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Academic and Examination Regulations for the Master's Degree Program Materials Science and Engineering at the Technical University of Munich

From 26 July 2017

Engrossed version

As amended by the Collective Amending Statute of 29 June 2020

In accordance with Art. 13 (1) sentence 2 in conjunction with Art. 58 (1) sentence 1, Art. 61 (2) sentence 1 and Art. 43 (5) of the *Bayerisches Hochschulgesetz (BayHSchG)* [Bavarian Higher Education Act] the Technical University of Munich issues the following Academic and Examination Regulations for the Master's Degree Program Materials Science and Engineering (*Fachprüfungs- und Studienordnung, FPSO*):

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§ 34

Applicability, Academic Titles

- (1) ¹The Examination and Academic Regulations for the Master's Degree Program Materials Science and Engineering (FPSO) complement the General Academic and Examination Regulations for Bachelor's and Master's Programs at the Technical University of Munich (APSO) dated 18 March 2011 as amended. ²The APSO has precedence.
- (2) ¹Upon successful completion of the Master's examination the degree "Master of Science" ("M.Sc.") is awarded. ²The academic title may also be used with the name of the university "(TUM)".

§ 35

Commencement of Studies, Standard Duration of Study, ECTS

- (1) The Master's Degree Program Materials Science and Engineering at the Technical University of Munich commences, as a rule, in the winter semester.
- (2) ¹The number of classes in required and elective subjects needed to obtain the master's degree is 90 credits (74 weekly hours per semester) spread over three semesters. ²Students will have a maximum of six months to complete their master's thesis in accordance with § 46 and the master's colloquium (30 credits in total). ³The number of coursework units and examinations to be completed in the Master's Degree Program Materials Science and Engineering according to Appendix 1 is a minimum of 120 credits. ⁴The standard duration of study for the master's program will be a total of four semesters.

§ 36

Eligibility Requirements

- (1) Eligibility for the Master's Degree Program Materials Science and Engineering is demonstrated by:
1. a qualified bachelor's degree obtained after a program of at least six semesters from a domestic or foreign institution of higher education, or at least an equivalent degree in engineering, mechanical engineering, electrical engineering, informatics, civil/environmental engineering, chemical engineering or a comparable degree program.
 2. proof of expertise in the form of a "Graduate Record Examination (GRE) General Test" or a "Graduate Aptitude Test in Engineering" (GATE) for applicants who have completed a bachelor's degree in the following countries: Bangladesh, China, India, Iran, Pakistan; for other applicants who completed a bachelor's degree in a state that has not signed the Convention on the Recognition of Qualifications concerning Higher Education in the European Region from 11 April 1997 (Lisbon Recognition Convention), we recommend submitting the test as it will be requested later if there are significant differences in terms of the

competencies gained in the bachelor's degree in accordance with Section 2; this proof is not necessary for degrees that were completed in signatory states of the Lisbon Recognition Convention; further information, like the required number of points, will be announced in good time on the Internet pages for the degree program,

3. adequate knowledge of the English language; students whose language of instruction is not English must demonstrate proficiency through an acknowledged language test such as the Test of English as a Foreign Language (TOEFL) (with a minimum of 88 points), the International English Language Testing System (IELTS) (with a minimum of 6.5 points), or the Cambridge Main Suite of English Examinations; if, in the undergraduate program, at least 8 credits were obtained for examinations administered in English-language examination modules, adequate proficiency in English is also deemed proven, alternatively the proof of a bachelor's thesis written in English or a comparable pass/fail credit requirement amounting to 8 credits can be provided.
 4. proof of sufficient German language skills; students who obtained their study qualification at a non-German-speaking institution need to provide corresponding proof of B2 level according to the Common European Framework of Reference for Languages,
 5. passing the Aptitude Assessment for the Master's Degree Program Materials Science and Engineering in accordance with Appendix 2.
- (2) A degree is considered a qualified degree within the meaning of § 36(1)1 if there are no significant differences to the relevant scholarly oriented bachelor's programs at the Technical University of Munich named in § 36(1)1, or competencies (learning outcome) have been gained at an equivalent institution of higher education, and correspond to the subject-specific requirements of the master's program.
 - (3) For determining a qualified degree in accordance with § 36(2), the module catalog for a bachelor's degree in engineering at the Technical University of Munich will be considered.
 - (4) The Aptitude Assessment Commission decides on the comparability of the degree program, the special suitability and the recognition of competencies from the review of university degrees obtained at foreign institutions of higher education taking Art. 63 of the Bavarian Higher Education Act into consideration.
 - (5) ¹As an exception to § 36(1)1, students enrolled in a bachelor's program specified in § 36(1)1 may be admitted to the master's program in justified cases. ²An application to the master's program by students enrolled in a bachelor's program may only be submitted if it can be verified that, in the case of a six-semester bachelor's program, module examinations amounting to at least 140 credits; in the case of a seven-semester bachelor's program, module examinations amounting to at least 170 credits; and, in the case of an eight-semester bachelor's program, module examinations amounting to at least 200 credits have been completed at the time of submission of the application. ³Verification of the awarding of the bachelor's degree must be provided within one year of commencement of the master's program.

