

Degree Programme Regulations for Materials Science Master of Science (M.Sc.)

Implementation regulations
with appendices

I: Study and examination plan

II: Competence descriptions

III: Module handbook (*published electronically only*)

dated 28 February 2024

Resolution of the Departmental Council: 28 February 2024

Entry into force of the Degree Programme
Regulations on: 01 June 2024



TECHNISCHE
UNIVERSITÄT
DARMSTADT

The Degree Programme Regulations for Materials Sciences, Master of Science (M.Sc.), of the Department of Materials and Earth Sciences, dated 28 February 2024, supplement the APB (Allgemeine Prüfungsbestimmungen – General Examination Regulations) of TU Darmstadt. These Degree Programme Regulations have been published based on the joint approval of the Executive Board of Technical University of Darmstadt on 16 May 2024 (Ref.: 652-9-1).

Darmstadt, 16 May 2024

signed by
The President of TU Darmstadt
Prof. Dr. Tanja Brühl

Disclaimer

Die englische Übersetzung dient nur zu Informationszwecken. Rechtlich verbindlich ist der deutsche Text.
The English translation is for information purposes only. The legally binding document is the German version.

Table of contents of the Degree Programme Regulations

Table of contents of the Degree Programme Regulations	2
Preamble	3
Article 1	3
Implementation regulations specifying the APB	3
Article 2	7
Appendix I Study and examination plan	7
Appendix II Competence descriptions	9
Appendix III Module descriptions	12
Article 3	13

Preamble

In accordance with Section 3(1) APB (Allgemeine Prüfungsbestimmungen – General Examination Regulations) of TU Darmstadt, the Departmental Council of the Department of Materials and Earth Sciences has adopted by resolution the following Degree Programme Regulations for Materials Science, Master of Science (M.Sc.), and the appendices listed below on 28 February 2024:

1. Appendix I Study and examination plan
2. Appendix II Competence descriptions
3. Appendix III Module descriptions

Article 1

Implementation regulations specifying the APB

To Section 2(1): Academic degrees

The degree programme in Materials Science, Master of Science (M.Sc.), is carried out by the Department of Materials and Earth Sciences of TU Darmstadt. TU Darmstadt awards the academic degree Master of Science once the total of 120 credit points (CPs) required for the degree programme have been achieved.

It is possible to study modules as part of a double degree option as per the cooperation agreements. Additional information on this option can be found in the study information of the degree programme.

To Section 5(3) and (4): Modules, examination components and type of examination

Appendix I to these implementation regulations, containing the study and examination plan (SPP), specifies the type (technical examination (Fachprüfung), study examination (Studienleistung)), scope, number and form or category of the examination as well as the weighting with which these examinations will be included in the overall grade for the module.

Examinations that are taken in other departments of TU Darmstadt are governed by the regulations of the departments offering them.

To Section 7(1): Examination boards – joint examination board of consecutive Bachelor's / Master's degree programmes

A joint examination board is being established for the Bachelor's degree programme in Materialwissenschaft (B.Sc.) (materials science – offered in German), and the Master's degree programme in Materials Science (M.Sc.).

To Section 11(2): General admission requirements – Online Self Assessment (OSA)

To be admitted to the Master's degree programme in Materials Science (M.Sc.), the applicant must provide proof of participation in an Online Self Assessment (OSA) that the Department of Materials and Earth Sciences offered for the degree programme.

To Section 11(5): General admission requirements – language of instruction

The degree programme is taught in English.

Some courses/modules can be offered in German. This is indicated in the module description. It can safely be assumed that scientific literature in German will have to be read and handled as well.

To Section 17a(1): Entry requirements for Master's degree programmes

The entry requirements for the Master's degree programme in Materials Science (M.Sc.) and, in particular, the prior knowledge and qualifications (entrance competencies) required from the applicants are defined below.

To Section 17a(2): Entrance competencies for a consecutive Master's degree programme

The entrance competencies for the consecutive Master's degree programme in Materials Science (M.Sc.) are based on the competence profile defined for the Bachelor's degree programme in Materialwissenschaft (B.Sc.) (materials science – offered in German) of TU Darmstadt that is used as a reference degree programme for admission to the Master's degree programme.

The entry requirement for the Master's degree programme in Materials Science (M.Sc.) is a Bachelor's degree in the reference degree programme of TU Darmstadt or a degree in a degree programme that teaches competencies that are not substantially different from those taught in the reference degree programme (comparable degree programme) and amount to 180 CPs at least.

Further details on entrance competencies taught in the reference degree programme at TU Darmstadt are specified in the competence description in Appendix II.

To Section 17a(4) lit. a) and b): Formal entrance examination

During the formal entrance examination, proof of the required entrance competencies is verified on the basis of the written documents to be submitted by the applicants.

The following documents must be submitted:

- The final transcript of records (Zeugnis) for the first degree and the Diploma Supplement or comparable documents for the degree programme leading to the first degree.

