Universität für Bodenkultur Wien

University of Natural Resources and Life Sciences, Vienna

in cooperation with the Medical University of Vienna

Curriculum

for the Master's Programme in

Biotechnology

Programme classification no. 066 418

Effective date: October 1st, 2025

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§ 1 QUALIFICATION PROFILE

The master's programme in Biotechnology is a degree programme which serves to deepen and extend students' pre-vocational academic education, building on the basis provided by a bachelor degree programme (§ 51 [2] item 5 of the Universities Act UG 2002, Federal Law Gazette BGBl I no. 81/2009). The programme fulfils the requirements of Directive 2005/36/EC on the recognition of professional qualifications, article 11, letter e.

1a) Definition, knowledge and professional skills

Biotechnology is the integration of biological sciences, chemistry and process technology. It uses organisms, cells and enzymes to manufacture, process and prepare products from biogenic raw materials for the good of the general public and the environment.

The academic education provided within the master's degree in Biotechnology features highly interdisciplinary basic courses in biochemistry, microbiology, molecular biology and bioprocess engineering. In addition to the teaching of scientific and technical subjects, importance is also given to personal development. Therefore, guidance in independent, critical and logical thinking, the ability to work abstractly, the ability to communicate and work within a team, as well as ethical and social responsibility is promoted.

Graduates of the master's degree programme in Biotechnology develop a consolidated knowledge on biotechnological processes and on related areas of expertise such as biophysical chemistry, biochemistry, cell- and molecular biology, nanobiosciences, biostatistics and process engineering. They can analyse and evaluate chemical, biochemical, genetic, cell biological and process technology-related results of biotechnological processes. They have developed a critical comprehension of theories and scientific foundations and can apply them to analyse and describe processes. Graduates are capable to process large amounts of data to answer complex questions. They are also enabled to assess scientific questions in the field and apply chemical, biological and engineering techniques for the identification, design, production and implementation of biotechnological resources or for the disposal of specific substances. Graduates can perform research and develop and assess relevant techniques. The obtained results can be illustrated, presented and argued in suitable ways. Graduates are used to working in teams and take over the role as instructor and team leader.

Upon graduation, students have state-of-the-art knowledge on scientific research and development in the areas of expertise stated. They are competent to follow and critically evaluate developments in their field of expertise based on the study of scientific literature. Furthermore, graduates are enabled to serve the development of the field. Graduates are also equipped with concepts of quality management and relevant social scientific, economic and legal principles, rules and regulations. This enables them to effectively develop, construct, analyse and improve biotechnological products, processes and organisational structures. Graduates deal with ethical and social questions in the context of the entire field of expertise and can critically reflect and reason their own actions.

In addition to the qualification profile stated above, students have the possibility to complete one of six optional specialisations in the course of their study programme in Biotechnology:

- Graduates of the specialised programme in **Bioinformatics** are enabled to critically evaluate and utilise scientific methods from the fields of bioinformatics, biostatistics and molecular simulation. Furthermore, they can independently develop efficient experimental designs and complex computer analyses.
- Graduates of the specialised programme in **Bioprocess Engineering** are equipped with a broad understanding and knowledge in respect to biotechnological production processes including their biological and technical elements. Due to their scientific background they are in a position to plan, develop and operate industrial processes in detail.
- Graduates of the specialised programme in **Medical Biotechnology** are able to design, develop, produce, characterise and formulate medically relevant biotechnological products.
- Graduates of the specialised programme in **Plant Biotechnology** have gained a solid foundation in the fields of plant sciences, molecular biology and biochemistry. This serves as basis for the development, enhancement, production and use of plants for the food and animal feed sector, for industrial raw materials as well as medical purposes.
- Graduates of the specialised programme in **Environmental Biotechnology** are qualified to develop and use biotechnological procedures for the treatment of waste streams and environmental contamination. Furthermore, they know how to avoid the development of future environmental problems.
- Graduates of the specialised programme in **Protein Engineering and Technology** are well-trained in protein analysis, characterisation of proteins, simulation techniques, protein engineering and biocatalysis. Graduates can engineer biomolecules for biocatalytic, bioanalytic, and biomedical applications.