§ 37

Modular Structure, Module Examination, Courses, Areas of Specialization, Language of Instruction

- (1) ¹General provisions on modules and courses are set out in §§ 6 and 8 of the APSO. ²For any changes to the stipulated module provisions § 12(8) of the APSO applies.
- (2) The curriculum with the course offerings from the Fundamental Modules and Elective Modules as well as the Practical Courses, the Scientific Skills and the Advanced Research Internship is provided in Appendix 1.
- (3) The following study focuses can be selected for the Master's Degree Program Materials Science and Engineering:
 - Multiscale Material Principles
 - Uncertainty Quantification and Mathematical Modeling
 - Materials in Engineering Applications
 - Material Characterization, Testing & Surveillance
- (4) ¹Within the framework of the elective modules, students select one of the offered areas of specialization upon consultation with a mentor assigned by the Study Program Division Council at the Munich School of Engineering and put together an individual semester curriculum amounting to at least 30 credits that corresponds with the selected area of specialization. The curriculum is approved by the Examination Board chairperson for the Master's Degree Program Materials Science and Engineering. ²Modules amounting to at least 15 credits from the "Electives I" list (chosen area of specialization) need to be selected (Appendix 1). ³Any person who is an authorized examiner in accordance with the University Examiners Act and offers courses on the Master's Degree Program Materials Science and Engineering can be assigned as a mentor.
- (5) ¹The language(s) of instruction on the Master's Degree Program Materials Science and Engineering are English and German. ²The language of instruction for the individual modules is indicated in Appendix 1. ³Where the language of instruction for a module is specified in Appendix 1 as either English or German, the examiner will announce, in a suitable manner no later than the first day of classes, which will be the official language of instruction.

§ 38

Examination Deadlines, Academic Progress Checks, Failure to Meet Deadlines

- (1) Examination deadlines, academic progress checks, and failure to meet deadlines are governed by § 10 of the APSO.
- (2) ¹At least three of the module examinations from the Fundamental Modules listed in Appendix 1 must be successfully completed by the end of the second semester. ²For any failure to meet the deadlines, § 10(5) of the APSO applies.

§ 39 Examination Board

¹In accordance with § 29 of the APSO, the board responsible for all decisions concerning examination matters is the Master's Examination Board for Materials Science and Engineering at the Munich School of Engineering Study Program Division. ²The Examination Board is made up of five members. ³Representatives from the TUM schools and departments Civil, Geo and Environmental Engineering, Chemistry, Electrical and Computer Engineering, Informatics, Mechanical Engineering, Mathematics and Physics can be members of the Examination Board.

§ 40 Recognition of Periods of Study, Coursework and Examination Results

The recognition of periods of study, coursework, and examination results is governed by § 16 of the APSO.

§ 41 Continuous Assessment Procedure, Type of Assessment

- (1) In addition to written and oral examinations, types of assessment in accordance with § 12 and § 13 of the APSO may include (but are not limited to) laboratory assignments, exercises (tests, where applicable), reports, project work, presentations, learning portfolios, research papers, or parcours examinations.
- a) ¹A **written examination** is a supervised examination, in which students are expected to demonstrate, within a limited amount of time and using predefined methods and resources, their ability to identify problems, find solution strategies and, if required, implement them. ²The duration of written examinations is regulated in § 12(7) of the APSO.
- b) ¹Depending on the discipline, **laboratory assignments** may include experiments, measurements, field work, field exercises, etc., with the goal of students conducting such work, evaluating results, and gaining knowledge. ²These may consist of, for example, process descriptions and the underlying theoretical principles including the relevant literature; preparation and practical implementation; calculations, if required; documentation, evaluation, and interpretation of the results in the context of the knowledge to be gained. ³Laboratory assignments may be complemented by presentations designed to demonstrate a student's communication competency in presenting scholarly work to an audience. ⁴Details of each laboratory assignment and the related competencies to be examined are set out in the module descriptions.
- c) ¹**Practical credit requirements (tests, where applicable)** involve students completing assigned tasks (for example, solving mathematical writing computer programs, preparing models) using theoretical knowledge to solve application-oriented problems. ²Exercises are designed to assess a student's factual and detailed knowledge and its application. ³Practical exercises may be administered in writing, orally, or electronically. ⁴They may be in the form of homework assignments, practice sheets, programming exercises, (e-)tests, tasks assigned within a university internship program, etc. ⁵Details of each practical credit requirement and the related competencies to be examined are set out in the module descriptions.

