theoretical knowledge of computer-aided modelling and numerical computer simulation. This way the knowledge acquired can be applied directly in practical situations. Based on this competence, they can model and simulate the following systems depending on the track used:

Track 1 "Computational Mathematics": complex, especially nonlinear mathematical models and (partial) differential equations.

Track 2 "Visual Computing": Image and video data as well as interactions between human users, computer systems and virtual realities.

Track 3 "Computational Engineering": complex technical systems consisting of mechanical and electrical components and their interaction.

Track 4 "Computational Life Science": biological and medical systems, such as cells, tissues and organs.

Track 5"Computational Modelling in Energy Economics": Energy Networks and Energy Market Systems.

(2) Through their broad expertise in data modelling and computer simulation as well as in the development and software implementation of the corresponding algorithms and competence in problem abstraction and transfer, graduates are capable of analysing and mastering a wide range of complex tasks in the context of society as a whole after a corresponding training period in professional practice. This includes in particular activities as data analyst, simulation engineer, quantitative analyst, market researcher, software developer, computer-aided engineer, modeller or manager. The project competence acquired during their studies also prepares students for an academic career, starting with a doctorate.

§ 3
Admission Requirements

The prerequisite for admission is a first university degree recognised in Germany or a degree from a state or state-recognised university of cooperative education in informatics, mathematics, natural sciences, economics or engineering. In addition, English proficiency is required at least at level B2 of the European Reference Framework for Languages and special computer modelling skills. Proof of this particular suitability is provided by an aptitude assessment procedure in accordance with the aptitude assessment regulations on 14 March 2018 (Official Announcement of TU Dresden No. 04/2018 of 21 March 2018, p. 70) in the currently valid version.

§ 4
Start and Duration of the Studies

(1) The course can be taken up in the winter semester.

(2) The standard period of study is four semesters and includes, in addition to attendance, self-study and the Master's examination.

§ 5
Teaching and Learning Methods

(1) The subject matter is structured in modules. In the individual modules, the course content is taught, consolidated and deepened through lectures, exercises, tutorials, seminars, practical courses, project work, language courses and self-study.

(2) During lectures, the subject matter of the modules is introduced. Exercises allow for the application of the material to special areas of focus. In tutorials, students are supported in the transfer of knowledge and the problem-related implementation of the lecture contents. Seminars enable the students to inform themselves about the basic principles of special literature and other materials in a selected problem area, to report the results of their work, to discuss these within the group and / or to present these in written format. The purpose of practical is to help students apply and solidify the learning contents delivered, as well as to acquire practical skills in potential areas of employment. Project work promotes teamwork and collaborative content development, but can also serve the individual implementation of a task in a single project. Language courses teach and train knowledge, skills and abilities in the respective foreign language. And they develop communication and intercultural competence within an academic and professional context, as well as in everyday situations. In self-study, students learn how to acquire specialist knowledge independently from written sources.

§ 6
Structure and Course of Study

(1) The studies are organised into modules. The curriculum offered is divided among three semesters. The third semester is designed in such a way that it is particularly suitable for a temporary stay at another university (mobility window). The fourth semester is exclusively intended for the preparation of the master thesis including the performance of the defence.

(2) The course of study comprises basic training and the compulsory elective field of professional profiling. The basic training includes three compulsory modules and three elective modules. The compulsory elective area consists of five tracks from which the student chooses one. The number of mandatory modules in each track is between four and seven, as shown in Attachments 1 and 2. For each track, a higher education lecturer is appointed as track manager. Registration is required to select an elective module and a track. A track according to § 25 paragraph 4 sentence 1 of the examination regulations is considered selected upon registration; an elective module according to § 25 paragraph 3 sentence 1 of the examination regulations is only considered selected when the registration has been confirmed by the chairman of the examination board. An elective compulsory module of the basic training cannot be selected if the module examination of this or a substantially identical module was already included in the final examination of a Bachelor's programme through which the admission requirements for the Master's programme Computational Modelling and

Simulation were acquired; in such cases enrolment will not be confirmed. If the enrolment is not confirmed, the student can enrol in another compulsory elective module of the basic training. The form and deadline for enrolment will be announced at the beginning of each semester in the Faculty of Computer Science and the Faculty of Mathematics and the Center for Molecular and Cellular Bio-engineering (CMCB) in the usual manner. The choice is binding. The elective modules and the track can be redialed once each. The re-election takes place in consultation with the mentor in accordance with § 9 paragraph 1 in each case by a written application to the examination board, in which the module to be replaced and the newly selected module or track to be replaced and the newly selected track are to be named.

(3) Qualification goals, contents, covered forms of teaching and learning, requirements, usability including possible combination restrictions, frequency, workload and duration of the individual modules can be found in the module descriptions (Attachment 1).

(4) The courses are generally held in English or in German in accordance with the module description.

(5) The appropriate allocation of the modules to the individual semesters, the observance of which makes it possible to complete the course of study within the standard study period, as well as the type and scope of the courses covered in each case and the number and standard time of the required study and examination achievements can be found in the attached schedule of study (Attachment 2).