1b) Professional qualifications

The employment opportunities are diverse, from occupations in scientific research and development, in the planning, control and monitoring of biotechnological processes and applications, to the development of processes in the production of biological substances. Opportunities for specialisation exist in the following fields of employment: bioinformatics, bioprocess engineering, medical biotechnology, plant biotechnology, environmental biotechnology, and protein engineering and technology. In addition, the curriculum allows students to become competent in the areas of economics and management. International relations are promoted through exchange programmes, international co-operation and foreign language modules.

Graduates of this master's study programme work in the public sector (organisations, interest groups, research- and testing institutions, certification offices, quality management) as well as the private sector (biotech-, chemical- and pharmaceutical industry, start-ups and consulting).

An industrial work placement of one month's duration supports the vocational education.

§ 2 ADMISSION REQUIREMENTS

The proof of English knowledge at level B2 (Common European Framework of Reference for Languages) must be provided.

Graduates of the bachelor's programme in Food Science and Biotechnology offered by BOKU – University of Natural Resources and Life Sciences, Vienna are eligible for admission with no further requirements.

For graduates of other bachelor's programmes, mastery of the following learning outcomes is required for admission:

- Competence in mathematical, physical, chemical, biological, process technological, legal and economic foundations on an advanced theoretical and practical level as far as this is essential for biotechnological processes.
- The ability to choose and evaluate biological and engineering principles and methods for the production of resources or for the disposal of specific substances.
- Practical skills in organic and inorganic chemistry, in biochemistry, cell and molecular biology as well as process engineering.
- Basic IT knowledge, text and data processing, statistical programmes, biotechnologically relevant databases and bioinformatics software.
- Knowledge of basic concepts of quality management and codes of good manufacturing practice.
- Comprehension of scientific, technical, social, economic and legal aspects to biotechnological applications.
- Familiarity with ethical concepts in the context of biotechnology.

§ 3 PROGRAMME STRUCTURE

3a) Duration, total ECTS credits, and structure

The programme consists of courses and other requirements worth a total of 120 ECTS credits. This is equivalent to a duration of four semesters (a total of 3000 60-minute credit hours). The programme is divided into:

Compulsory courses:	**70 ECTS credits**
- core subjects (including compulsory internship)	42 ECTS credits
- specialisations in the study programme*	28 ECTS credits
Master's thesis:	**30 ECTS credits**
Elective courses:	**5 ECTS credits**
Free electives:	**15 ECTS credits**

*) Specialisations in the study programme:

The following six optional specialisations in the study programme in Biotechnology are available:

- Bioinformatics
- Bioprocess Engineering
- Medical Biotechnology**)

- Plant Biotechnology
- Environmental Biotechnology
- Protein Engineering and Technology

**) The specialised programme in Medical Biotechnology is offered in cooperation with the Medical University of Vienna.

A requirement for a specialisation in the study programme – to be stated as a specialisation in the final documents – is the successful completion of the core subjects as well as all compulsory courses of the respective specialised study programme and the composition of a master's thesis that is assigned to the respective specialised study programme.

The master study programme Biotechnology can also be completed successfully without a specialisation. In this case, 28 ECTS credits (that is equivalent to the amount of ECTS credits for a specialised study programme) have to be completed successfully. These 28 ECTS credits can be freely chosen from all specialisations in the study programme offered. Only up to 6 ECTS credits of these may come from the course types "exercise course" (UE) and "practical course" (PR).

The official language of the study programme is English.

3b) Three-pillar principle

The three-pillar principle is the central identifying characteristic of both the bachelor's and master's programmes offered at BOKU – University of Natural Resources and Life Sciences, Vienna. In the master's programmes, the sum of the compulsory and elective courses must be made up of at least

15% Technology and engineering
15% Natural sciences
15% Economic and social sciences, law

The master's thesis, compulsory internship and free electives are excluded from the three-pillar rule.