- d) ¹A **report** is a written record and summary of a learning process for the purpose of presenting the acquired knowledge in a structured way and analyzing the results in the context of a module. ²Students are expected to demonstrate that they have understood all essential aspects and are able to present them in writing. ³Reports may include excursion reports, internship reports, work reports, etc. ⁴The written report may be complemented by a presentation for the purpose of assessing the student's communication competency in presenting scholarly work to an audience.
- e) ¹**Project work** is designed to reach, in several phases (initiation, problem definition, role assignment, idea generation, criteria development, decision, implementation, presentation, written evaluation), the defined objective of a project assignment within a given period of time and using suitable instruments. ²In addition, project work may include a presentation in order to assess a student's communication competency in presenting scholarly work to an audience. ³Details of each project work assignment and the related competencies to be examined are set out in the module descriptions. ⁴The project work can also take the form of group work. ⁵In this case, it should be demonstrated that tasks can be solved in the team. ⁶The contribution to be assessed as an examination result needs to be individually recognizable and assessable. ⁷This also applies to the individual contribution to the group results.
- f) ¹A **research paper** is a written assignment in which students work independently on solving complex scholarly or scholarly/application-oriented problems, using the scientific methods of the related discipline. ²Students are expected to demonstrate that they are able to solve problems corresponding to the learning results of the module in question in compliance with the guidelines for scholarly work – from analysis and conception to implementation. ³Research papers, differing in their requirement standards, may take the form of a conceptual framework/theory paper, abstract, term paper, seminar paper, etc. ⁴The research paper may be complemented by a presentation and/or a colloquium for the purpose of assessing the student's communication competency in presenting scholarly work to an audience. ⁵Details of each research paper and the related competencies to be examined are set out in the module descriptions.
- g) ¹A **presentation** is a systematic and structured oral performance supported by suitable audio-visual equipment (such as projector, slides, posters, videos) for the purpose of demonstrating and summarizing specific issues or results and paring complex problems down to their essential core. ²For the presentation, the student is expected to demonstrate that he or she is capable of preparing a certain topic within a given time frame in such a way as to present or report it in a clear and comprehensible manner to an audience. ³In addition, the student is expected to demonstrate that he or she is able to respond competently to any questions, suggestions, or discussions brought by the audience and relating to his or her subject area. ⁴The presentation may be complemented by a brief written precis. ⁵The presentation can given as an individual or group assignment. ⁶The contribution to be assessed as an examination result needs to be individually recognizable and assessable. ⁷This also applies to the individual contribution to the group results.
- h) ¹An **oral examination** is a timed, graded discussion on relevant topics and specific questions to be answered. ²In oral examinations students are expected to demonstrate that they have reached the qualification objectives documented in the module descriptions, understood the central concepts of the subject matters covered by the exam, and are able to apply them to specific problems. ³The oral exam can be taken as an individual exam or group exam. ⁴The duration of the examination is regulated in § 13(2) of the APSO.

- i) ¹A **learning portfolio** is a collection of completed written work compiled by the student according to predefined criteria that exhibits the student's progress and achievements in defined content areas at a given time. ²Students are required to explain why they chose the work they have and its relevance for their learning progress and the achievement of the qualification objectives. ³With the learning portfolio, students are expected to demonstrate that they actively taken responsibility for their learning process and that the documented qualification objectives have been reached. ⁴Depending on the module description, types of independent study assessment in a learning portfolio may include, in particular, application-oriented assignments, web pages, weblogs, bibliographies, analyses, conceptual framework/theory papers, as well as the graphic representation of facts or problems. ⁵Details of each learning portfolio and the related competencies to be examined are set out in the module descriptions.
- j) ¹The **parcours examination** is made up of several components. ²Unlike a module examination component, parcours exam components are administered in sequence and completed in a specific time frame and location. ³Parcours components entail various types of examination, which together evaluate the competency profile of the module as a whole. ⁴Parcours components can in particular also be types of examination according to a) to i). ⁵The total duration of the parcours examination with all its components is indicated in the module catalog. The type of examination and duration of the parcours components are indicated in the module description.
- (2) ¹As a rule, module examinations are taken concurrently with the program. ²The type and duration of module examinations is stipulated in Appendix 1. ³For any changes to the stipulated module provisions § 12(8) of the APSO applies. ⁴The assessment of the module examination is governed by § 17 of the APSO. ⁵The grade weights of module examination components correspond to the weighting factors assigned to them in Appendix 1.
- (3) Where Appendix 1 provides that a module examination is either in written or oral form, the examiner will inform the students officially and in appropriate form, no later than the first day of classes, of the type of examination to be held.

§ 42

Registration for and Admission to the Master's Examination

- (1) Students who are enrolled in the Master's Degree Program Materials Science and Engineering are deemed admitted to the module examinations of the master's examination.
- (2) ¹Registration requirements for required and elective module examinations are stipulated in § 15(1) of the APSO. ²The registration requirements for repeat examinations for failed required modules are stipulated in § 15(2) of the APSO.

§ 43

Scope of the Master's Examination

- (1) The master's examination consists of:
1. the module examinations in the corresponding modules according to § 43(2)
 2. the pass/fail credit requirements listed under § 45
 3. the master's thesis in accordance with § 46 including the master's colloquium in accordance with § 46a.
- (2) ¹The module examinations are listed in Appendix 1. ²40 credits are required in the Fundamental Modules, at least 30 credits in the Elective Modules in accordance with § 37(3) and (4) and at least 8 credits in the Practical Courses. ³The selection of modules must comply with § 8(2) of the APSO.

§ 44

Repeat Examinations, Failed Examinations

- (1) The repetition of examinations is governed by § 24 of the APSO.
- (2) Failure of examinations is governed by § 23 of the APSO.

§ 45

Coursework (Pass/Fail Credit Requirements)

In addition to the examinations named under § 43(1)1 and 3, successful completion of the coursework as part of the Advanced Research Internship and the Scientific Skills in accordance with Appendix 1 is required.

