UK 066/875

CURRICULUM FOR THE
MASTER'S PROGRAM IN
BIOINFORMATICS.

(in English)

discontinued, beginning 2019W

JꓘU

**JOHANNES KEPLER
UNIVERSITY LINZ**

Contents

§ 1 Qualification Profile

(1) Bioinformatics is a relatively new, interdisciplinary research area and forms the interface between life sciences and computer science. Bioinformatics is known as a key technology of one of the fundamental achievements of mankind, the decoding of the human genome. These days bioinformatics is established as an independent education and scientific discipline. Data from life science, medicine, drug design and pharmacy industry is managed, visualized, analyzed, interpreted, compared to one another, and simulated on basis of bioinformatics methods. Bioinformatics further utilizes and develops methods and techniques from computer science in order to solve tasks from biology, chemistry, physics, medicine, or mathematics.

(2) Various job profiles exist for masters in bioinformatics, where they build the connection between life science and IT experts. On the one hand they may work in pharmacy, chemistry, and food industry or in biotech companies, on the other hand they may be employed in software companies producing software for experts in biology, physics, medicine or chemistry. The scope of duties of masters in bioinformatics is manifold, e.g. they may be experts in databases, molecular dynamics simulations, machine learning and pattern recognition, or in algorithm design.

(3) Masters in bioinformatics use their social competences to quickly comprehend the problems of life science experts and thereafter efficiently apply and adapt methods and techniques from computer science for solving those problems. Further, due to their interdisciplinary experiences, they are able to combine computer science with areas which are not associated with life sciences. Masters in bioinformatics are educated to apply methods of computer science in a responsible and critical way and to challenge new developments.

(4) Education in bioinformatics aims at developing competency in problem solving. A master in bioinformatics has knowledge and abilities in the following areas:

1. FUNDAMENTAL KNOWLEDGE: Fundamental knowledge in computer science, biology, biochemistry, biophysics, mathematics as well as in the central subjects of bioinformatics.

2. SPECIAL KNOWLEDGE: Specialized courses and current topics of bioinformatics. The specialized courses are both in computer science and in biology, mathematics, chemistry or physics.

3. METHODS: Theoretical and practical knowledge of bioinformatic methods. Especially analysis of problems, analytical and logical thinking, understanding and representation of complex dependencies and structures. Masters in bioinformatics know how to use and how to apply the methods and techniques of bioinformatics and how to access and use the public available software and data base resources adapted to the problem at hand.

4. INNOVATION: Readiness and ability to scientific research as well as to independently and systematically advance bioinformatics.

5. CONTINUING EDUCATION: Readiness and ability to independently learn further knowledge, especially training the handling of new methods and techniques of bioinformatics. Specialization in specific subjects and following new developments.

6. INTERNATIONALITY: Supported visits of foreign countries and exchange programs and courses in foreign languages. Solid knowledge of the English colloquial and technical language in order to communicate with international partner institutions.

7. CRITICAL FACULTY: Critical and responsible use of the methods and techniques of bioinformatics regarding questions of ethic and of social and environmental effects of new technologies.

8. SOCIAL COMPETENCE: Ability to work in a team, willingness and ability to cooperate, management capabilities, and expertise in presenting and moderating.

§ 2 Admissions

(1) In accordance with § 54 (1) UG the Master's program in Bioinformatics belongs to the category of degrees in natural sciences and is taught in English.

(2) The Master's program in Bioinformatics is based on the joint Bachelor's program in Bioinformatics (K033/675) at JKU and USB. Graduates of this Bachelor's program as well as graduates of Computer Science (K033/521, K066/921, K066/911, K066/937, K066/938, K880), Business Informatics (K033/526, K066/926, K175), Technical Mathematics (K033/201, K066/404), Technical Physics (K033/261, K066/461, K811), or Fundamentals of Natural Sciences for Technology (K033/320) at JKU are admitted to the Master's program without any restrictions.

(3) Students holding a degree in Biology, Chemistry (K033/290, K066/491, K800) or in a similar subject are admitted to the Master's program with the requirement that basics of molecular biology and biochemistry must be documented to the extent of at least 3 ECTS.