3c) Limited number of participants in courses

For courses with a limited number of participants the head of the master's course is authorized to first admit students enrolled in the master programme (that means that students enrolled in a bachelor study programme can only be admitted to the courses if further places are available). The admission of students enrolled in the master study programme follows the order of required courses by the students: compulsory course > elective course > free elective.

§ 4 COMPULSORY COURSES

The following compulsory courses are required to complete the master's programme:

4a) Core subjects

Core subjects	**Course type**	**ECTS credits**
Course title		
Biophysical chemistry	VU	3
Bioprocess engineering I	VU	4
Cell and molecular biology I	VO	4
Laboratory course in molecular biology II	UE	3
Practical course in biochemistry II	UE	5
Cell factories	VO	4
Biological nanosciences and nanotechnology	VO	2
Applied mathematics and biostatistics	VO	2
Applied mathematics and biostatistics exercises	UE	1
Mechanical and thermal process technology II	VO	2
Engineering of biotechnological production facilities	VO	2
Quality management in biotechnology	VU	3
Patent law and strategic patent management	VO	2
Computing skills for biotechnology	VU	2
Compulsory internship seminar	SE	3
	SUM	**42**

ECTS = European Credit Transfer System

4b) Specialisations in the study programme:

Upon the successful completion of 28 ECTS credit points taken from one specialisation in the study programme in Biotechnology and the composition of a master's thesis that is assigned to the respective specialisation, this specialisation in the study programme is being stated as a specialisation in the final documents.

If no specialisation is chosen, 28 ECTS credit points freely chosen from all specialisations have to be completed successfully. Only up to 6 ECTS credit points of these may come from the course types "exercise course" (UE) and "practical course" (PR).

Bioinformatics	**Course type**	**ECTS credits**
Course title		
Statistics with R	VU	2
Introduction to programming	VU	3
Essentials for bioinformatics data analysis	VU	3
Multivariate statistics	VU	3
Modelling and simulation of biomolecules	VU	3
Introduction to metabolic modelling	VU	2
High-throughput sequencing and genome analysis	VS	3
Bioinformatics: Selected aspects	VU	3
Machine learning and pattern recognition	VU	4
Bioinformatics lab rotation	VU	2
	SUM	**28**

Bioprocess Engineering	**Course type**	**ECTS credits**
Course title		
Metabolic and cell engineering	VO	2
Introduction to metabolic modelling	VU	2
Up- and downstream-processing	VO	3
Bioprocess engineering II	VU	4
Bioprocess engineering laboratory	UE	5
Products and processes in biotechnology	VS	2
Process simulation	VU	2
Biochemical reaction engineering	VO	2
Protein chemistry and protein engineering	VU	4
Biopolymers for sustainable utilization	VO	2
	SUM	**28**

Medical Biotechnology	**Course type**	**ECTS credits**
Course title		
Protein chemistry and protein engineering	VU	4
Cell and molecular biology II	VO	3
Immuno- and vascular biology in health and disease	VO	2
Pathophysiology for biotechnologists	VO	2
Oncology for biotechnologists	VO	2
Preclinical studies	VO	1
Clinical studies	VS	1
Up- and downstream-processing	VO	3
Infectious diseases and vaccines	VS	2
Stem cells and tissue engineering	VO	3

Biological therapeutics	VO	2
Practical course in cell culture and fermentation	UE	3
	SUM	**28**

Plant Biotechnology	**Course type**	**ECTS credits**
Course title		
Crop plant science	VO	2
Plant molecular biology	VO	3
Plant biochemistry and cell biology	VO	2.5
Molecular plant breeding	VO	3
Safety aspects of plant biotechnology	VO	3
Practical course in plant biotechnology	UE	4.5
Structure and analysis of genomes	VO	3
Genetic control of secondary metabolites in perennial crop plants	VS	3
Biopolymers for sustainable utilization	VO	2
Plant polysaccharide analysis	VO	2
	SUM	**28**