To Section 17a(4) lit. c), 17a(5): Substantive entrance examination

If the entrance competencies cannot be clarified positively or negatively during the formal entrance examination, a substantive entrance examination will subsequently be conducted.

A repetition of the entrance examination including a retake of the substantive examination within the same application period is not permitted.

As part of the substantive entrance examination:

- A 20-minute oral examination is conducted on the premises of Technical University of Darmstadt;
- A 20-minute oral examination is conducted via Internet-based video telephony that is unobjectionable under data protection law; or
- A 20-minute oral examination is conducted on the premises of an institution of higher education as part of a double degree option as per Section 2(1). The Examination Board can appoint a trustee on site (an employee of another university) to conduct a substantive entrance examination on the premises of the other institution of higher education.

To Section 17a(8): Admission subject to conditions

Admission can be granted subject to conditions if, after an entrance examination, it is found that the applicant lacks entrance competencies that can be compensated by completing modules amounting to no more than 30 CPs. The letter of admission will list the dates by which the modules or technical examinations (Fachprüfungen) must be successfully completed to meet the conditions for admission.

The conditions are governed by the APB (Allgemeine Prüfungsbestimmungen – General Examination Regulations) of TU Darmstadt with the exception of the second retake examination in accordance with Section 31 APB and the oral supplementary examination (mEP) in accordance with Section 32 APB; that is, only two attempts per condition are permitted.

To Section 18: Admission requirements

The admission requirements for examinations or modules, if any, are specified in Appendix I and III to these implementation regulations, containing the study and examination plan (SPP) and the module descriptions, respectively.

To Section 22(1): Conducting examinations – duration of the oral examination

The duration of the oral examination (at least 15 minutes per candidate and examination) is specified in Appendix I to these implementation regulations, containing the study and examination plan (SPP).

To Section 22(5): Conducting examinations – duration of proctored/monitored examinations

The duration of proctored/monitored examinations (Aufsichtsarbeiten) (at least 45 minutes) is specified in Appendix I to these implementation regulations, containing the study and examination plan (SPP).

To Section 22(6): Conducting examinations – special forms of examination

The minimum duration of examinations categorised as special forms of examination is specified in Appendix I to these implementation regulations, containing the study and examination plan (SPP).

To Section 23(2): Thesis – requirements

For the topic of the thesis (Abschlussarbeit) to be issued, the student must have completed the following modules successfully:

- Functional Materials
- Surfaces and Interfaces
- Theoretical Materials Science
- Advanced Characterisation Methods
- Sustainable Materials

as well as the Compulsory Elective area “Quantum Mechanics/Micromechanics”.

To Section 23(3): Thesis (Abschlussarbeit) – topic

The topic of the thesis (Abschlussarbeit) must be approved by the Examination Board.

To Section 23(5): Thesis (Abschlussarbeit) – completion time

The thesis (Abschlussarbeit) includes a workload of 30 CPs (900 hours) and must be completed and submitted within 26 weeks.

To Section 25(1) and (3): Formation and weighting of grades

The assessment system (BWS) for each examination is specified in Appendix I to these implementation regulations, containing the study and examination plan (SPP). The study and examination plan also specifies how the grades for the technical examinations (Fachprüfungen) and study examinations (Studienleistungen) are weighted for module grading.

To Section 28(2): Overall grade

Appendix I to these implementation regulations, containing the study and examination plan (SPP), specifies how the module grades are weighted for overall grading. Unless otherwise specified in Appendix I, the module grades are included and weighted in the overall grade according to the credit points earned in the modules.

To Section 30(1a): Bettering one's grade

An attempt to better one's grade is only possible in the examination(s) indicated accordingly in Appendix I (study and examination plan).

Article 2

Appendices

Appendix I Study and examination plan

Appendix II Competence descriptions

Entrance competencies

General requirements: The research-oriented degree programme in Materials Science resulting in a Master of Science (M.Sc.) generally requires a fundamental Bachelor's degree programme in Materialwissenschaft / Materials Science with a 3-month thesis completion time, and requires knowledge and competencies in the field of materials science, chemistry, physics, engineering sciences and mathematics to ensure successful studies, as acquired in the Bachelor's degree programme in Materialwissenschaft (B.Sc.) (material science – offered in German), at TU Darmstadt (reference degree programme).

Qualification objectives

Professional competence

Graduates competently master the fundamentals of materials science relating to mathematics and natural sciences, critically examine and refine them. They put interdisciplinary challenges into context of state-of-the-art research and technology in materials science, and elaborate and assess methods of resolution, and implement solutions independently. They have acquired comprehensive knowledge and skills in material science-related fundamentals that enable them to work on scientific questions of neighbouring disciplines. In select fields of materials science and neighbouring disciplines, they have consolidated their critical understanding based on state-of-the-art research and technology. They can apply this knowledge to interdisciplinary questions and broaden this knowledge.

