Study regulations of the Master course Materials Science

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TECHNISCHE UNIVERSITÄT DARMSTADT

Inofficial translation! Only the German version "Ordnung des Studiengangs M.Sc. Materials Science" is legally binding!

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Study regulations of the Master of Science (M.Sc.) course Materials Science

1. Implementation Regulations

Referral to § 2 (1): Academic degrees

The anglophone study course Master of Science (M.Sc.) is sustained by the Department of Materials and Earth Sciences of Technische Universität Darmstadt. Technische Universität Darmstadt shall grant the academic degree Master of Science (M.Sc.) after achievement of the necessary 120 credit points.

Referral to § 3 (5): Schedule of examinations

The examinations (course achievements, examinations) are scheduled in Appendix I (study and examination schedule) of these regulatory statutes.

Referral to § 5 (4): Modules, parts and character of the exams

In Appendix I (study and examination schedule) and Appendix III (module guide) the character of the exams (oral, written, special form, homework, etc.) is defined. Course achievements and examinations outside of the Materials Science department will be handled according to custom of the relevant department.

Referral to § 11 (5): General admission requirements – language skills

The language of instruction is English.

Referral to § 17a (1-9): Admission requirements to Master courses

(1) Applicants for this degree course are required to 1st hold a Bachelor of Science in Materials Science of TU Darmstadt or an equivalent degree, 2nd have passed the admission examination, and 3rd have passed a practical internship of a duration of at least 6 weeks accepted by the Examination Board. This industrial internship may also be done subsequently during the course of studies but has to be completed - including the report on the internship - prior to the beginning of the master thesis. If the internship was already passed for the Bachelor course in Materials Science at TU Darmstadt, this requirement is fulfilled also for the Master course.

(2) The Examination Board conducts the admission examination as specified in §17a (1) an decides according to the criteria in Appendix II. The chairman of the Examination Board makes an overall assessment individually for each case within the course of the admission examination. On request, the applicant has to allow the Examination Board to look at his records on the subject of the precedent study course. Particularly decisive for the admission is the expected academic success within a reasonable time.

(3) The knowledge and understanding tested for in the admission examination is of the extent and manner as required for a Bachelor degree in Materials Science of TU Darmstadt. The admission examination comprises exams in three subjects of the catalogue given in Appendix II. The timing of the examination dates and the appointment of the examiners is done by the Examination Board. Examinations of equal value can be accredited by the Examination Board.

(4) Admission to the study course may be granted on the condition that further examinations have to be passed within a specified time limit with the intention to qualify the student for the master course. If the applicant is accepted under conditions, his/her registration at TU Darmstadt is preliminary and can be revoked. Admission can be denied if the extent of the additional requirements exceeds 20 credit points. If justified, the Examination Board may arrange for further requirements or for further aptitude tests as admission interviews or examinations.

(5) Upon admission the Examination Board may enforce or restrict the choice of adjustment modules or specific modules in the programme part "Elective Course Materials Science," in order to ensure a uniform state of knowledge and to avoid doubling competences from a previous course of studies. Adjustment courses need to be identified in the module guide of the Master course in Materials Science.

(6) The Examination Board may accept an applicant without any assessment if it shows without a doubt that he/she is sufficiently qualified, especially if the applicant holds a Bachelor of Science of Materials Science of TU Darmstadt or an equivalent degree. Admission may be denied by the

Examination Board without any aptitude test if it is evident without doubt from the submitted documents that the extent of further requirements would exceed 20 credit points.
(7) If personal appearance cannot reasonably be expected of the applicant for financial or geographical reasons, the Examination Board offers to have the examination interview via internet video telephone. It is the applicant's task to arrange for the technical organization for his/her part.

Referral to § 19 (1-2): Dates of exams

Course examination of modules comprising examinations are supposed to take place in a period from two weeks before to four weeks after the end of the lecture. A make-up examination will be offered before the beginning of the subsequent semester.

Referral to §22 (2): Implementation of exams

The duration of oral examinations is 30 min for modules with lectures in the mandatory part of the programme and for the modules „Quantum Mechanics for Materials Science" und „Micromechanics and Homogenization Techniques". It is 15-30 min for seminar talks and for single examinations in the programme part „Elective Courses Materials Science", to the extent that they are offered by the department offering the Master course.

