University of Zagreb

FORM 1 Evaluation of university study programmes of undergraduate, graduate and integrated undergraduate and graduate studies, and vocational studies

DETAILED PROPOSAL OF THE STUDY PROGRAMME

1. GENERAL INFORMATION ON THE STUDY PROGRAMME			
1.1. Name of the study programme	Undergraduate university study programme Biotechnology		
1.2. Provider of the study programme	Faculty of Food Technology and Biotechnology, University of Zagreb		
1.3. Partner institutions	/		
1.4. Type of study programme	Vocational study programme ☐		University study programme ☒
1.5. Level of study programme	Undergraduate ☒	Graduate ☐	Integrated ☐
1.6. Manner of implementation of the study programme	Classical ☐	Mixed (classical + online) ☒	Online in entirety ☐
1.6.1. Is it a?	☒single major ☐double major ☐interdisciplinary study ☐multidisciplinary study ☐developing programme		
1.7. Academic/vocational title earned at completion of the study	Bachelor of Science in Biotechnology (univ. bacc. ing. biotechn.)		
1.8. Scientific/artistic field/area of the proposed study programme	Biotechnical Sciences / Biotechnology		

2. INTRODUCTION		
2.1. Reasons for starting the study programme	Scientific need	Higher education in the field of biotechnology in Croatia began among the first in Europe in 1956 at the former Faculty of Technology, and since 1978 at the Faculty of Food Technology and Biotechnology, University of Zagreb (FFTB-UniZG) where it has been continuously upgraded. This upgrade is driven primarily by the development of the pharmaceutical industry, but also other industries in this field, as well as institutes and university centres, which created the need for experts in the field of biotechnology in scientific research, development and application of technical solutions and advanced production bioprocesses and procedures. Today, the alumni of the FFTB of the University of Zagreb are essential in the establishment and competitive functioning of the biotechnology industry, small and medium-sized enterprises, public services, professional associations and other non-governmental organizations and representative bodies. The higher education system at FFTB-UniZG has been restructured in accordance with

		the requirements of the Bologna Process, and since the academic year 2005/2006, the FFTB-UniZG has had modernized university undergraduate study programmes in Biotechnology, Food Technology and Nutrition that last three years, and as of the academic year 2008/2009, there have been five two-year graduate studies: Bioprocess Engineering, Molecular Biotechnology, Food Engineering, Food Safety Management and Nutrition. The European Commission (EC) has identified biotechnology as a key technology for the development of the bioeconomy of the European Union (EU) in the 21st century. In addition to the production of food, medicines, biochemicals, materials, fuels and other innovative products and services, biotechnology ensures the independence of the bioeconomy in terms of: increasing the range of raw materials; providing new job positions, income and forms of business; and contributing significantly to the sustainability of the quality of life. Accordingly, the strategy of the FFTB-UniZG was designed and the Faculty Council decided to propose a new undergraduate study programme Biotechnology, which would replace the existing study programme Biotechnology that has been taught unchanged since the academic year 2005/2006. The main aim of the proposed study programme Biotechnology is to follow the latest scientific standards in the higher education of the field in accordance with the Croatian Qualifications Framework and strategic documents of the Republic of Croatia (Croatia) and the EU. This would attract more students from the country and abroad, significantly increase their mobility, improve scientific cooperation inside and outside of the UniZG and broaden the impact of the proposed study programme to previously underrepresented areas where biotechnology has expanded and integrated with other areas (aquaculture, marine biotechnology, biorefineries, bioinformatics, medicine and other fields), especially in the last twenty years. FFTB-UniZG has the human resources and infrastructure to conduct the proposed study programme Biotechnology. The provider of the study programme has designed a framework of the programme for this undergraduate study and, in accordance with the bibliography, the course teachers have been designated. The designed programme is based on the latest scientific knowledge from all fields that biotechnology encompasses, primarily chemistry, biochemistry, microbiology, engineering and industrial biotechnology, with the aim of educating employable graduates who will be willing to support and develop the bioeconomy of the Republic of Croatia throughout their working life. During their studies, the students acquire interdisciplinary theoretical knowledge and practical skills, which cover all segments of bioprocesses and/or biorefineries: from (*i*) selection of substrates/raw materials, (*ii*) selection and preparation of robust