Competence of abstraction

Graduates can phrase and critically apply physical models for materials science-related questions. They can design and conduct appropriate laboratory-based or numerical experiments. They know the limits of models and examine resulting modelling critically. They can examine and contrast various modelling methods carefully. In doing so, they refine existing models or formulate new models.

Methodological competence

Graduates master the basics of scientific working methods and apply research strategies specifically related to research questions. They look through research- and patent-related literature, analyse lectures and talks on current research topics critically, and put these sources into the context of research. They generate data on complex materials science-related questions and analyse these data using scientifically recognised methods. At the same time, they independently refine experiments, numerical modelling and methods of data analysis. They report and discuss their scientific findings clearly and from all angles in spoken and written form.

Social competence

Graduates can develop positions and solutions to complex, interdisciplinary problems by examining these problems critically and defending their positions and solutions convincingly. They lead interdisciplinary teams, define collective strategies and ensure their implementation. They influence social processes discriminately, thoughtfully, with a strong sense of responsibility and in the interest of a democratic community.

Self-competence

Graduates are able to reflect self-critically on their own expertise, actions and abilities regarding current challenges to our society based on the current state of research and technology and to assess

their expertise, actions and abilities adequately. They have developed a realistic and positive self-concept of their professional competencies. They acquaint themselves with complex, interdisciplinary questions, continue their training independently and purposefully by organising their ongoing learning processes on their own.

Linguistic competencies

Graduates can express themselves adequately, appropriately and in a sophisticated manner in a mathematical, scientific and technical context. This encompasses phrasing complicated mathematical problems, programming complex field-specific application programs, mastering field-specific professional German, in addition to basic skills in field-specific professional English.

Students who successfully completed their degree programme will be able to:

- Explain the fundamentals and principles of theoretical modelling of materials and to apply them to specific problems;
- Explain the principles of quantum theory and to apply them to the properties of functional materials;
- Select and apply advanced experimental methods required to characterise materials structurally and functionally;
- Name and put into context the most important aspects of surface- and interface properties of materials;
- Plan, conduct and evaluate materials science-related experiments on their own;
- Analyse the property profiles of materials from all angles, to assess materials with regard to sustainability aspects and to select suitable materials;
- Penetrate complex problems by understanding and broadening the relevant scientific fundamentals to do so, to develop new engineering-specific methods to solve them, and to coordinate holistic solutions in a team by combining methods and competencies from disciplines of natural and technical sciences as needed;
- Identify social challenges and to assess the consequences of their activities with regard to social, economic, safety/security-related and environmental aspects. They critically reflect on their professional actions in these respects. This allows graduates to play a decisive role in shaping social processes with a strong sense of responsibility and in the interest of a democratic community, even beyond the narrower professional area of responsibility.

The following skills and abilities are being imparted through seminars, work placements and labs for consolidation, and the Master's thesis; thus enabling graduates:

- To extend the boundaries of the field and to put new and existing knowledge into perspective;
- To work on complex, interdisciplinary, problems relating to technology and science in a team or on their own, to coordinate teams and to instruct team members as necessary;
- To assume the role of a designer who creates materials, products, processes or methods through innovation and invention that have not existed in this form or composition previously;
- To translate real-world problems into questions to be solved and worked on based on the methods of research and science;
- To question materials science-related or material-related statements critically, and to defend their own position convincingly in front of expert colleagues and non-experts;
- To implement FAIR principles when handling research data, and to organise workflows accordingly;
- To present findings of scientific working methods precisely and clearly in spoken and written form;
- To structure complex problems by considering relevant criteria from materials science, materials engineering and ecology appropriately;

- To collaborate with other disciplines. Graduates can pick up problems from other disciplines and can identify which scientific methods will be most useful to solve them. This applies particularly to materials science and materials engineering that are so closely connected, they cannot be considered separately;
- Graduates are able to set realistic, though challenging goals, which they achieve in a reasonable period of time, and to reflect on their findings and how to get there.

Appendix III Module descriptions

The module descriptions are published electronically as a module handbook (MHB) in accordance with Section 1(1) of the Statute of Technical University of Darmstadt regulating the publication of statutes of Technical University of Darmstadt, dated 18 March 2010.

Article 3

Entry into force

The Degree Programme Regulations come into force on 01 June 2024. The courses offered in accordance with these Degree Programme Regulations start on 01 October 2024. They will be published in the Satzungsbeilage (appendix to the statutes) of TU Darmstadt.

With these Degree Programme Regulations coming into force, the Degree Programme Regulations, dated 08 March 2023 (Satzungsbeilage – appendix to the statutes 2023-V), cease to apply in accordance with Section 38a.

Darmstadt, 17 May 2024

gez. Prof. Dr. Karsten Durst
The Departmental Chairperson of Materials and Earth Sciences
of TU Darmstadt