

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

Implementation regulations
with appendices

I: Study and examination plan

II: Competence descriptions

III: Module handbook (*published electronically only*)
dated 11 July 2022

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.



TECHNISCHE
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The Degree Programme Regulations for Synthetic Biology of the Department of Biology, dated 11 July 2022, supplementing the APB (*Allgemeine Prüfungsbestimmungen – General Examination Regulations*) of TU Darmstadt have been published based on the joint approval of the Executive Board of TU Darmstadt on 22 December 2022 (Ref.: 651-8-1).

Darmstadt, 22 December 2022

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

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Preamble

In accordance with Section 3(1) APB (*Allgemeine Prüfungsbestimmungen* – General Examination Regulations) of TU Darmstadt, the Departmental Council of the Department of Biology has adopted by resolution the following Degree Programme Regulations for Synthetic Biology, Master of Science (M.Sc.), including the appendices listed below, on 11 July 2022:

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 Synthetic Biology, Master of Science (M.Sc.), is carried out by the Department of Biology 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.

To Section 3(4): Examination schedule

It is best to take all examinations in the sequence specified and the semester recommended in Appendix I.

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 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.

Hence, 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 Synthetic Biology and, in particular, the prior knowledge and qualifications (entrance competencies) required from the applicants are defined below.

Applications for the Master's degree programme in Synthetic Biology are possible for applicants until 15 July of the year (cut-off period) for a winter semester.

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

The entrance competencies for the consecutive Master's degree programme in Synthetic Biology are based on the competence profile defined for the Bachelor's degree programme in *Biologie* (biology) 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 Synthetic Biology 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 at least 180 CPs.

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 transcript of records (*Zeugnis*) for the first degree and the Diploma Supplement or comparable documents for the degree programme leading to the first degree;

Applicants must also submit the following documents:

- A current performance overview (*Leistungsübersicht*);
- Proof of entrance competencies in an equivalence list;
- Proof of relevant practical laboratory experience;
- Summary of the topic of the Bachelor's thesis, including explanations on the methods used.

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 possible retake of the substantive examination within the same application period is not permitted.

As part of the substantive entrance examination, an oral examination of at least 30 minutes is conducted either on the premises of TU Darmstadt or via Internet-based video telephony that is unobjectionable under data protection law.

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 (SSP) 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

In accordance with Section 22(1) and (5) APB, the duration of the oral examination is specified in Appendix I to these implementation regulations, containing the study and examination plan (SPP).

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.

Article 2

Appendices

Appendix I Study and examination plan

Appendix II Competence descriptions

Entrance competencies

The entrance competencies are essentially derived from the qualification results of the reference degree programme in “*Biologie* (B.Sc.)” (biology) of TU Darmstadt. The following minimum field-specific research competencies and practical skills are expected, as well as a previous degree in a comparable degree programme that imparts competencies amounting to at least 180 CPs:

- First-year students have a broad fundamental knowledge of life sciences as well as in-depth knowledge of at least 24 CPs from compulsory elective modules in at least one of the following areas: Microbiology, cellular and molecular biology, bioinformatics, biochemistry or comparable areas, including a thesis (*Abschlussarbeit*) in these specialisations. In addition, they have in-depth knowledge in chemistry, physics and mathematics.
- They have extensive basic knowledge in fundamental mathematics and natural sciences.
- They have methodological skills in life sciences, particularly in the area of cellular and molecular biology. This enables them to apply biological knowledge and methods to the scientific analysis and experiment-based solution of practical problems.
- They are able to work on and design select questions by way of example that are arising in current research and the professional sphere and to develop conceptual solutions.
- They are able to do bibliographic research, to document their work scientifically and to present this work publicly.
- They are able to recognise and assess the field-specific and social consequences of their actions.
- They are able to cooperate interdisciplinarily and are interested in solving application problems by using molecular tools and bio-computational methods.