Referral to §22 (5): Implementation of exams

The duration of written examinations is 90 min for modules with lectures in the mandatory part of the programme and for the modules „Quantum Mechanics for Materials Science" und „Micromechanics and Homogenization Techniques". It is 60 min for modules in the programme part „Elective Courses Materials Science" to the extent that they are offered by the department offering the Master course.

Referral to §23 (2): Thesis – subject and requirements

Admission requirements to the Master Thesis are that the candidate (i) has acquired at least 75 credit points in the framework of the Master course, (ii) has completed the module "Advanced Research Lab with Seminar" successfully, and (iii) has fulfilled all imposed requirements if applicable (see "Referral to §17a (1-5)", (4) and (5)). The subject of the Master Thesis can only be issued after the candidate has fulfilled all requirements. It is to the Examination Board to decide about exceptions. On request, the chairman of the Examination Board arranges for the applicant to be provided with a thesis subject in due time.

Referral to § 23 (5): Thesis – handling time

The Master Thesis (amount of work: 810 hours) has to be prepared and handed in within 26 weeks. The Master Thesis is completed by a public presentation with discussion.

Referral to § 25 (3): Generation and weighting of grades

Appendix III (the module guide) specifies the weight of the grades of the single course achievements and examinations within the grade of each module. For modules not offered by the sub-department of Materials Science, the regulations of the offering unit hold. If nothing else is specified, the grades of the course achievements and examinations related to module parts are weighted with their corresponding credit points in the module's overall grade.

Referral to § 26 (2): Evaluation of course achievements and examinations

The grade for the Master Thesis defines the grade of the final module. The public presentation with discussion is an ungraded course achievement that needs to be passed. The presentation has a length of 30-45 min and is assessed by the responsible Master Thesis supervisor.

Referral to § 27 (5): Pass and fail – elective programme parts

(1) In the programme part „Quantum Mechanics/Micromechanics" the student shall choose the module „Quantum Mechanics for Materials Science" or the module „Micromechanics and Homogenization Techniques" according to the planned orientation of the studies towards functional

materials of structural materials. The respective other module may be chosen in the programme part “Elective Courses Materials Science”, if desired.
(2) The programme part “Elective Courses Materials Science” constitutes a frame of 29 credit points that shall be filled with modules from materials science or nearby areas such as physics, chemistry, electric engineering, mechanical engineering and materials engineering.
(3) Because of the heterogeneity of materials science and engineering the choice according to (1) and (2) should be discussed and agreed with the mentor. It shall be fixed from the second semester in an individual examination plan. Elective courses outside the choice offered by the sub-department Materials Science have to be approved by the Examination Board. The possible choices may be restricted upon admission by the Examination Board (Referral to § 17a (1-9), (5)).
(4) Credit points from adjustment modules (Referral to § 17a (1-9), (5)) are credited in the programme part “Elective Courses Materials Science”.
(5) In justified cases approved by the chair of the Examination Board, an adjustment course may be taken as an elective course.
(6) Modules of materials science that consist only of a lecture should be examined together as two or three modules at a time.
(7) The programme part “Elective Courses (not Materials Science)” constitutes a frame in the extent of 9 credit points that should be filled with modules of all departments, the interdisciplinary major fields of study, the fields of study of TU Darmstadt, as well as the courses of the language center. Courses of other areas, such as the Musikakademie Darmstadt, may be given credit for if the Examination Board agrees. Courses in mathematics, natural and engineering sciences shall only be considered, if they are not suitable for the programme part “Elective Courses Materials Science”.

Referral to § 28 (3): Cumulative grade

“Research Labs I and II”, „Advanced Research Lab“, and the modules of the programme part “Elective Courses (not Materials Science)” (together 32 credit points) have to be passed, but do not contribute to the final grade of the Master course. The grades of the other modules and the thesis module are weighted with their credit points in the final grade. Additionally, the grade of the thesis module is weighted with a factor 1.5 (one point five).