		biocatalysts, then (*iii*) planning, researching and testing, designing, implementing and controlling bioprocesses, (*iv*) conceptualization and implementation of procedures for isolation and purification of high-value biochemicals and biomass of (micro)organisms, to (*v*) the development of innovative solutions, (*vi*) technology transfers and (*vii*) starting a biotechnology company. The launch of the proposed Biotechnology study programme will improve the existing system and create a more favourable one for the development of new and innovative scientific and research activities within the faculty and at the UniZG, as well as cooperation with biotechnological institutions in the country and abroad and in new areas covered by biotechnology. In addition to strengthening the infrastructure, this will help achieve greater competitiveness and prominence of the FFTB-UniZG, the UniZG and the entire scientific research community.
	Cultural need	It is believed that the progress of civilization is largely defined by the development of biotechnology. Historically, this refers to all fermented and other traditional products and generally accepted norms in a society, according to which different cultures and societal stages of development are recognized. The history of biotechnology is measured by thousands of years and the development of various biotechnological processes and products, especially in the past two centuries (production of antibiotics, enzymes and other heterologous proteins, etc.), which have already become standards in the society, has determined the quality of human life. The proposed university undergraduate study programme Biotechnology educates experts who will significantly determine a new and sustainable quality of life. The creation and application of innovative bioprocesses and/or biorefineries will achieve greater utilization of traditional and new raw materials, produce new and better biotechnological products and services, and ensure greater availability and safety of these products and services. In addition, the aforementioned activities reduce the geopolitical dependence of the economy on certain raw materials, energy sources, products and services, but also on highly educated experts - biotechnologists, who are required to found, start and run various laboratories, production plants, biorefineries, public services, representative bodies, as well as professional societies and other non-governmental organizations. Furthermore, through their activities in representative bodies, professional associations and other non-governmental organizations, as well as through other forms of volunteer work, biotechnologists communicate the latest achievements in their field to the society and inform citizens about the benefits of biotech products and services, thus helping to shape public opinion and adopt new norms, as well as listen to the needs and wishes of the citizens. The EC has recognized the importance of the activities listed here and has identified

		five missions in the next Horizon Europe Framework Program, which actually define the quality of life and a new paradigm of culture in Europe in the near future, namely: (1) adaptation to climate change including societal transformation, (2) cancer, (3) climate-neutral and smart cities, (4) healthy oceans, seas, coastal and inland waters, and (5) soil health and food. These missions include changing the perception and habits of the citizens regarding the listed topics, adoption of new products and services (e.g. new diagnostic procedures and innovative treatments, standards in housing culture, privileges of experiencing natural resources, etc.) in order to improve health, but also cultural and other human statuses, then innovative ways of producing raw materials [e.g. algae and (other) marine (micro)organisms] as well as new ways of agricultural production and exploitation of raw materials in bioprocesses and/or biorefineries. All five defined missions are attainable only with the application of knowledge and skills that the students who finish the university undergraduate study programme Biotechnology possess. Furthermore, in addition to preserving, maintaining and promoting traditional biotechnological procedures and products, it is necessary to continuously work on improving these and designing new procedures, products and services, in order to preserve recognizable cultural identity, tourist attractiveness and cultural identity of the society, both inland and on the coast. In addition to the biotechnology industry, small and medium-sized biotechnology enterprises, representative bodies as well as professional societies and non-governmental organizations have great potential here in achieving the listed cultural features, and for their competitive functioning, adaptation and recognition in cultural heritage and development of new cultural motifs, experts in the field of biotechnology are essential.
	Social need	Society's needs for biotechnological products and services are extensive, specific and require constant and rapid change and adaptation, both in the supply and demand of the full range of these products and services, as well as in their quality, availability and price, but also in reliable, comparable and verifiable information dissemination and ensuring the compliance with the legal framework. Limited resources and the current ways of their use in industrial and other production have led to pollution of all ecosystems and reduction of biodiversity, and accordingly to risks, primarily health ones, but also for human well-being in general. The European Green Deal (2019), which is an integral part of the Commission's strategy for the implementation of the UN's 2030 Agenda and the Sustainable Development Goals, aims to transform the European society into a just and prosperous society.