§ 45 a

Multiple Choice Tests

The conduct of multiple choice tests is governed by § 12a of the APSO.

§ 46

Master's Thesis

- (1) ¹As part of the master's examination, each student must write a master's thesis in accordance with § 18 of the APSO. ²The master's thesis can be determined and supervised by the expert examiner from the schools and departments at the Technical University of Munich involved in the Master's Degree Program Materials Science and Engineering (thesis supervisor). ³The expert examiners according to sentence 2 are appointed by the Examination Board.
- (2) ¹As a rule, the completion of the Master's Thesis module should form the last examination component. ²Students can request early admission to the master's thesis if the aim of the thesis within the meaning of § 18(2) APSO can be achieved taking the previous course of study into consideration.

- (3) ¹The period between topic assignment and submission of the completed master's thesis must not exceed six months. ²The master's thesis is considered presented and not passed if the student fails to submit it on time without valid reasons as specified in § 10(7) of the APSO. ³The master's thesis should be written in English.
- (4) ¹The completion of the master's thesis consists of a written composition and the master's colloquium in accordance with 46a. ²30 credits are awarded for the Master's Thesis module.
- (5) ¹If the master's thesis was not graded with at least "sufficient" (4.0), it may be repeated once with a new topic. ²Students must renew their application to prepare the Master's Thesis module within six weeks of receipt of the grade.

§ 46 a Master's Colloquium

- (1) ¹Students are deemed to be registered for the master's colloquium in the Master's Thesis module when they have reached at least 60 credits on the Master's Degree Program Materials Science and Engineering and have successfully completed the master's thesis. ²The examination should be taken two months after the registration date set in accordance with sentence 1.
- (2) The master's colloquium is conducted by the thesis supervisor for the master's thesis and an expert test supervisor.
- (3) The master's colloquium should be conducted in English.
- (4) ¹As a rule, the master's colloquium lasts 60 minutes. ²The students have approx. 30 minutes to present their master's thesis. ³That is followed by a disputation that, starting from the topic of the master's thesis stretches to the broader field to which the master's thesis belongs.

§ 47 Passing and Assessment of the Master's Examination

- (1) The master's examination is deemed passed when all examinations required for the master's examination according to § 43(1) have been passed and a plus credits account of at least 120 credits has been achieved.
- (2) ¹The grade for a module will be calculated according to § 17 of the APSO. ²The overall grade for the master's examination will be calculated as the weighted grade average of the modules according to § 43(2) and the Master's Thesis module. ³The grade weights of the individual modules correspond to the credits assigned to each module. ⁴The overall assessment is expressed by the designation according to § 17 of the APSO.

§ 48
Degree Certificate, Diploma, Diploma Supplement

¹If the master's examination was passed, a degree certificate, a diploma, and a diploma supplement including a transcript of records are to be issued in compliance with § 25(1) and § 26 of the APSO. ²The day on which all examination and coursework requirements are met should be entered as the date on the certificate.

§ 49
Entry into Force*)

¹These regulations will enter into force on 15 May 2017. ²They apply to all students who commence their studies at the Technical University of Munich as of the winter semester 2017/18.

*) This regulation concerns the entry into force in the original version from 26 July 2017. The point in time that the amendments come into force is indicated in the amending statute.

Appendix 1: Examination Modules

Explanation:

Sem. = semester; SWS = weekly hours per semester; WiSe = winter semester; SoSe = summer semester; V = lecture; Ü = exercise module; P = practical course; SE = seminar; d = German; e = English; d/e = German or English.

In the column "Duration of examination", the duration of written and oral examinations is specified in minutes.

Fundamental Modules (Required Modules)

No.	Module number	Module name	Type of instruction SWS	Sem.	SWS	ECTS	Type of examination (Weighting %)	Duration of examination	Language of instruction
1	MW2361	Physics of Fluids	2V+1Ü	WiSe	3	5.0	Written exam	90	e
2	MW2368	Nonlinear Continuum Mechanics	2V+1Ü	WiSe	3	5.0	Written exam	90	e
3	BGU35016	Advanced Rheology	2V+1Ü	WiSe	3	5.0	Written exam	90	e
4	PH9031	Materials Sciences	2V+1Ü	WiSe	3	5.0	Written exam	90	e
5	PH9032	Measurement & Sensor Technology	2V+1Ü	SoSe	3	5.0	Written exam	90	e
6	MW2360	Probability Theory and Uncertainty Quantification	2V+1Ü	WiSe	3	5.0	Written exam	120	e
7	MA9805	Mathematical Modeling of Materials	2V+1Ü	WiSe	3	5.0	Written exam	90	e
8	MW2359	Multiscale Modeling	2V+1Ü	SoSe	3	5.0	Written exam	90	e

Master's Thesis

9		Master's Thesis	-	SoSe	-	30	Research paper (80), colloquium (20)	- 60	e
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Elective Modules: ¹From the electives, at least 30 credits are required in consultation with the mentor assigned in accordance with § 37(4), whereby at least 15 credits need to come from one of the Electives I lists (area of specialization). ³ The complete module catalog will be published on the web pages for the degree program. The Examination Board regularly updates the elective modules course catalog. ⁴Changes will be announced on the web pages for the degree program at the latest on the first day of the semester.