Referral to § 31 (1): Second repeat

If the second re-examination is only a written examination it can be conducted orally if both the candidate and the examiner agree to it. The written request of the candidate has to be filed to the examiner at least 4 weeks prior to the examination.

Referral to § 39 (2): Entering into force

These Regulatory Statutes become effective on October 01, 2015. They will be published in the supplements to the statutes of the Technische Universität Darmstadt.
With entering into force of theses statutes the statutes from February 12, 2011 (supplements to the statutes of the Technische Universität Darmstadt 5.11) go out of force.
Courses of studies that have already been entered can be finished according to the previous statutes upon request. The request has to be filed with the responsible study office within one year of the entering into force of these statutes.

Appendix I Study and Examinations Plan
Appendix II Competence Descriptions
Appendix III Module Guide
Appendix IV Internship Regulations

Darmstadt, June 2, 2015
The Dean of Department 11 Materials and Geosciences of Technische Universität Darmstadt
Prof. Dr. Dr. h.c. Ralf Riedel

1.1. Appendix I: Studies and Examinations Plan

Legend	
Grading system:	St = standard (graded); bnb = pass/fail
Type of exam:	s = written; m = oral; m/s = written or oral; R = talk; A = delivery; Th = thesis
Length:	Lenght of the examination in min (optional)
Weight:	For courses = weight of the exam grade for he module grade For moduls = weight of the module grade for the cumulative grade
SWS:	contact hours per week
Status:	o = obligatory; f = optional
Type of course:	VL = lecture; Ü = exercises; S = seminar; P = lab
CP:	credit points
AB:	implementation regulations
APB:	general exam regulations of TU Darmstadt