Prior to registration (*Einschreibung*), the entrance competencies of the applicants will be determined via an entrance examination. This entrance examination is conducted following the regulations below:

1 Purpose of the procedure

To be admitted to the Master’s degree programme in Synthetic Biology, proof of the applicants competencies and skills in line with the entrance competencies described above is required. Existing specialist knowledge acquired in an undergraduate degree programme in the field of life sciences and the fundamental subjects of natural sciences is verified by the contents of the previous degree programme in biology, particularly in the fields of microbiology, cellular and molecular biology, bioinformatics, biochemistry or comparable fields as well as in chemistry, physics and mathematics.

2 Procedure of the entrance examination

- 2.1. The entrance examination takes place annually.
- 2.2. Applications for admission to the entrance examination must be submitted by 15 July of the year for the winter semester (cut-off period).
- 2.3. The application must include the following:
 - 2.3.1. Proof of an academic degree in accordance with 1.2.1;
 - 2.3.2. A current performance overview (*Leistungsübersicht*);
 - 2.3.3. Proof of entrance competencies in an equivalence list as per the tabular template;
 - 2.3.4. Summary of the content of the Bachelor’s thesis;
 - 2.3.5. Proof of relevant practical laboratory experience of at least 6 weeks, if this cannot be documented as part of the Bachelor’s degree;

- 2.3.6. Applicants who cannot provide documentation confirming an academic degree with the application for admission, must provide documentation confirming the progress of their studies to date including the examinations taken to date;
- 2.3.7. Diploma Supplement, if available.

3 Commission handling the entrance examination

The entrance examination is conducted by a commission appointed by the examination board. The size of the commission depends on the number of applications. There are always at least two members of whom more than half are professors actively teaching within the degree programme concerned and the others are post-doctorate research associates (WiMi). A representative of the departmental student body of the Department of Biology assists the commission in an advisory capacity. The head of the examination board of the degree programme is also the head of the commission.

4 Conducting the entrance examination

4.1 First stage of the entrance examination

- 4.1.1 On the basis of the incoming written application dossiers, the commission assesses whether the applicants are qualified to study in accordance with the entrance competencies described above. To this end, the written documents are first reviewed and evaluated independently by two members of the commission. On the basis of the application dossiers submitted, the commission then examines whether the applicants have the required competencies and skills for the chosen degree programme based on the proven qualifications and the specific potentials and abilities outlined. The commission has to assess the submitted documents based on the following scale of 0 to 100 points, with 0 being the worst result and 100 the best result to achieve:

For the Master's degree programme in Synthetic Biology at TU Darmstadt...	Points
highly suited	80-100
suited (with restrictions as to some criteria)	60-79
suited to a limited extent	40-59
not suited	0-39

- 4.1.2 The applicant's score is based on the arithmetic mean of the individual assessments. Decimal places must be rounded up.
- 4.1.3. Applicants who have achieved 80 points will be admitted directly. Not suited applicants with less than 40 points will receive a rejection notice.

4.2. Second stage of the entrance examination

- 4.2.1. The other applicants will be invited to an entrance examination interview. The date for the entrance examination interview will be announced at least two weeks in advance. Time slots for any entrance examination interviews to be conducted must be specified before the application deadline expires. Applicants must adhere to the specified date of the interview. If applicants are prevented from taking part in the entrance examination interview for reasons beyond their control, an additional appointment can be arranged at the latest two weeks before the start of lectures upon a reasoned request. An on-site selection interview at the Technical University of Darmstadt can be waived at the applicant's request if the applicants' first place of residence is outside the Federal Republic of Germany or if the applicants' are outside the Federal Republic of

Germany during the period of the selection interviews announced for the application phase due to service obligations or social (community) assignments or if there are other plausible reasons that rule out an on-site interview. Instead, a remote interview is held, if possible, by using a medium transmitting image and sound. The assessment is handled in the same way as the on-site interviews.