Environmental Biotechnology	**Course type**	**ECTS credits**
Course title		
Biotechnology for sustainable processes and environmental protection	VO	4
Methods in environmental biotechnology	UE	3
Environmental bioprocess engineering	VO	4
Industrial water management	VO	3
Global waste management I	VO	3
Renewable energy resources	VX	3
Fundamentals of environmental biotechnology	VO	3
Microbial ecology	VS	2
Environmental and biotechnological analysis	VO	3
	SUM	**28**

Protein Engineering and Technology	**Course type**	**ECTS credits**
Course title		
Structure and function of proteins	VO	2
Protein engineering	VO	3
Methods in protein characterization	VU	4
Introduction into crystallography and NMR spectroscopy of proteins	VO	3
Modelling and simulation of biomolecules	VU	3
Enzyme reactions: mechanisms and kinetics	VO	2
Applied biocatalysis	VO	3

Antibody engineering	VO	3
Practical course in protein engineering and technology	PR	5
	SUM	**28**

Prerequisite to participate in:	**Is the positive completion of:**
Bioprocess engineering laboratory	Bioprocess engineering I Bioprocess engineering II

§ 5 ELECTIVE COURSES

Elective courses worth a total of no fewer than 5 ECTS credits are required to complete the master's programme. In addition to the courses stated in the table below, students can also complete additional courses from the specialisations listed under § 4b, if these have not been chosen as part of the compulsory work load. They are then considered elective subjects.

Elective courses	**Course type**	**ECTS credits**
Course title		
Organisational behaviour and gender issues	VU	3
Processes in enzyme technology	VO	2
Practical course in enzyme technology	PR	3
From sequence to structure: prediction, modelling and molecular dynamics of protein structures	VU	3
Enzyme technology seminar	SE	2
Seminar in food technology	SE	2
Separation science and mass spectrometry	VU	3
Laboratory course on separation science and mass spectrometry	UE	4
Proteomics	VU	3
Glycobiology	VO	3
Genetic model organisms in biotechnology	VU	3
Biochemistry of trace elements	VO	3
Kinetics of biochemical reactions	VU	3
Advanced practical course in biochemistry	PR	3
Bioorganic chemistry	VO	3
Modern methods in structural and biochemical analysis	VU	3
Antibodies and beyond – emerging fields in antibody engineering	VS	2
Automation of bioprocesses	VU	3
Strain improvement of microorganisms and higher eukaryotic cells	VS	3
Animal cell culture	VO	2
Applied virology	VO	3
Immunology	VS	3

Microbial plant protection	VO	3
Seminar in biotechnology	SE	2
Seminar in environmental biotechnology	SE	2
Mechanisms of cell regulation in biotechnology practical	PR	3
Practical course in environmental biotechnology	PR	3
Flow cytometry and cell sorting in biotechnology	VO	3
Biology of aging	VS	3
Mechanisms of cell regulation in biotechnology	VO	2
Bayesian data analysis in the life sciences	VU	4
Modern bioinformatics	VS	2
Molecular evolution and phylogenetics	VO	1
Using bioinformatics for expression profiling by next generation sequencing	VU	2
Sequencing data analysis	VU	3
Synthetic biology	VO	2
Microbiology and disease	VS	2
Practical course in measurement systems and applied programming	PR	3
Practical course in energy engineering	PR	3
Applied measurement and control systems	VU	3
Seminar in energy and process engineering	SE	2
Energy engineering	VO	3
Fluidization engineering	VU	4
Statistical thermodynamics and molecular simulation	VU	3
Molecular genetics of baker´s yeast	VU	2
Molecular genetics of filamentous fungi – basic course	VU	2
Molecular genetics of filamentous fungi – advanced course	VU	2
Molecular biology of plant-pathogen interactions	VO	3
Methods in cell biology	VU	3
Developmental genetics	VO	3
Cell factory – plants	UE	3
Molecular phytopathology	VU	4
Cell biology	VO	3
Seminar in molecular biology	SE	2
Genetically modified organisms in the environment	SE	2
Exercises in molecular biology	PR	3
Practical course in cell biology	PR	3
Seminar in cell biology	SE	2
Biomaterial interfaces and interactions	VO	4
Synthetic bioarchitectures	VS	4
Biophysics	VO	4