The following catalog contains an incomplete selection as an example.

Specialization in Multiscale Material Principles (Electives I)

No.	Module number	Module name	Type of instruction SWS	Sem.	SWS	ECTS	Type of examination (weighting, %)	Duration of examination	Language of instruction
1	PH2071	Fundamentals of Surface and Nanoscale Science	2V+2Ü	WiSe SoSe	4	5.0	Written exam	60	e
2	PH2166	Physics and Chemistry of Functional Interfaces	2V	WiSe SoSe	2	5.0	Written exam	60	d/e
3	PH2134	Advanced Materials Analysis with Synchrotron Radiation: Techniques and Applications	2V	SoSe	2	5.0	Written exam	60	e
4	MW1412	Prozesssimulation und Materialmodellierung von Composites	2V+1Ü	SoSe	3	5.0	Written exam	90	d

Specialization in Uncertainty Quantification and Mathematical Modeling (Electives I)

No.	Module number	Module name	Type of instruction SWS	Sem.	SWS	ECTS	Type of examination (weighting %)	Duration of examination	Language of instruction
1	MW0620	Nichtlineare Finite-Element-Methoden	3V	SoSe	3	5.0	Written exam	90	d
2	MW0612	Finite Elemente	3V	WiSe	3	5.0	Written exam	90	d
3	MA4405	Stochastic Analysis	3V+1Ü	WiSe	4	6.0	Written exam	90	e
4	BV60000 1	Risk Analysis	2V+2Ü	WiSe SoSe	4	6.0	Oral	30	e

Specialization in Materials in Engineering Applications (Electives I)

No.	Module number	Module name	Type of instruction SWS	Sem.	SWS	ECTS	Type of examination (weighting %)	Duration of examination	Language of instruction
1	MW1419	Thermodynamics for Energy Conversion	2V+1Ü	WiSe	3	5.0	Written exam	120	e
2	MW2152	Modeling, Control and Design of Wind Energy Systems	2V+1.5Ü	WiSe SoSe	3.5	5.0	Written exam	60	e

3	MW0612	Finite Elemente	3V	WiSe	3	5.0	Written exam	90	d
4	BV640006	Non-destructive Testing in Engineering	3V+1Ü	WiSe SoSe	4	5.0	Oral	30	e

Specialization in Material Characterization, Testing & Surveillance (Electives I)

No.	Module number	Module name	Type of instruction SWS	Sem.	SWS	ECTS	Type of examination (weighting %)	Duration of examination	Language of instruction
1	BV640007	Zerstörungsfreie Prüfung	3V+1Ü	WiSe SoSe	4	5.0	Written exam	60	d/e
2	CH0805	Spectroscopical Methods	2V+1Ü	WiSe SoSe	3	8.0	Oral	90	d/e
3	MW1995	Experimentelle Schwingungsanalyse	2V+1Ü	WiSe	3	5.0	Written exam	90	d
4	PH2140	Nanoscience using Scanning Probe Microscopy	2V	WiSe SoSe	2	5.0	Written exam	60	d/e

Individual Discipline-specific Supplement (Electives II)

The lists will be published on the web pages for the degree program.

Practical Courses: ¹At least 8 credits are required from the Practical Courses, at least 4 credits of these need to come from the list for the corresponding selected area of specialization. ²The complete catalog will be published on the web pages for the degree program. ⁴The Examination Board regularly updates the Practical Courses catalog. ⁵Changes will be announced on the web pages for the degree program at the latest on the first day of the semester. The following catalog contains an incomplete selection as an example.

Specialization in Multiscale Material Principles

No.	Module number	Name	Type of instruction SWS	Sem.	SWS	ECTS	Type of examination (weighting %)	Duration of examination	Language of instruction
1	CH1046	Materialchemisches Praktikum	8P	WiSe SoSe	8	8.0	Oral	30	d
2	MW0312	Thermofluidodynamisches Praktikum	4P	WiSe	4	4.0	Practical credit requirement		d

Specialization in Uncertainty Quantification and Mathematical Modeling

No.	Module number	Name	Type of instruction SWS	Sem.	SWS	ECTS	Type of examination (weighting %)	Duration of examination	Language of instruction
1	MW2268	Computational Aeroacoustics – Practical Course	4P	WiSe SoSe	4	4.0	Project work	--	d/e

2	EI74491	Modellierung von Lithium-Ionen-Zellen	1VO, 4PR	WiSe SoSe	5	5.0	Practical credit requirement (10%) Laboratory assignment (70%) Oral (20%)	- - 15	d
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Specialization in Materials in Engineering Applications

No.	Module number	Name	Type of instruction SWS	Sem.	SWS	Credits	Type of examination (weighting %)	Duration of examination	Language of instruction
1	MW2267	Design of Wind Turbines	4P	SoSe	4	4.0	Project work		e
2	MW1381	Fertigungstechnologien für Composite-Bauteile	4P	SoSe	4	4.0	Written exam	60	d

Specialization in Material Characterization, Testing & Surveillance

No.	Module number	Name	Type of instruction SWS	Sem.	SWS	ECTS	Type of examination (weighting %)	Duration of examination	Language of instruction
1	MW0300	Schwingungsmesstechnik Praktikum	4P	SoSe	4	4.0	Written exam	100	d
2	EI0660	Optomechatronische Messsysteme	2P	SoSe	2	5.0	Written exam (60%), laboratory assignment (40%)	60 -	d

Practical courses that can be additionally selected

The catalog will be published on the web pages for the degree program.