		The proposed university study programme Biotechnology and the college-educated experts in this field have an extremely important role in the realization of such an advanced society in the EU and the Republic of Croatia. Namely, biotechnologists in cooperation with other stakeholders in the society design and implement the use of new and sustainable resources, i.e. raw materials for the so-called clean biotechnological processes. Furthermore, the consumption of clean and safe energy sources, but without energy poverty and/or energy dependence of the Croatian economy on other economies, is also one of the key tasks of a highly educated multidisciplinary team, in which biotechnologists are crucial. In addition, the application of innovative biotechnological solutions reduces the use and risks of chemical pesticides, fertilizers and antibiotics, helps develop new forms of cooperation with the biotechnological industry and business models in order to form new value chains and produce sustainable products while reducing waste. In addition to all of the above, the proposed study programme Biotechnology educates experts with full work ability to support and develop the circular economy, within which greenhouse gas emissions are reduced and measures to clean and remove environmental pollution are introduced, which should lead to climate neutrality. In doing so, it is important to encourage sustainable consumption and the use of biotechnological products and services and to promote affordable products and services for all members of the society. In addition to the required courses, which provide unique and constructive knowledge and skills, the proposed study programme Biotechnology also contains the necessary elective courses, which are selected to supplement the acquired knowledge and skills with specific and current content. Proactive revision of the university undergraduate study programme Biotechnology will enable the education of employable professionals who have the knowledge and skills necessary to continue their studies at the graduate level, primarily at graduate studies Bioprocess Engineering and Molecular Biotechnology, but also at other complementary studies at the UniZG and other institutions in Croatia and the EU. The continuation and lifelong education of biotechnologists is necessary for them to perform more complex work and tasks in order to design innovations, launch and lead new technologies and sustainable technical solutions, which lead to achieving the goals of the European Green Deal and other existing strategic documents, i.e. to fair, energy independent, a climate-neutral and prosperous society. All these tasks performed by college-educated experts in the field of biotechnology are upgraded through their activities in public administration bodies and their independent activities in professional associations and representative bodies. Graduated biotechnologists will be equipped to improve legal frameworks, (inter)national strategies

		and plans and ethical principles, to lobby and represent the interests of an open and progressive society. Through their professional, ethical and independent activities in the society, biotechnologists will communicate, educate, and make biotechnological products and services understandable, acceptable and accessible for all members of the society.
	Economic need	The challenges of the global economy, especially over the last two decades, primarily the global financial crisis and the coronavirus pandemic, clearly indicate a crucial characteristic of any economy, and that is rapid adaptation to new conditions. The financial crisis has strengthened and brought forward key technologies, in the first place information and communication technologies and biotechnology, but also yielded more medium and small biotechnology companies in the Republic of Croatia, which is noted in public administration documents of the Republic of Croatia and the EC. The pandemic situation has additionally poured extensive economic resources into the biotechnology industry. The most important economic resource of every national economy is human potential, and in the 21st century, having a high level of education, employability and mobility of employees in the field of biotechnology, as well as their connection with colleagues from highly developed economies, is one of the main motifs of economic progress in Croatia. Biotechnological industrial production as well as the dynamics of production in small and medium-sized biotechnological enterprises requires an increasing number of college-educated biotechnologists, without whom these systems cannot function properly and necessarily develop into their sustainable varieties. A number of laboratories for the quality control in preparation, production and marketing of various biotechnological products should be mentioned here; laboratories for the control of processing of the so-called waste materials (raw materials) and their suitability for use as raw materials or discharge/disposal in/on natural recipients; then medical-biochemical laboratories, laboratories for forensic research and expert opinion; as well as laboratories dealing with chemical-biological and other threats in order to preserve the integrity, safety, health and quality of life of citizens and other economic resources in the Republic of Croatia. The close cooperation of all the economic factors listed here with the academic community has provided clear guidelines on the needs of the so-called real sector and thus significantly contributes to the formation of the necessary proposed study programme and employability of biotechnologists with a higher education degree.
2.2. Assessment of the study programme's usefulness relative to the demands of the	According to the data of the Ministry of Labour and Pension System of the Republic of Croatia from March 2020 (http://hko.mrms.hr/), only 816 employees work in the sub-sector Biotechnology within sector I. Agriculture, Food and	