TUCaN no. and attribution of CP to module building blocks have informative character. CP are credited after finishing the respective module.		Exminations: Examination	Exminations: Course achievement	Exminations: Type of exam	Exminations: Length (min)	Exminations: Weight	Course: SWS	Course: Status	Course: Type of course	Sum	Semester: The attribution of examinations to semesters has recommendatory character Workload per semester (CP)			
										CP	**1.**	**2.**	**3.**	**4.**
Mandatory programme part							**49**	**o**		**46**				
11-01-4101	Research Lab I		bnb	A		0	4	o		4				
11-01-4011-pr	Research Lab I						4	o	P		4			
11-01-4102	Research Lab II		bnb	A		0	4	o		4				
11-01-4012-pr	Research Lab II						4	o	P			4		
11-01-4103	Advanced Research Lab with Seminar		bnb	A + R	R: 15-30	0	26	o		15				
11-01-4013-pr	Advanced Research Lab with Seminar						26	o	P & S				15	
11-01-4104	Functional Materials	St		m/s	m: 30 / s: 90	6	4	o		6				
11-01-1036-vl	Functional Materials						4	o	VL		6			
11-01-4105	Surfaces and Interfaces	St		m/s	m: 30 / s: 90	5	3	o		5				
11-01-7922-vl	Surfaces and Interfaces						3	o	VL		5			
11-01-4106	Theoretical Methods in Materials Science	St		m/s	m: 30 / s: 90	6	4	o		6				
11-01-9314-vl	Theoretical Methods in Materials Science						3	o	VL			6		
11-01-9314-ue	Theoretical Methods in Materials Science						1	o	Ü					
11-01-4107	Advanced Characterization Methods of Materials Science	St		m/s	m: 30 / s: 90	6	4	o		6				
11-01-9313-vl	Advanced Characterization Methods of Materials Science						3	o	VL			6		
11-01-9313-ue	Advanced Characterization Methods of Materials Science						1	o	Ü					
Elective programme part Quantum Mechanics/Micromechanics (see AB § 27(5)) (Type §30 (5) APB mit restricted module changes)							**4**	**o**		**6**				
11-01-4108	Quantum Mechanics for Materials Science	St		m/s	m: 30 / s: 90	6	4	f		6				
11-01-4004-vl	Quantum Mechanics for Materials Science						3	o	VL					
11-01-4004-ue	Quantum Mechanics for Materials Science						1	o	Ü					
11-01-4109	Micromechanics and Homogenization Techniques	St		m/s	m: 30 / s: 90	6	4	f		6				
11-01-7050-vl	Micromechanics and Homogenization Techniques						3	o	VL					
11-01-7050-ue	Micromechanics and Homogenization Techniques						1	o	Ü					
Programme part Elective Courses Materials Science (Moduls exemplary, see AB § 27(5)) (Type §30 (6) APB with unrestricted module changes)							**15**	**o**		**29**				
11-01-2005	Fundamentals and Technology of Solar Cells					4	2	f		4				
11-01-8401-vl	Fundamentals and Technology of Solar Cells	St		m/s	m: 15-30 / s: 60	1	2	o	VL			4		
11-01-2008	Graphen and Carbon Nanotubes - from fundamentals to applications					4	2	f		4				
11-01-2008-vl	Graphen and Carbon Nanotubes - from fundamentals to applications	St		m/s	m: 15-30 / s: 60	1	2	o	VL			4		
11-01-3018	Mathematical Methods in Materials Science	St		m/s	m: 15-30 / s: 60	4	2	f		4				
11-01-8662-vl	Mathematical Methods in Materials Science						2	o	VL				4	
05-27-2996	Dynamik von Polymeren (Experimentell)		St	The regulations of the department that offers the respective module hold.		5	2	f		5				
05-27-2997-se	Dynamik von Polymeren						2	o	S			5		
07-08-0301	Chemische Prüfung von Zellstoff und Papier - (M.CPZP)		St			4	2	f		4				
07-08-0104-vl	Chemische Prüfung von Zellstoff und Papier - (M.CPZP)						2	o	VL		4			
16-08-5210	Einführung in die Kunststofftechnik	St				4	2	f		4				
16-08-5210-vl	Einführung in die Kunststofftechnik						2	o	VL				4	
18-sw-1010	Halbleiterbauelemente	St				4	3	f		4				
18-sw-1010-vl	Halbleiterbauelemente						2	o	VL		4			
18-sw-1010-ue	Halbleiterbauelemente						1	o	Ü					
Programme part Elective Courses (not Materials Science) (moduls exemplary, see AB § 27(5)) (type §30 (6) APB with unrstricted module change)							**6**	**o**		**9**				
16-21-9050	Projektmanagement	St		The regulations of the department that offers the respective module hold.		0	2	f		2				
16-21-5050-se	Projektmanagement						2	o	VL		2			
41-40-0022	Germanische Sprachen lesen lernen					0	2	f		3				
41-40-1021-ku	Germanische Sprachen lesen lernen		St			1	2	o	S			3		
02-01-02m1	Erkenntnistheorie (M)					0	2	f		4				
02-01-0010-ku	Erkenntnistheorie für Ingenieure		bnb			1	2	o	S				4	
Final module								**o**		**30**				
11-01-5001	**Final module**					45		o		30				
11-01-4010-pj	Master Thesis	St		Th		1		o	P					27
11-01-4010-ko	Master Defense		bnb	R	30-45	0		o	S					3
Sum							68			**120**	31	32	27	30

Status: Regulary statutes 2016 - II, June1, 2016

1.2. Appendix II: Description of Competences

1.2.1. Competences at Entry

General requirements: The foundations and research oriented course in Materials Science with the degree Master of Science (M.Sc.) continues in general a foundations and research oriented Bachelor course in Materials Science with a final Bachelor Thesis of a duration of three months. For a successful study it requires knowledge and competences in the areas of materials science, chemistry, physics, and mathematics to an extent that is approximately equivalent to what is acquired during a successful Bachelor course in Materials Science at TU Darmstadt.

Admission examination: Materials Science is a strongly interdisciplinary course of study. Therefore graduates of different Bachelor courses may continue their studies with a Master course in Materials Science. Typically, this will be materials science, physics, or chemistry oriented Bachelor courses. But also graduates from mechanical, electric, or civil engineering may study after inspection by the Examination board. In order to facilitate the transition, an adjustment course was included into the study plan of the first semester to catch up with missing requirements for the Master course. Those students that do not require the adjustment course choose instead additional elective courses. Since even different Bachelor courses in Materials Science may be structured very differently, the Examination board inspects any application. This may result in the obligation to take certain courses, but also in an oral examination to check the ability to study and graduate in a reasonable amount of time. An appropriate mastery of the English language is another admission criterion.