(4) Graduates of Bioinformatics or related programs at other Universities, Universities of Applied Sciences, and other recognized national or international post-secondary educational institutions can be admitted to the Master's program in Bioinformatics if their degree programs are equivalent to the Bachelor's program in Bioinformatics at JKU.

(5) Graduates of programs that are not equivalent according to § 2 (3) can be granted admission on the condition to complete additional courses with up to 40 ECTS points during their Master's study.

(6) Sufficient knowledge of the English language (corresponding to level B2 of the Common European Framework of Reference for Languages, CEFR) is recommended.

(7) Graduates of a Diploma program with a longer duration than a Bachelor's program can obtain recognition for examinations of the Master's program (see § 78 UG) to the extent of which the Diploma program (excluding the diploma thesis) exceeds the Bachelor's program.

§ 3 Structure and Outline

(1) The Master's program in Bioinformatics covers 4 semesters and consists of 120 ECTS points, which are distributed among the following subjects:

Subjects	ECTS
Mandatory Subjects	51
Complementary Subjects	30
Master's Thesis (incl. Master's Thesis Seminars)	25
Master's Examination	2
Free Electives	12
Total	120

(2) For Free Electives students have to pass examinations corresponding to 12 ECTS points, which can be chosen from any recognized national or international post-secondary educational institution. The Free Electives shall provide additional skills beyond Bioinformatics and can be taken anytime during the Master's study.

(3) The recommended course of study is shown in the annex 1.

§ 4 Mandatory Subjects/Modules

The following mandatory subjects have to be completed successfully:

Code	Name	ECTS
875BIML16	Bioinformatics and Machine Learning	21
875SBIN12	Seminar Bioinformatics	3
875PBIN12	Project Bioinformatics	9
875SOSK14	Soft Skills and Ethics	3
875ARSP16	Area of Specialisation	15

§ 5 Complementary Subjects

In the phase of alignment in terms of fundamental knowledge, students have to successfully pass the complementary subjects given in the letter of acceptance according to the earlier graduation.

Code	Name	ECTS
875CBAB16	Complementary Subjects for Bioinformaticians	0/30
875CBIO16	Complementary Subjects for Biologists	0/30
875CCHE16	Complementary Subjects for Chemists	0/30
875CCSB16	Complementary Subjects for Computer Scientists and Business Informaticians	0/30
875CMAT16	Complementary Subjects for Mathematicians	0/30
875CPHY16	Complementary Subjects for Physicists	0/30

§ 6 Courses

(1) The names and the types of all courses of the Mandatory and Complementary Subjects, as well as their ECTS points, their duration in hours per week, their codes, their registration requirements, and their admission procedures (in case of limited availability of places) are described in the study handbook of JKU (studienhandbuch.jku.at).

(2) The possible types of courses as well as the examination regulations are described in §§ 13 and 14 of the JKU statute (Section "Studienrecht").

§ 7 Master's Thesis

(1) Students of the Master's program in Bioinformatics must complete a Master's Thesis according to § 81 UG and § 36 of the JKU statute (Section "Studienrecht").

(2) The Master's Thesis is a written paper corresponding to an effort of 22 ECTS points.

(3) The Master's Thesis serves as a proof that graduates are able to perform scientific work autonomously and systematically. The topic of the thesis must be taken from Bioinformatics or a field closely related to Bioinformatics and must permit completion within a period of 6 months.

(4) The Curricular Committee for Bioinformatics may specify guidelines for the formal structure of a Master's Thesis.

(5) In addition to the Master's Thesis, students must pass one Master's Seminar with 3 ECTS points.

§ 8 Examination Regulations

(1) The regulations for subject examinations and course examinations are described in the study handbook of JKU.

(2) The Master's program in Bioinformatics is concluded by a Master's examination.

(3) The Master's examination consists of two parts: The first part is the successful completion of Mandatory and Complementary Subjects according to §§ 4 and 5.

(4) The second part of the Master's examination is a comprehensive oral exam (2 ECTS points) conducted by an examination committee. Prior to being admitted to the Master's examination, students must complete the first part of the Master's examination, the Master's Thesis, the Master's Seminar, and the Free Electives.