labour market in the public and private sectors	Veterinary Medicine. This number is considered to be too small and unrealistic and there are two main reasons for that - (a) until 2008, the academic title of all graduated engineers at the FFTB-UniZG, was "graduate engineer of food technology", regardless of the university study programme they have completed (then five-year one), and (b) with one exception (graduate engineer of biotechnology), the listed occupations in the field of biotechnology that do not include the term "biotechnology" are still in the database, available at the link provided above. By reviewing the structure of the members of professional societies, e.g. The Croatian Society of Biotechnology and the Croatian Association of Food Technologists, Biotechnologists and Nutritionists, it has been found that biotechnologists are mostly employed as: (I) experts and scientists; (II) engineers, technicians and related occupations; and (III) heads and members of legislative bodies, heads and officials of state bodies, directors. This data clearly shows the purposefulness of the proposed university undergraduate study programme Biotechnology and the importance of biotechnologists in the continued sustainable development of the bioeconomy of the Republic of Croatia. In the last ten years, and especially after the accession of the Republic of Croatia to the EU, the prominence of biotechnology and graduates of the university undergraduate study programme Biotechnology has been increasing, primarily in the EU, where many graduates of this study programme continued their education and/or have been employed, but also in our society, namely in the public and private sector. In accordance with the latest models in the economy, the trend of employing biotechnologists in all so-called traditional, but also new areas encompassed by biotechnology in the public sector, is continuing, and there is an increase in the demand for experts in newly established small and medium-sized enterprises, which are mainly financed from EU funds. These indicators further emphasize the importance of this study programme, but also require its proactive revision.
2.3. Compatibility of the study programme with the University mission and the strategy of the proposer, as well as with the Higher Education Institutions Network strategic plan	The proposed study is in line with the mission of the University of Zagreb, 2019-2025 Development Strategy of the Faculty of Food Technology and Biotechnology, University of Zagreb, and the strategic document Network of Higher Education Institutions and Study Programmes in the Republic of Croatia.
2.4. Comparability of the study programme with other accredited programmes in higher education institutions in the Republic of Croatia and the EU (name at least two programmes, one of which is from an EU country, and compare them with the proposed programme; provide internet addresses of the programmes)	The proposed university undergraduate study programme Biotechnology is comparable to the undergraduate university study Biotechnology and drug research, which is conducted at the Department of Biotechnology, University of Rijeka, Croatia. University undergraduate study programme Biotechnology can be compared to undergraduate study Food technology, which is conducted at the Faculty of Food Technology Osijek at the University of Josip Juraj Strossmayer in Osijek, Croatia. This study is also comparable to university undergraduate study programmes *Chemical and Process Engineering*, *Chemistry*, *Environmental System Sciences/Natural Sciences-Technology* and *Molecular Biology*, in which the main portion of the courses is taught at the Institute for Biotechnology and Biochemical Engineering, *Graz University of*

	Technology, Austria. The proposed university undergraduate study programme Biotechnology is also comparable to undergraduate study programmes *Bachelor Life Science & Technology* and *Molecular Science & Technology*, which are taught at *TU Delft (Faculty of Applied Sciences) & Leiden University (Faculty of Mathematics and Natural Sciences)*, Netherlands.
2.5. Openness of the study to student mobility (horizontal, vertical in the Republic of Croatia and international)	The study is open to the mobility of students on a horizontal and vertical level in the Republic of Croatia and the EU. Previous experiences indicate the attractiveness of this study for students of UniZG, e.g. students who enrol in this study after previously being enrolled in the Faculty of Science, Faculty of Pharmacy and Biochemistry and the Faculty of Chemical Engineering and Technology of the UniZG, but also students of the Faculty of Food Technology Osijek, Josip Juraj Strossmayer University of Osijek. Every academic year, a certain number of students (10-15) of the university undergraduate study programme Biotechnology study or do internships within the Erasmus+ programme in EU countries. Students use this mobility program during the second or third year of study and acquire part of their education at universities, such as e.g. *The University of Natural Resources and Life Sciences Vienna*, *Bielefeld University*, *The University of Kaiserslautern* and others. It is important to point out that students are increasingly interested in professional internships in companies in the EU, which value the students of the university undergraduate study programme Biotechnology of the FFTB-UniZG. Similarly, the exchange of students through CEEPUS is realized in cooperation with a number of universities in the Republic of Croatia and the EU (Josip Juraj Strossmayer University in Osijek, Republic of Croatia; *Faculty of Food Science, Corvinus University*, Budapest; *Technical University of Graz* in Graz and others). The vertical mobility of students primarily takes place towards the graduate studies of Bioprocess Engineering and Molecular Biotechnology at FFTB-UniZG, as well as the university postgraduate (doctoral) study programme Biotechnology and Bioprocess Engineering, Food Technology and Nutrition at FFTB-UniZG. In addition, upon completion of the previous Biotechnology study programme, several bachelor graduates continued their education in the EU. These candidates enrolled in the graduate studies directly, without additional requirements, e.g. Cellular Biology and Physiology, University of Copenhagen, as well as graduate studies at Technical University of Denmark. This data additionally demonstrates how valuable this study programme is, but also necessitates continuous modernization of the university undergraduate study programme Biotechnology.
2.6. Relationship with the local community (economy, entrepreneurship, civil society, etc.)	The inevitable development of circular economy with an emphasis on the development of small and medium-sized enterprises, especially in rural and uninhabited areas in the Republic of Croatia, as defined in the National Development Strategy of the Republic of Croatia 2030, is possible only with professional support from college-educated biotechnologists. This primarily refers to: (A) self-sufficiency in the exploitation of available raw materials, which are characteristic of the continental and coastal-marine part of the Republic of Croatia; (B) energy sustainability and independence as well as