Prokaryotic glycoconjugates and disease	VO	3
Biomimetic model lipid membranes	VO	3
Scattering techniques in nanomaterials science	VO	2
Seminar in nanobiosciences and nanotechnology I	SE	2
Physical chemistry (soft matter dynamics)	VU	3

§ 6 FREE ELECTIVES

Free electives worth a total of 15 ECTS credits are required to complete the master's programme. Free electives may be selected from all courses offered by all recognized universities in Austria and abroad. Free electives are intended to impart knowledge and skills in the student's own academic subject as well as in fields of general interest.

§ 7 COMPULSORY INTERNSHIP

(1) The compulsory internship is intended to help students improve the skills learned in their degree programme. It is also intended to encourage students to apply what they have learned into practice, and recognize relationships between theory and practice.

(2) The compulsory internship shall be at least 4 weeks of full-time work in duration. It is recommended to complete the internship between the second and third semesters of the degree programme. Students may also split the internship into more than one part.

(3) The compulsory internship seminar provides students with a thematic review of the internship experience.

(4) A detailed description of the procedure to be taken for the choice and completion of an internship placement as well as the completion of the compulsory internship seminar is available on BOKUonline.

(5) If no internship placement pursuant to (1) can be organised in spite of a genuine effort on the part of the student, a substitute must be selected in agreement with the instructor of the internship seminar. Possible substitutes include e.g. participation in a research project at BOKU or another research institution in a relevant field.

(6) Completion of the internship seminar is the confirmation of the completion of the compulsory internship or the substitute activity.

§ 8 MASTER'S THESIS

A master's thesis is a thesis on a scientific topic, to be written as part of a master's degree programme (for exceptions please see the bylaws (Satzung) of the University of Natural Resources and Life Sciences, Vienna, § 86 [9]). The thesis is worth a total of 30 ECTS credits. With their master's thesis, students demonstrate their ability to independently address a scientific topic, both thematically and methodologically (§ 51 [8] UG 2002 BGBl. I no. 81/2009).

The topic of a master's thesis shall be chosen in such a way that it is reasonable to expect a student to be able to complete it within six months. Multiple students may jointly address a topic, provided that the performance of individual students can be assessed (§ 81 [2] UG 2002 BGBl. I no. 81/2009).

The master's thesis shall be written in English. The thesis defensio must be held in English.

§ 9 COMPLETION OF THE MASTER'S PROGRAMME

The master's programme in Biotechnology has been completed when the student has passed all required courses and received a positive grade on the master's thesis and defensio.

§ 10 ACADEMIC DEGREE

Graduates of the master's programme in Biotechnology are awarded the academic degree Diplom-Ingenieurin (f) or Diplom-Ingenieur (m), abbreviated as Dipl.-Ing.^{in}/Dipl.Ing. or DI^{in}/DI. The academic degree Dipl.-Ing.^{in}/Dipl.Ing. or DI^{in}/DI, if used, shall precede the bearer's name (§ 88 [2] UG 2002 BGBl. I no. 81/2009).

§ 11 EXAMINATION REGULATIONS

(1) The master's programme in Biotechnology has been completed successfully when the following requirements have been met:

- positive completion of the compulsory courses worth a total of 42 ECTS credits (§ 4a)
- positive completion of specialised courses worth a total 28 ECTS credits (§ 4b)
- positive completion of elective courses worth a total of 5 ECTS credits (§ 5)
- positive completion of free electives worth a total 15 ECTS credits (§ 6)
- a positive grade on the master's thesis and the defensio

(2) Student evaluation takes the form of course and module examinations. Course examinations can be either written or oral, as determined by the course instructor, taking the ECTS credit value of the course into account. Any prerequisites for admission to examinations shall be listed in § 4 under the respective course/module.