Scientific Skills: ¹At least, 4 credits from coursework are required. ²The credits can only be obtained as part of courses that are intended to test the competencies acquired. Only participation or attendance is not permitted as proof of courses and exams passed. ³Students can select courses offered by TUM or another institution of higher education/university if they enhance or expand the student's competencies in the area of research work (Scientific Reading/Writing). ⁴The seminars listed below are merely examples, the list is not complete:

- Management of Research Projects
- A Literary Writer's Lab
- Energy Communication
- Writer's Lab (Scriptorium)
- Engineer Your Text – Technical Writing
- Communication and Presentation
- Communicating Science
- Science-Learning

- Scientific Writing

Advanced Research Internship (ARI): ¹An advanced research internship amounting to 8 credits is required. This corresponds with a total course duration of six weeks that can be completed either in one go or in several blocks. ²The ARI can be conducted through a Professorship at the Technical University of Munich or another institution of higher education or a research institute cooperating with the TUM and ideally forms the basis for the master's thesis. ³The participation is verified by the institution where the research work was carried out in the form of coursework (creation of an academic poster and presentation) within the meaning of § 6(7) APSO. ⁴The research topic worked on during the ARI is assigned and supervised by an expert examiner within the meaning of the APSO (expert examiners are university educators from the TUM schools and departments involved in the Master's Degree Program Materials Science and Engineering) (thesis supervisor).

Credit balance for respective semester:

Semester	Credits Fundamentals	Credits Electives	Credits Practical Courses	Credits Scientific Skills	Credits ARI	Credits Master's Thesis	Total credits
1	30	0	0	0	0	0	30
2	10	10	8	2	0	0	30
3	0	20	0	2	8	0	30
4	0	0	0	0	0	30	30
Total	40	30	8	4	8	30	120

Appendix 2: Aptitude Assessment

Aptitude Assessment for the Master's Degree Program Materials Science and Engineering at the Technical University of Munich

1. Purpose of the Process

¹Eligibility for the Master's Degree Program Materials Sciences and Engineering, in addition to the requirements according to § 36(1)1 to 4, requires proof of aptitude as set out in § 36(1)5 in accordance with the following provisions. ²The special qualifications and skills of the candidates should correspond to the field of engineering with a focus on material science. ³Individual aptitude parameters are:

- 1.1 ability to do research work and/or basic research and methodological work;
- 1.2 existing expertise from bachelor's degree in engineering, mechanical engineering, electrical engineering, information technology, civil/environmental engineering, or chemical engineering, or comparable degree programs
- 1.3 adequate (subject-specific) language articulateness both in English and in German
- 1.4 ability and interest to acquire new complementary expert knowledge and methodical approaches
- 1.5 ability to efficiently apply theoretical knowledge in practice and
- 1.6 scientific interest in engineering problems.

2. Aptitude Assessment Process

- 2.1 The Aptitude Assessment process is carried out annually by the Munich School of Engineering Study Program Division.
- 2.2 Applications for admission to the Aptitude Assessment process for the winter semester must be submitted to the Technical University of Munich together with the documents listed in 2.3.1. through 2.3.5. and in § 36(1)3 and § 36(1)4 no later than 31 May (absolute deadline) using the online application procedure.
- 2.3. The application must include:
 - 2.3.1 curriculum vitae formatted as a table;
 - 2.3.2 transcript of Records with modules of at least 140 credits for a six-semester bachelor's program, at least 170 credits for a seven-semester bachelor's program, and at least 200 credits for an eight-semester bachelor's program as proof of the average grade and the subject-specific individual grades; the Transcript of Records must be issued by the relevant examination authority or the relevant academic programs office,
 - 2.3.3 the form provided by the Study Program Division at the Munich School of Engineering in which the applicant compiles the grades and credit points of all examinations taken so far,
 - 2.3.4 a short description in English (max. one DIN A4 page) of the bachelor's thesis (regardless of its size) or comparable coursework amounting to at least 8 credits that covers the content of the work, the methods used and the (expected) results,
 - 2.3.5 an English-language written statement (max. 1 A4 page) of the reasons for choosing the Master's Degree Program Materials Science and Engineering at the Technical University of Munich, in which the candidate explains those specific abilities and interests that make him/her particularly qualified for the program; a candidate's exceptional motivation and commitment is to be

demonstrated by providing details, for example, on program-related vocational training, internships, stays abroad, or program-related further education beyond the attendance and course requirements of the bachelor's program, if necessary by appropriate documentation, further guidelines for the written statement are provided by the aptitude parameters listed in No. 1.1 to 1.6,

- 2.3.6 a declaration that the written statement and the brief description of the bachelor's thesis or a similar seminar paper are the applicant's own work and that the applicant has clearly identified any ideas taken from outside sources.