- 4.2.2. The entrance examination interview must be held individually for each applicant. The interview lasts at least 30 minutes per applicant and covers the entrance competencies listed above. If the applicants agree, a student representative can be admitted as a listener/an observer. In order to ensure comparability of the interviews, the examination board provides guidelines for conducting interviews.
- 4.2.3. The interview will be conducted by at least two members of the commission. Each of the members records the outcome of the entrance examination interview on a scale of 0 to 100 points, with 0 being the worst result and 100 being the best result to achieve.
- 4.2.4. The applicants' score is calculated from the arithmetic mean of the individual evaluations of item 4.2.3. Decimal places must be rounded up. Applicants who have achieved 60 or more points will be considered suitable and will receive a confirmation notice.
- 4.2.5. In cases where it becomes apparent that individual subject requirements from the first degree programme are not met, applicants can be admitted on condition that they make up the missing entrance competencies by successfully completing modules from the reference degree programme amounting to a maximum of 30 credit points. The examination board can make admission to individual technical examinations (*Fachprüfungen*) of the Master's degree programme dependent on passing the modules of the reference degree programme listed as conditions.

5 Formal record

A record of the course of the entrance examination in the first and second stages will be drawn up, indicating the date, duration and location of the assessment, the names of the participating members of the commission, the names of the applicants and the assessment by the members of the commission, in particular which entrance competencies are present and which are not, as well as the overall result. Where appropriate, conditions will be set out in the formal record.

6 Retry

Applicants who have not provided proof of suitability for the Master's degree programme in Synthetic Biology can apply again for another winter semester and take the entrance examination again.

Qualification objectives

Graduates of the research-oriented Master's degree programme in Synthetic Biology are qualified to work independently, both in industry and non-university institutions, as well as in the context of a doctorate at the university.

After completing their Master's degree programme in Synthetic Biology, students will be able:

Field-specific competencies

- To independently apply concepts and methods of synthetic biology to solve complex life science problems and to evaluate different approaches to solutions;

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- To understand, create and apply mathematical models of biological systems;
- To apply engineering principles to life science problems and to understand, design and construct systems at the interface of technology and biology, such as microfluidics, bioprinting and biohybrid systems;
- To plan and carry out experimental work in the field of synthetic biology and to manage related projects;
- To identify and realise potential applications for laboratory automation and robotics;
- To use a programming language to create programs or scripts to handle problems in the field of synthetic biology;
- To extract and further process relevant information from large amounts of life science data by applying statistical methods and suitable algorithms;
- To distinguish biomaterials in terms of their mechanical, biological and biofunctional properties and to select them appropriately for specific applications in the field of synthetic biology;
- To apply strategies of protein engineering, metabolic engineering, genetic engineering and molecular biology to complex questions in synthetic biology and related fields;
- To understand and review international legal requirements related to topics in synthetic biology and to implement projects in accordance with this legal framework;

Intercultural, interdisciplinary and social-communicative competencies

- To critically reflect, assess and categorise their own abilities and skills;
- To take a global perspective on the field of study, the academic discipline and the future professional field, for example by developing solutions that take into account various cultural areas and local contexts;
- To change points of view and to formulate their own position in relation to or in contrast to other disciplines;
- To form and lead interdisciplinary, intercultural teams working on complex projects, to communicate effectively (including in a foreign language) and to act in a solution-oriented manner;
- To appreciate differing perspectives and cultural diversity and to understand them as a resource for their own professional actions;
- To critically reflect on the local ties of their own perspective and thus the starting conditions of their own actions;
- To document research findings scientifically, to present them appropriately (in writing/orally) to an international expert audience and/or a culturally diverse audience of readers or listeners, and to discuss and critically reflect on them in the light of current scientific findings;
- To conduct ethical assessments of synthetic biology projects and to include them in the social context of various cultures.

Appendix III Module descriptions

The module descriptions are published electronically as a module handbook 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.

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Article 3

Entry into force

The Degree Programme Regulations come into force on 01 October 2023. They will be published in the *Satzungsbeilage* (appendix to the statutes) of TU Darmstadt.

Darmstadt, 16 January 2023
signed by Prof. Dr. Jörg Simon
The Chairperson of the Department of Biology
of TU Darmstadt