	climate neutrality of the Republic of Croatia; (C) the competitiveness of large biotech, but also small and medium-sized enterprises in order to ensure sufficient quality and (affordable) products and services available on the market; (D) modern higher education and, through additional encouragement of innovation and creation of new ideas, entrepreneurship. All of the above leads to equal opportunities for everyone, higher employment and quality of life, balanced regional development and strengthening resilience to crises. The academic community, and especially the community in the area of Biotechnical Sciences and the field of Biotechnology, is an independent, internationally recognized, educational, scientific and research environment, connected with economic entities and public administration, for which it has educated leaders and other experts, and it still continues to educate them, formally and informally, as well as continuously cooperate with them. Volunteer work of college-educated biotechnologists, e.g. within international and national engineering (FEANI and HIS - Croatian Engineering Association) and other associations (e.g. EBTNA) as well as non-governmental national professional associations (e.g. HDB - Croatian Society of Biotechnology and HDPBN - The Croatian Association of Food Technologists, Biotechnologists and Nutritionists), includes public forums and lectures, popularization of the latest scientific and technical achievements and their accessibility to all age groups in the society (e.g. Science Festival). Professional and science-based communication and other legally and ethically appropriate activities of biotechnologists are extremely important in creating an open, just and progressive society.
2.7. Compatibility with the requirements of professional associations, if any exist	The proposed university undergraduate study programme Biotechnology is fully in line with the requirements of professional associations and is one of the few most important foundations of these associations, as follows: Croatian Society of Biotechnology (HDB), Croatian Association of Food Technologists, Biotechnologists and Nutritionists (HDPBN), the Croatian Microbiological Society - HMD), Croatian Association of Genetic Engineers (HUGI) and others, as well as the corresponding national (HPD) and international umbrella organizations (e.g. EBTNA), which is quite evident from the core documents of these associations (e.g. Statute of the Croatian Society of Biotechnology). It should be noted here that biotechnologists have been the founders, presidents, members of executive and scientific boards and other bodies of these societies and scientific conferences, both in the Republic of Croatia and the EU.
2.8. Name possible partners outside the higher education system	/
2.9. Other (as the proposer wishes to add)	/

3. GENERAL INFORMATION	
3.1. Duration of the study programme (is there an option of distance learning, part-time	Three years (six semesters)