3. Aptitude Assessment Commission

- 3.1 ¹The Aptitude Assessment is conducted by a commission that is normally made up of the Dean for Academic Affairs responsible for the Master's Degree Program Materials Science and Engineering, at least two university educators, and at least one academic staff member. ²At least half of the Commission members must be members of the professorial faculty. ³At least one student representative works with the Commission in an advisory role.
- 3.2 ¹The members are appointed by the MSE Study Program Division with the Dean for Academic Affairs. ²At least one university educator is appointed as a deputy member of the Commission. ³The Dean for Academic Affairs is normally the chair of the Commission. ⁴Procedures are governed by Art. 41 of the Bavarian Higher Education Act [BayHSchG] as amended.
- 3.3 ¹If the Commission commences work in accordance with this statute, the revocable transfer of specific tasks to individual Commission members is permitted. ²If only one Commission member commences work to perform certain tasks in accordance with Sentence 1, they must be a university educator. ³If two or more Commission members commence work to perform certain tasks in accordance with Sentence 1, at least half of them must be university educators. ⁴The Commission ensures appropriate distribution of work. ⁵If there is freedom of discretion for one assessment criterion in the Aptitude Assessment and at least two Commission members are involved in the assessment of this criterion, the Commission members will assess independently according to the specified weighting, unless otherwise regulated. The points total will be calculated as the arithmetic means of the individual assessments, rounded up to the nearest full point.

4. Admission to the Aptitude Assessment Process

- 4.1 Admission to the Aptitude Assessment process requires that all documentation specified in No. 2.3 has been submitted in a timely and complete fashion.
- 4.2 Applicants who have fulfilled the requirements will be assessed according to No. 5.
- 4.3 Applicants who are not admitted will receive a notification specifying the reasons and providing information on legal remedies.

5. Stages of the Aptitude Assessment Process

5.1 First Stage

- 5.1.1 ¹The Commission assesses the written application documents required in accordance with No. 2.3 to establish whether an applicant is suitable for studies in accordance with No. 1. ²For this purpose, the commission evaluates and grades the candidate's application documents on a scale ranging from 0 to 90 points, 0 being the worst and 90 the best possible result.

- a) Final Grade

¹The applicant will be awarded 3 points for each tenth that the average calculated from examinations in the amount of 140 credits is better than 2.5. ²The maximum number of points is 45. ³Negative points will not be awarded. ⁴Grades of international degrees will be converted by applying the Bavarian formula.

⁵If the candidate has submitted a degree certificate containing more than 140 credits with the application, the assessment will be made on the basis of the modules with the best grades amounting to 140 credits. ⁶The applicant needs to submit a list of the results together with the application and confirm its accuracy in writing.

⁷The average is calculated from graded module examinations amounting to 140 credits.

⁸The overall grade average is calculated as a weighted grade average. ⁹The grade weights of the individual modules correspond to the credits assigned to each module.

b) Discipline-Specific Skills and Qualifications

¹The curricular analysis of existing expertise is conducted on the basis of competencies, rather than a schematic comparison of modules. ²It is oriented to the elementary subject groups listed in the following table that are taken into consideration for bachelor's graduates from engineering degree programs.

Field	Module	ECTS - TUM
Fundamentals of Engineering	Applied Mechanics I	6
	Applied Mechanics II	6
	Applied Mechanics III	7
	Continuum Mechanics	7
	Fluid and Solid Mechanics	5
	Thermodynamics I	5
	Thermodynamics II	5
	Informatics for Engineering I	5
	Informatics for Engineering II	5
	Control Technology/Control Systems	4
	Computer-Assisted Solid and Fluid Dynamics	5
	Fluid Dynamics II	5
	Modeling of Uncertainty in Engineering	5
	Uncertainty Quantification in Mechanical Engineering	5
	Model Construction for Structural Analysis and Vibro-Acoustic Questions	6

	Material Science I	5
	Material Science II	5
	Signal Display	5
	Fundamentals of Heat Transfer	5
	Heat Transfer Phenomena	4
	Technical Electricity Science	6
	Computational Fluid Dynamics	5
	Models of Structural Mechanics	5
	Numerical Methods for Engineers	5
	Digital Circuits for Engineers	4
	Circuit Technology 1	6
	Circuit Technology 2	6
	Construction and Environmental Informatics 1	5
	Construction and Environmental Informatics 2	5
Science Fundamentals	Mathematical Fundamentals	8
	Differential and Integral Calculus	8
	Numerical Treatment of Partial Differential Equations	5
	Algorithmics of Partial Differential Equations	5
	Modeling and Simulation with Ordinary Differential Equations	6
	Physics	9
	Chemistry	7
	Higher Mathematics 1	6
	Higher Mathematics 2	6
	Higher Mathematics 3	4
	Linear Algebra	7
	Analysis 1	6

	Analysis 2	7
	Analysis 3	7
	Algorithms and Data Structures	5
	Numerical Mathematics	5
	Discrete Mathematics for Engineers	5
	Applied Mathematics	4

³If it is established that there are no significant differences in the competencies acquired (learning outcomes), a maximum of 25 points will be awarded. In this case, one point can be awarded for one area of expertise. ⁴If listed modules from different degree programs serve the acquisition of identical or comparable competencies, only one point can be awarded per competency.