(5) The second part of the Master's examination starts with a presentation and defense of the Master's Thesis, followed by an oral exam that aims at assessing the candidate's general knowledge in the most relevant fields of Bioinformatics and, therefore, concentrates on the breadth of knowledge and cross connections between different subjects.

(6) The examination committee consists of three members who are appointed by the Vice Rector of Academic Affairs. The candidate may submit a proposal for the appointment of the committee members. As a general rule the supervisor of the Master's Thesis is a member of the examination committee. One committee member is head of the committee and the other two are examiners. One examiner (not the supervisor of the Master's Thesis) suggests the grade for the defense of the Master's Thesis, the other examiner suggests the grade for the oral exam. The assessment of the student's performance at the examination focuses on the knowledge of different subjects in bioinformatics and their interrelations as well as their applications.

§ 9 Academic Degree

(1) Graduates of the Master's program in Bioinformatics are awarded the academic degree „Master of Science in Bioinformatics", abbreviated „MSc" or „MSc (JKU)".

(2) The certificate about the academic degree is issued in German and in English translation.

§ 10 Legal Validity

(1) This curriculum comes into effect on October 1st, 2016.

(2) The curriculum of the Master's program in Bioinformatics in the version published in the official newsletter of Johannes Kepler University Linz on June 25th, 2014, 25th piece, item 200 expires by the end of September 30th, 2016. Included interim regulations remain effective as long as practically applicable.

(3) § 2 para. 2, § 6 para. 1 and § 11 para. 1 as published in the official newsletter of the Johannes Kepler University Linz on June 22nd, 2018, 26th piece, item 272 will take effect on October 1st, 2018.

(4) § 2 para. 1, § 11 para. 2 and annex 1 as published in the official newsletter of the Johannes Kepler University Linz on June 24th, 2019, 33rd piece, item 455 will take effect on October 1st, 2019.

§ 11 Transitional Provisions

(1) For students who have passed examinations within the curriculum of the Master's program in Bioinformatics in a previous version, the equivalences listed in the study handbook of JKU (studienhandbuch.jku.at) apply.

(2) In addition to the equivalences given in the study handbook of JKU, following equivalences are effective:

Table E: Equivalence of subject packages

Package of subjects in the Master Bioinformatics version of 2014	equivalent package of subjects in the Master Bioinformatics version of 2016
Bridge Subject for {name} (18 ECTS) + 875BIN112: Sequence Analysis and Phylogenetics (6 ECTS) + 875BIN213: Theoretical Bioinformatics and Machine Learning (12 ECTS) + 875BIN313: Structural Bioinformatics and Gene Analysis (6 ECTS) + 875BIN413: Information Systems (6 ECTS) + 875BIN513: Mathematical Methods of Bioinformatics (6 ECTS) + 875VINF12: Area of Specialisation A: Computer Science (6 ECTS) + 875VBPM12: Area of Specialisation B: Biology/Chemistry/Physics/Mathematics (6 ECTS)	Complementary Subjects for {name} (30 ECTS) + 875BIML16: Bioinformatics and Machine Learning (21 ECTS) + 875ARSP16: Area of Specialisation (15 ECTS)

Annex 1: Global map of study subjects - Master's Program in Bioinformatics (2019)

1st Semester (WS)		2nd Semester (SS)		3rd Semester (WS)		4th Semester (SS)	
Subject/Module	ECTS	Subject/Module	ECTS	Subject/Module	ECTS	Subject/Module	ECTS
Complementary Subjects	21	**Complementary Subjects**	9	**Seminar Bioinformatics**	3	**Master's Seminar/ Master's Examination**	5
Bioinformatics and Machine Learning	7,5	**Bioinformatics and Machine Learning**	10,5	**Project Bioinformatics**	9	**Soft Skills and Ethics**	3
Free Electives	1,5	**Area of Specialisation**	6	**Bioinformatics and Machine Learning**	3	**Master's Thesis**	22
		Free Electives	4,5	**Area of Specialisation**	9		
				Free Electives	6		
30		**30**		**30**		**30**	120