studying, etc.)	
3.2. The minimum number of ECTS credits required for completion of study	180 ECTS credits
3.3. Enrolment requirements and admission procedure	Defined by the Open call for enrolment in undergraduate studies (available on website Enrolment)
3.4. Language of the study programme	Croatian Language
3.5. Learning outcomes of the study programme relative to legislative acts, requirements of applicable professional associations, demands of the labour market, possibilities for continuation of education and general social needs (name 15-20 learning outcomes)	**Learning Outcomes** 1. Define and explain the principles of basic scientific disciplines, such as mathematics, physics, chemistry, biochemistry and biology with particular emphasis on microbiology and molecular genetics and apply these skills and knowledge in the field of biotechnology. 2. Describe and explain the principles of basic engineering disciplines, such as thermodynamics, fluid mechanics, transfer phenomena and unit operations, and apply this knowledge and skills in the field of biotechnology. 3. Select and practically apply basic biochemical engineering knowledge and skills, manage biotechnological and genetic engineering processes. 4. Select and use common laboratory equipment and appropriate computer tools. 5. Conduct appropriate analyses and biotechnological procedures in chemical, biochemical, microbiological, molecular-genetic, process and development laboratories, and identify and solve simpler problems in these laboratories. 6. Use conventional process equipment in a biotechnological plant (production and/or pilot research). 7. Manage smaller production units of industrial biotechnological systems. 8. Identify and analyse production problems and communicate them to superiors and subordinates. 9. Interpret the results of routine laboratory analyses in biotechnology. 10. Report on laboratory, production plant and business results verbally and in writing using professional terminology. 11. Work in an interdisciplinary team in the field of biotechnology. 12. Summarize the conclusions based on the results of research in the field of biotechnology. 13. Apply ethical principles, legislation and standards pertaining to the specific requirements of the profession. 14. Develop knowledge and skills necessary to continue studying at a higher level, primarily in graduate study programmes Bioprocess Engineering and Molecular Biotechnology, as well as awareness of the need for lifelong learning.
3.6. Evaluation of student employability at completion of the study programme, including opinions or official documents from three organizations associated with the labour market (e.g. professional associations or scientific institutions, employers or their associations, unions, public services, etc.) on the suitability of the anticipated learning	Quality interdisciplinary education in basic disciplines, which includes theoretical and practical work in a laboratory and production plant (hands-on training), provides competencies and significantly increases competitiveness in direct employment in various traditional and new areas of biotechnology and entrepreneurship. This university study programme is an outstanding basis for the acquisition of new knowledge and skills in line with the dynamic and sustainable development of the field. Upon completion of the study programme, a bachelor will be trained to perform tasks in planning, development, management, control, supervision, communication and formation of strategic and other documents in: - virtual, research, development, selection, analytical, control, diagnostic and inspection laboratories and/or pilot

outcomes to the demands of the labour market	plants (microbiological, biochemical, genetic, bioprocess and bioinformatics); - preparatory, production and isolation industrial biotechnological plants; - new biorefinery plants; public sector, representative bodies as well as professional societies and non-governmental organizations.
3.7. Possibilities of continuing studies at a higher level	Upon completion of this undergraduate university study, the bachelor has the right to enrol in FFTB-UniZG graduate studies. Enrolment requirements are available on the FFTB website. The preconditions for enrolment in graduate study programmes at other institutions of the University of Zagreb and other universities in the Republic of Croatia are determined by these institutions. The bachelor has the right to enrol in graduate study programmes at universities in the EU directly, without additional requirements, e.g. University of Copenhagen.
3.8. Upon submitting proposals for graduate study programmes, name undergraduate studies of the proposer or other institutions in the Republic of Croatia that qualify for admission to the proposed graduate study	-

4. DESCRIPTION OF THE STUDY PROGRAMME				
4.1. List of mandatory and elective courses and/or modules with class hours and ECTS credits (appendix: Table 1)				
4.2. Description of each course (appendix: Table 2)				
4.3. Structure of the study (number of semesters, trimesters, class sizes for lectures and exercises/seminars)	Classes at the university undergraduate study programme Biotechnology are conducted throughout six (6) semesters. Lecture groups consist of 150 students, and groups for exercises and seminars have, respectively, 10 and 30 students.			
4.4. Enrolment requirements for the following semester or trimester	The requirements for enrolment in the first (1st) year of study, i.e. the conditions for enrolment in the study programme, are prescribed by the study programmes, and published in the Open call for enrolment. The requirements for enrolment in the second (2nd) and third (3rd) year of study are regulated in accordance with the operational plan of the study programme.			
4.5. List of courses and/or modules offered in a foreign language (which language)	All compulsory and elective courses of the third (3rd) year of the proposed study programme are expected to be taught in Croatian and English.			
4.6. Completion of the study:				
a. Final requirement for completion of the study	Final thesis ☒	Diploma thesis ☐	Final exam ☐	Diploma exam ☐
b. Requirements for application of final/diploma thesis and/or final/diploma exam	The requirements for applying for the final thesis are (a) passing all the exams and (b) having fulfilled all other obligations required by this study programme.			
c. Evaluation procedure for final/diploma exam and evaluation and defence procedure for final/diploma thesis	Details of the final thesis evaluation procedure and the evaluation of the final thesis defence are outlined in the Ordinance on the preparation of the final thesis.			