(6) The range of compulsory elective modules and the study schedule may be amended by the Faculty Council of the Faculty of Computer Science, the Faculty Council of the Faculty of Mathematics and the Scientific Council of the CMCB upon proposal of the Study Commission. The current range of elective modules is to be announced at the beginning of the semester as is customary at the Faculty of Computer Science. The changed study schedule applies to students who are informed of it at the beginning of their studies as is customary at the Faculty of Computer Science. Any exception to the rules explained in Sentence 3 is decided by the Examination Board.

§ 7
Content of the Study

(1) The Master's Programme in Computational Modelling and Simulation is research-oriented.

(2) Mathematical, informatical and scientific basics in the strong emphasis on computer-aided modelling and simulation create the prerequisites for the application-specific consolidation in one of the offered tracks. The basics include: Mathematical and computer basics, machine learning, data analysis, parallel programming, high-performance computing, numerical methods, probability calculation and statistics, computer graphics and visualisation, stochastics, planning and evaluation of computer experiments, literary and application competence in at least two fields of application.

(3) Based on the basics, the optional tracks offer students the opportunity to focus on one of the areas of computer-aided modelling and simulation described in these tracks:

1. Track Computational Mathematics: Numerical analysis, numerical solving of partial differential equations using finite element methods, scientific computing, mathematical biology, calculation methods, mathematical modelling, numerics of partial differential equations, scientific programming, optimisation methods, calculation methods for multi field methods, numerical statistics and Monte-Carlo methods.
2. Track Visual Computing: data visualization, algorithms for forward problems and inverse

problems, design of user interfaces, computer graphics, computer vision and image processing, information visualization, interactive media and multimedia, virtual realities, advanced machine learning and artificial intelligence.

3. Track Computational Engineering: Numerical fluid mechanics, simulation of multi-body dynamics, calculation methods for multi-field problems, finite element method in mechanics, computer-aided design and optimisation of technical systems.
4. Track Computational Life Science: Introduction to computer modelling of biochemical processes, applied bioinformatics, modelling and simulation of biological systems and processes in space and time, statistical methods and design of experiments, validation and verification of simulation results, dynamics of and on biological networks, mathematical biology, computational biophysics, scientific visualisation in biology and medicine, particle methods, simulation of reaction networks, computer models in cognitive neuroscience, simulation methods for tissue biomechanics.
5. Track Computational Modelling in Energy Economics: Modelling and Simulation of Electricity Markets, Energy Economics, Simulation of Economic Energy Market Systems, Modelling of Environmental Resources and Environmental Protection Regulations, Scientific Computing, Numerical Solving of Partial Differential Equations.

(4) The compulsory modules of basic training shall include language training, good scientific practice, scientific project implementation and other non-technical subjects, and analysis of existing scientific approaches in selected fields.

§ 8
Credit points

(1) ECTS credit points document the average workload of the students and their individual study progress. One performance point is equal to 30 hours of workload. Normally, 60 performance points are awarded per academic year, which means 30 performance points per semester. The total workload for the course equals to 120 credit points and comprises the teaching and learning forms described in the module descriptions, the study and examination achievements as well as the master thesis and the defence.

(2) The module descriptions indicate how many credit points can be earned by each module. The performance points are earned upon successful passing of the module examination. § 26 of the examination regulations remains unaffected thereby.

§ 9
Course guidance service

(1) The general course guidance is provided by the Central Advisory Office of Technische Universität Dresden and covers questions of study options, enrolment modalities and general student matters. The structural units involved in the course of study provide specialist advice during the course of study by means of a mentoring system. It supports students in particular in questions of study design, choice of elective modules and courses in catalogue modules, selection of the track, and the choice of the topic of the project or master thesis. For this purpose, each student is assigned a university teacher involved in the course of study as a mentor at the beginning of the course. The mentor invites students to a counselling interview at the beginning of their studies, but no later than 8 weeks after the beginning of the first semester, and is also available to advise them as required.

(2) At the beginning of the third semester, each student who has not yet provided any proof of

performance, has to take part in specialised academic counselling.

§ 10
Adaptation of module descriptions

(1) In order to adapt to changed conditions to an optimal study organisation, the module descriptions can be changed in a simplified procedure, with the exception of the fields "Module name", "Content and qualification objectives", "Teaching and learning forms", "Prerequisites for the awarding of performance points" and "performance points and grades".

(2) In a simplified procedure, the Faculty Council of the Faculty of Computer Science and the Faculty of Mathematics and the Scientific Council of the Center for Molecular and Cellular Bio-engineering (CMCB) jointly decide to amend the module description on the proposal of the Study Commission. The changes are to be published in the Faculties of Computer Science, Mathematics and CMCB in the usual manner.

§ 11
Entry into force and Publication

(1) This examination regulation shall take effect starting 1st October 2018 and will be published in the official notices of the Dresden Technical University.

(2) It shall apply to all students enrolled in the Master's degree programme in Computational Modelling and Simulation, starting with the Winter semester of 2018/2019.

Issued at the Technical University of Dresden on the basis of the resolutions of the Faculty Council of the Faculty of Computer Science on 17th January 2018 and the Faculty of Mathematics on 31st January 2018 as well as the resolution of the Scientific Council of the Center for Molecular and Cellular Bioengineering (CMCB) on 14th February 2018 and the approval of the University Ececutive Board on 27th February 2018.

Dresden, April 20, 2018

The Rector
of Technische Universität Dresden

Prof. Dr.- Ing. habil. DEng / Auckland Hans Müller-Steinhagen