1.2.2. Qualification Results

After graduation the graduates are enabled to…

- understand the foundations and principles of theoretical modelling of materials and to apply them to concrete problems,
- to realize the principles of quantum mechanics and transfer them to the properties of functional materials,
- to select and apply advanced experimental methods to characterize structure and function of materials,
- to label and classify the most important aspects of surface and interface properties of materials,
- to differentiate between the characteristic profiles of functional materials and select them appropriately,
- to independently plan, carry out, and evaluate materials science experiments.

The following abilities are conveyed in seminars, advanced labs and the master thesis:

- The development of the ability to expand the limits of the subject and to draw a link between recently gathered and previous knowledge.
- Introduction to playing the role of a creative designer, where he/she is creatively active and creates materials, products, processes or methods that did not exist before in this form or composition.
- The ability of the students to transfer a problem from practical experience to a question that can be answered by him/her by applying methods from science/research.
- Training of the ability and sovereignty to question statements referring to materials science or relevant for materials and to maintain his/her position in front of colleagues or laymen.
- Training of the skill to present the results of scientific work orally as well as in written form in a precise and comprehensible way.

- Ability to structure complex problems with adequate respect to relevant criteria arising from materials science, material engineering or ecology. This also includes economic questions specific to materials, which for example are linked to production costs depending on the availability of resources and technology.
- Ability to collaborate with other disciplines, i.e. ability to adopt problems from other disciplines and to realise, which of the scientific approaches are leading to the desired result. This particularly holds for the inseparably attached disciplines materials science and material engineering.
- Clarification of the societal challenges and of the impact on society that arise from the work of the materials scientist as well as encouragement to take over responsibility.
- Ability to target realistic but also very ambitious goals, to achieve them within an appropriate time and to reflect about the chosen path and the achieved results.

1.3. Appendix III: Module Guide

According to § 1 (1) of the statutes of TU Darmstadt from March 18, 2010 to regulate the publishing of statutes of TU Darmstadt, the module guide is published online.

1.4. Appendix IV: Internship Regulations

As another requirement for being accepted as a student in the Master course of study in Materials Science, the student has to prove his/her participation in an industrial internship with a duration of at least 6 weeks (this may also be a corresponding apprenticeship) by providing an internship report. This internship may also be attended while being a student of Materials Science already. It must be finished including the internship report, though, before starting the Master Thesis. Alternatively, an equivalent internship abroad or a technical or scientific project may be attended. In discussions with their mentors, the students should be given advice regarding the subject of the internship. The examination board decides if the internship report is accepted.
Before starting with the internship, the students should, informally but in writing, request acceptance of the chosen internship from the examination office. They will receive written notice on the acceptance of the internship as well as, later on, on completion of the internship. A corresponding apprenticeship may replace the internship, a job as a working student or on a production line, however, does not. The examination board or its representative decides if the internship is accepted.
Duration: At least 6 weeks with usual working hours.
Internship report: After finishing the internship, the student has to write a short report on the conducted work. It should be about 10 pages (DIN A4) in length. If the work conducted in the context of the internship is confidential and therefore an ordinary report cannot be written, it is absolutely necessary to state this already together with the request for the acceptance of the internship, i.e., before starting with the internship.
Assessment: The assessment of the internship will be carried out by the chair of the examination board or an assigned professor. A certificate on the completed internship issued by the provider of the traineeship (employer) plus the internship report have to be submitted to the chair of the examination board, who decides if the internship was successfully completed, and who also reports on its decision to the student and to the Dean's office (examination office). This decision needs to be available when the student registers for the Master Thesis. The internship reports are stored in the Dean's Office.
Companies: Particularly those companies are suggested that are active in materials engineering. Examples are: Merck (Darmstadt), Evonik and Heraeus (Hanau), Schott (Mainz), ASEA Brown Boveri (Mannheim). But also other enterprises in Germany or abroad may be chosen.
Research Institutes: Examples are: Gesellschaft für Schwerionenforschung (GSI), Fraunhofer Institutes (e.g. the Fraunhofer-Institute for Structural Durability and System Reliability in Darmstadt) and Max Planck institutes.