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Table 2 Course description
In a separate document

Table 3 List of required and elective courses and modules with class hours and ECTS credits

LIST OF COURSES/MODULES									
Year of study: 1									
Semester: I									
MODULE	COURSE	COURSE TEACHER	From n to x semester	L	S	E	e-learning	ECTS	Required/elective
	General Chemistry	Damir Iveković	I	30	36	30	5 %	8.0	required
	Physics	Davor Horvatić	I	45	15	15	0 %	5.0	required
	Mathematics 1	Marjan Praljak	I	30	30	0	10 %	5.0	required
	Analytical Chemistry	Ivone Jakaša	I	14	14	36	2 %	4.0	required
	Introduction to Biotechnology	Anita Slavica	I	30	0	0	< 20 %	3.0	required
	English / German Language for Specific Purposes 1	Ana Kovačić / Dijana Njerš	I	10	20	0	< 20 %	2.0	required
	Basic Informatics	Ana Vukelić	I	10	0	15	10 %	2.0	required
	Physical Education 1	Neven Karković	I	0	0	30	5 %	0.5	required

LIST OF COURSES/MODULES									
Year of study: 1									
Semester: II									
MODULE	COURSE	COURSE TEACHER	From n to x semester	L	S	E	e-learning	ECTS	Required/elective
	Biology	Tomislav Vladušić	II	45	9	42	5 %	7.0	required
	Organic Chemistry	Senka Djaković	II	30	30	45	5 %	7.0	required

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	Physical Chemistry	Filip Šupljika	II	30	15	30	20 %	6.0	required
	Mathematics 2	Julije Jakšetić	II	30	30	0	10 %	5.0	required
	Principles of Engineering	Mirjana Čurlin	II	25	25	5	5 %	5.0	required
	Physical Education 2	Neven Karković	II	0	0	30	5 %	0.5	required

LIST OF COURSES/MODULES

Year of study: 2

Semester: III

MODULE	COURSE	COURSE TEACHER	From n to x semester	L	S	E	e-learning	ECTS	Required/elective
	Microbiology	Ksenija Markov	III	30	30	45	< 20 %	7.0	required
	Biochemistry 1	Vladimir Mrša	III	30	15	26	10 %	6.0	required
	Raw Materials in Biotechnological Production	Sunčica Beluhan	III	20	20	40	< 20 %	6.0	required
	Transport Phenomena	Tomislav Bosiljkov	III	30	15	30	10 %	4.0	required
	Numerical Methods and Programming	Ana Vukelić	III	20	20	10	10 %	4.0	required
	English / German Language for Specific Purposes 2	Dijana Njerš	III	10	20	0	< 20 %	2.0	required
	Physical Education 3	Lidija Podvalej	III	0	0	30	5 %	0.5	required

LIST OF COURSES/MODULES

Year of study: 2

Semester: IV

MODULE	COURSE	COURSE TEACHER	From n to x semester	L	S	E	e-learning	ECTS	Required/elective
	Molecular Genetics	Ivan-Krešimir Svetec	IV	40	15	30	< 20 %	7.0	required
	Biochemistry 2	Renata Teparić	IV	45	13	0	10 %	5.0	required
	Unit Operations	Damir Ježek	IV	30	15	30	5 %	4.0	required
	Statistics	Marjan Praljak	IV	30	20	10	10 %	4.0	required
	Water Technology	Marin Matošić	IV	20	0	30	20 %	4.0	required
	Digital Biotechnology	Antonio Starčević	IV	20	10	20	20 %	3.0	required

	Protein Purification and Characterization	Renata Teparić	IV	30	10	20	10 %	3.0	required
	Physical Education 4	Lidija Podvalej	IV	0	0	30	5 %	0.5	required