(3) Student evaluation in modules: Module evaluation is based on the grades given the students in the individual courses that make up the module. The total evaluation for the module is calculated as the average of the grades of all module courses, weighted by ECTS credits. Average values of .5 or lower are rounded to the better (numerically lower) grade; values of over .5 are rounded to the worse (numerically higher) grade. If deemed necessary, the Dean of Students may require a module examination at his/her discretion.

(4) The choice of examination method shall be based on the type of course: Lectures shall conclude with a written or oral examination, if continuous assessment of student performance is not applied. Seminars (SE) can be evaluated based on independently written papers, length and contents of which are determined by the course instructor. For all other course types, the examination type is at the instructor's discretion.

(5) After the successful completion of all the courses and examinations required in the master's programme, the completed master's thesis, after it has been given a positive evaluation by the thesis supervisor, shall be publically presented by the student and defended in the form of an academic discussion (defensio). The committee shall consist of a committee chair and two additional university teachers with a venia docendi or equivalent qualification. The student's total performance (thesis and defensio) will be assigned a comprehensive grade. Both thesis and defensio must receive a passing grade for the student to complete the programme. The written evaluations stating the rationale for the thesis grade and the defensio grade are included in calculating the comprehensive grade and are documented separately.

The comprehensive grade is calculated as follows:

- Master's thesis: 70%
- Defensio (incl. presentation): 30%

(6) A comprehensive evaluation of the student's performance on the entire programme shall be assigned. A comprehensive evaluation of "passed" means that each individual component of the programme was completed successfully. If individual components of the programme have not been successfully completed, the comprehensive evaluation is "failed". A comprehensive evaluation of "passed with honours" is granted if the student has received no grade worse than a 2 (good) on all individual components, and if at least 50% of the individual components were graded with 1 (excellent).

§ 12 TRANSITIONAL PROVISIONS

For students continuing their studies under the provisions of the previously valid curriculum, the list of equivalent courses (*Äquivalenzliste*) pursuant to a resolution of the Academic Programme Committee (*Studienkommission*) applies. This list includes all courses that correspond to courses offered in the previously valid curriculum.

For students who switch to the new master's programme curriculum, examinations for courses taken under the provisions of the previously valid curriculum shall be recognized towards the new programme under the provisions of this curriculum based on the list of equivalent courses.

Students who have passed elective courses of the previously valid curriculum which lack an equivalent elective course in the new curriculum, shall be awarded an equivalent number of credit points for elective courses of the new curriculum.

§ 13 EFFECTIVE DATE

This curriculum shall take effect on October 1st, 2025.

ANNEX A TYPES OF COURSES

The following types of courses are available:

Lecture (VO)
Lectures are courses in which certain areas of a subject and the methods used in this area are imparted through didactic presentation.

Exercise course (UE)
Exercise courses are courses in which students are instructed in specific practical skills, based on theoretical knowledge.

Practical course (PR)
Practical courses are classes in which students deal with specific topics independently, based on previously acquired theoretical and practical knowledge.

Compulsory internship seminar (PP)
The compulsory internship seminar is a class in which students deal independently with topics related to their internship placements, based on previously acquired theoretical and practical knowledge.

Seminar (SE)
Seminars are courses in which students are required to work independently on the respective subject, deepen their knowledge of the topic and discuss relevant issues.

Field trips (EX)
Field trips are courses in which students have the opportunity to experience relevant fields of study in real-life practical application, to deepen their knowledge of the respective subject. Field trips can be taken to destinations both in Austria and abroad.

Master's thesis seminar (MA)
Master's thesis seminars are seminars intended to provide students with academic support during the thesis writing process.

Mixed-type courses:
Mixed-type courses combine the characteristics of the courses named above (with the exception of project-type courses). Integration of different course-type elements improved the didactic value of these courses.

Project course (PJ)
Project courses are characterised by problem-based learning. Under instruction, students work - preferably in small groups - on case studies, applying appropriate scientific methods.

Lecture and seminar (VS)
Lecture and exercise (VU)
Lecture and field trip (VX)
Seminar and field trip (SX)
Exercise and seminar (US)
Exercise and field trip (UX)