⁵If a GRE or GATE test is to be presented in accordance with § 36(1)2, it will be assumed upon corresponding verification of this that, with regard to the competencies proven through the first academic degree, there are no significant differences in terms of the level compared with the reference criteria named under 5.1.1 b) and the curricular analysis is carried out in accordance with the above-mentioned criteria.

c) Brief description of the bachelor's thesis or comparable coursework

The brief description of the bachelor's thesis or comparable coursework amounting to at least 8 credits, in which the applicant explains the research idea, objective of the work, academic relevance within the framework of the state of research, research-leading questions and central hypotheses as well as presents and discusses the methods used and results, is assessed with a maximum of 10 points.

d) Letter of motivation

¹The applicant's written statement will be evaluated by two Commission members and graded on a scale of 0 – 10 points using the following criteria:

1. factual but appealing formulation of the application objective
2. a well-structured presentation of the connection between personal interests and the research-related content of the degree program,
3. convincing justification of the special suitability for the master's degree program, proven through arguments and meaningful examples (see no. 2.3.5),
4. key points of justification are highlighted linguistically in an appropriate way,
5. English spelling and grammar rules adhered to.

²The Commission members independently assess each of the five criteria with equal weighting. ³Each member will assign points for the result on a scale from 0 to 10, 0 being the worst and 10 being the best possible result. ⁴The points total will be calculated as the arithmetic means of the individual assessments, rounded up to the nearest full point.

5.1.2 ¹The points total in the first stage will be calculated as the sum of the individual evaluations. ²Decimal places must be rounded up.

5.1.3. ¹Applicants with at least 60 points will be accepted and receive confirmation of the passed Aptitude Assessment. ²Unsuitable applicants with 40 points in total or less will receive a letter of rejection stating the grounds for rejection and informing them of legal remedies that is signed by the head of the university. ³ Signatory power may be delegated.

5.2. Second stage of Aptitude Assessment (Aptitude Assessment Interview)

5.2.1 ¹The remaining applicants will be invited to an Aptitude Assessment Interview. ²As part of the second stage of the aptitude assessment, the qualification obtained from the bachelor's degree and the result of the aptitude assessment interview will be evaluated. ³Interview appointments will be announced at least one week in advance. ⁴Time slots for interviews must be scheduled before expiration of the application deadline. ⁵The interview appointment must be kept by the applicant. ⁶If the applicant is unable to attend an aptitude assessment interview due to reasons beyond his/her control, a later appointment may be scheduled upon a student's well-grounded request, but no later than two weeks before the beginning of classes.

- 5.2.2 ¹The aptitude assessment interview is to be held individually for each applicant. ²The interview will be held in German and in English and last at least 20 but not more than 30 minutes for each applicant. ³The interview will focus on the following topics:
1. exceptional motivations for the Master's Degree Program Materials Sciences and Engineering according to the criteria named under No. 2.3.5 for the assessment of the written statement,
 2. fundamentals and application-related questions from the area of mathematics, mechanics, physics, chemistry and other traditional engineering disciplines to assess the discipline-specific qualifications,
 3. assessment of personal aptitude profile; applicants will be evaluated, for example, on their ability to convincingly demonstrate information using arguments and meaningful examples and appropriately respond to interview questions.
 4. ability to implement theoretical knowledge in practice; this can be, for example, by demonstrating clear understanding of questions and contexts in material science by outlining the solution to an example problem.
 5. language skills in English and German.
- ⁴The above topics may cover the documentation submitted according to 2.3. ⁵Any subject-specific academic knowledge that is to be taught in the Master's Degree Program Materials Sciences and Engineering will not affect the decision. ⁶With the applicant's approval, a representative of the student body may sit in on the interview.
- 5.2.3 ¹The Aptitude Assessment Interview is conducted by two members of the Commission. ²The Commission members independently assess each of the five points with the five points being weighted equally. ³Each member will assign points for the result of the aptitude assessment interview on a scale from 0 to 70, 0 being the worst and 70 being the best possible result. ⁴The points total will be calculated as the arithmetic mean of the individual evaluations from the Commission members. ⁵Non-vanishing decimal places must be rounded up.
- 5.2.4 ¹The total number of points awarded in Stage 2 is the sum of the total points from No. 5.2.3 and the points from No. 5.1.1 a) (overall grade) and 5.1.1. b) (subject-specific qualification). ²Applicants achieving 80 points and above in the second stage will be assessed as suitable.
- 5.2.5 ¹The applicant will be notified of the result of the Aptitude Assessment determined by the Commission in writing. ²The official notification is to be signed by the President of the Technical University of Munich. ³Signatory power may be delegated. ⁴A letter of rejection should state the grounds for rejection and inform the applicant of legal remedies.
- 5.2.6 Admissions to the Master's Degree Program Materials Science and Engineering apply for all subsequent applications for that degree program.

6. Documentation

¹The Aptitude Assessment process must be documented, including the date, duration, and location of the assessment, the names of the participating Commission members, the applicant's name, the assessment by the Commission members, and the overall result. ²The documentation must indicate the key reasons and the topics of the interview with the applicant; the key reasons and the topics can be listed as keywords.

7. Repeat Aptitude Assessments

Applicants who are not assessed as suitable for the Master's Degree Program Materials Science and Engineering can register for the Aptitude Assessment again.