LIST OF COURSES/MODULES

Year of study: 3

Semester: V

MODULE	COURSE	COURSE TEACHER	From n to x semester	L	S	E	e-learning	ECTS	Required/elective
	Biochemical Engineering	Tonči Rezić	V	40	30	30	< 20 %	8.0	required
	Fundamental Aspects of Industrial Biotechnology	Tonči Rezić	V	40	0	45	< 20 %	6.0	required
	Biotechnological Production of Drugs and Fine Chemicals	Jagoda Šušković	V	20	10	30	20 %	5.0	required
	Genetic Engineering	Ivan-Krešimir Svetec	V	30	15	30	< 20 %	5.0	required
	Biotechnological Enzyme Production	Blaženka Kos	V	22	10	17	20 %	3.0	required
	Measurement and Process Control	Mirjana Čurlin	V	15	10	10	5 %	3.0	required

LIST OF COURSES/MODULES

Year of study: 3

Semester: VI

MODULE	COURSE	COURSE TEACHER	From n to x semester	L	S	E	e-learning	ECTS	Required/elective
	Elective Courses A	(see table below)	VI					12.0	elective
	Elective Courses B	(see table completely below)	VI					8.0	elective
	Final Thesis	Mentor of Final Thesis	VI	0	0	100	0 %	7.0	required
	Professional Practice	Blaženka Kos	VI	0	20	30	0 %	3.0	required

LIST OF COURSES/MODULES

Year of study: 3

DETAILED PROPOSAL OF THE STUDY PROGRAMME

Semester: VI									
MODULE	COURSE	COURSE TEACHER	From n to x semester	L	S	E	e-learning	ECTS	Required/elective
	Biotechnological Aspects of Wine Production	Vesna Zechner-Krpan	VI	24	0	24	< 20 %	4.0	elective
	English / German Language for Specific Purposes 3	Dijana Njerš	VI	10	20	0	< 20 %	3.0	elective
	Instrumental Methods of Analysis	Damir Iveković	VI	14	14	26	5 %	4.0	elective
	Food Microbiology	Jadranka Frece	VI	25	12	26	< 20 %	4.0	elective
	Application of High Performance Liquid Chromatography in Biotechnology	Ivana Radojčić Redovniković	VI	14	12	24	< 20 %	4.0	elective
	Technology of Alcohol and Yeast Production	Damir Stanzer	VI	20	10	20	< 20 %	4.0	elective
	Technology of Antibiotics	Jagoda Šušković	VI	24	6	19	20 %	4.0	elective
	Brewing Technology	Božidar Šantek	VI	25	9	15	< 20 %	4.0	elective
	Technology of Vitamins and Hormones	Višnja Gaurina Srček	VI	20	10	20	< 20 %	4.0	elective

LIST OF COURSES/MODULES

Year of study: 3									
Semester: VI									
MODULE	COURSE	COURSE TEACHER	From n to x semester	L	S	E	e-learning	ECTS	Required/elective
	Biodegradation of Organic Compounds	Tibela Landeka Dragičević	VI	25	0	15	< 20 %	3.0	elective
	Biotechnological Wastewater Treatment	Tibela Landeka Dragičević	VI	25	0	20	< 20 %	3.0	elective
	Good Manufacturing Practice for Pharmaceuticals	Jasna Novak	VI	8	16	8	20 %	3.0	elective
	Lignocellulosic Feedstocks in Biotechnology	Vlatka Petravić Tominac	VI	24	6	0	< 20 %	3.0	elective
	Microbiological Aspects in Malt and Beer Production	Sunčica Beluhan	VI	16	4	10	< 20 %	3.0	elective
	Basics of Genotoxicity Testing	Ksenija Durgo	VI	22	0	11	20 %	3.0	elective
	Application of Spectroscopic Methods in Biotechnology	Jasmina Lapić	VI	10	10	15	5 %	3.0	elective

	Production of Strong Spirits Beverages	Damir Stanzer	VI	17	0	25	5 %	3,0	elective
	Production of Microbial Lipids	Mirela Ivančić Šantek	VI	18	2	10	< 20 %	3.0	elective
	Bioprocess Development and Biotechnology Company Start-Up	Tonči Rezić	VI	18	18	0	< 20 %	3.0	elective
	Introduction to Metabolic Engineering	Anita Slavica	VI	16	14	0	< 20 %	3.0	elective