COURSE GUIDE – EXTENDED FORM

Academic year 2026 – 2027

1. Program information

1.1 University	*"Gheorghe Asachi" Technical University of Iasi*
1.2 Faculty	*"Cristofor Simionescu" Faculty of Chemical Engineering and Environmental Protection*
1.3 Department	*Organic, Biochemical and Food Engineering*
1.4 Field	*Chemical Engineering*
1.5 Study level	*Master*
1.6 Specialization	*Chemical and Biochemical Process Technology - CBPT*

2. Course information

2.1.1 Course name	**Bioprocesses**						
2.1.2 Course code	502	2.1.3. Course category (Fundamental/Specialized/Complementary)					DF
2.2 Course instructor	Professor Dan Cașcaval, Associate Professor bioing. Lenuța Kloetzer						
2.3 Course instructors for applied activities (S, L, P, Pr)	Associate Professor bioing. Lenuța Kloetzer						
2.4 Year of study [2]	1	2.5 Semesterl[3]	1	2.6 Evaluation type[4]	E	2.7 Course type [5]	DOB

3. Amount of time estimated for course activities (hours / term)

3.1 Hours /week	4	3.2 course	2	3.3a sem.	-	3.3b laboratory	2	3.3c project	-	3.3.d. practice	-
3.4 Total hours from curriculum[6]	56	3.5 course	28	3.6a sem.	-	3.6b laboratory	28	3.6c project			

Time spent for related activities[7]	Hours
Study of recommended books, course support, scientific papers and course notes	30
Study in library and practical skills development	24
Preparation of seminars / laboratory works / project phases / home works / presentations	22
Evaluation[8]	3
Other activities:	

3.7 Total hours of individual study [9]	76
3.8 Total hours per semestre[10]	135
3.9 Number of credits	5

4. Prerequisites (optional)

4.1 curriculum[11]	-
4.2 learning outcomes	-

5. Requirements

5.1 Conditions for course delivery[12]	Whiteboard, video projector, specific materials will be used. Students must attend the course with their mobile phones turned off.
5.2 Laboratory requirements[13]	Students must enter the laboratory with their mobile phones turned off. During laboratory work, students must wear lab coats and protective equipment appropriate for handling microorganisms. Students must come to the laboratory with written reports on the experiments to be carried out, already studied and understood. Students are not allowed to leave operating equipment unattended. Bringing food into the laboratory is strictly prohibited. Attendance at laboratory sessions is mandatory. Any accident or incident must be reported immediately to the lab supervisor.

6. Overall objective of the course

Bioprocesses course aims to provide students with fundamental and applied knowledge regarding the role and implications of bioprocesses in the chemical industry, with emphasis on their specific applications in food, pharmaceutical, and cosmetic industries. Through the integration of theoretical principles and practical applications, the course develops students' capacity to explain and compare classical and modern biotechnological processes, to evaluate and apply appropriate models and methods, and to operate specific technologies. It also fosters critical thinking, problem-solving abilities, and professional responsibility in relation to biosynthesis, separation methods, and process optimization, preparing graduates to work independently or in multidisciplinary teams in research, innovation, and industry.

7. Learning outcomes

Knowledge	The student / graduate: - explains the fundamental concepts, models, and mechanisms underlying bioprocesses in microorganisms, plants, and animals; - compares classical and modern biotechnological processes and their applications in food, cosmetics, and pharmaceuticals; - evaluates the efficiency, limitations, and industrial applicability of different bioprocesses and separation methods; - defines the physiological, biochemical, and enzymatic processes involved in biosynthesis and product recovery; - describes equipment, technologies, and process flows specific to the bioprocess industry; - uses specialized terminology in professional and academic communication, including in an international context; - applies theoretical knowledge to solve problems of synthesis, biosynthesis, and separation in industrial practice.
Skills	The student / graduate: - uses analytical methods for quantitative and qualitative evaluation of natural and biosynthetic products; - plans and organizes experiments and processes for the optimization of bioprocesses under defined conditions; - operates laboratory and pilot-scale equipment specific to fermentation, biosynthesis, and separation; - critically evaluates experimental data, technological solutions, and process performance, proposing improvements based on evidence.
Responsibility and autonomy	The student / graduate: - respects principles, norms, and ethical values in the correct and timely execution of professional tasks; - assumes responsibility for contributing to professional knowledge and practices, as well as for improving team performance in applied projects; - informs and documents themselves continuously by consulting specialized scientific literature and using modern learning tools; - applies theoretical knowledge to practical problem-solving in industrial contexts, demonstrating initiative and adaptability; - collaborates effectively in individual and team research, showing autonomy and responsibility in decision-making and communication.

8. Teaching methods

The teaching process will involve participatory lectures and debates, supported by PowerPoint presentations made available to students. These presentations include images and diagrams to make the information easier to understand and assimilate. Each lecture will begin with a brief review of the topics covered in the previous session.

The teaching method is also based on discovery learning models, facilitated through both direct and indirect exploration of reality (e.g., experiments, demonstrations, modelling). Additionally, action-based methods will be employed, such as practical exercises, hands-on activities, and problem-solving tasks.

9. Course content

9. 1. Courses[15]	**Teaching methods**	**Time allocation**
9.1.1. Introduction; comparative analysis of chemical processes and bioprocesses	Interactive lecture	2 hours
9.1.2 Particularities of the biosynthesis industry; microorganisms, enzymes		5 hours

9.1.3 Preliminary bioprocessing of raw materials	Guided discussions Clarifying explanations	4 hours
9.1.4 Biosynthesis processes: characteristics, general mechanisms, kinetics		5 hours
9.1.5 Bioprocesses after biosynthesis		4 hours
9.1.6 Bioprocessing specific devices		4 hours
9.1.7 Transcoding bioprocesses to higher operating scale		4 hours
Course bibliography: 1. C. Larroche, M. Angeles Sanroman, G. Du, A. Pandey - Current Developments in Biotechnology and Bioengineering. Bioprocesses, Bioreactors and Controls, Editura Elsevier, Amsterdam, 2016. 2. M. Shuler, F. Kargi, M. DeLisa - Bioprocess Engineering: Basic Concepts, 3rd edition, Editura Pearson, 2017. 3. A.C. Blaga, L. Kloetzer, A. Tucaliuc – Aplicaţiile ale enzimelor şi microorganismelor în industria alimentară şi biochimică, Editura Performantica, Iaşi, 2015. 4. D. Caşcaval, C. Oniscu, A.I. Galaction – Inginerie biochimică şi biotehnologie. 3. Procese de separare, Editura Performantica, Iaşi, 2004. 5. C. Oniscu, D. Caşcaval s.a. – Inginerie biochimică şi biotehnologie – Îndrumar pentru lucrări practice, Lit. UTI, 2000		
9.2b Laboratory	Working methods [17]	
9.2.1b.1 Work safety instructions and presentation of the topic of laboratory	Practical demonstrations, exercises, experiments	2 hours
9.2.b.2 Study of enzymatic and chemical cleavage of proteins		4 hours
9.2.b.3 Determination of thermal effect of biochemical processes		4 hours
9.2.b.4 Enzymatic degradation study of lipids		4 hours
9.2.b.4 Fermentation Fundamentals		6 hours
9.2.b.4 Bioreactor Operation and Process Monitoring		6 hours
9.2.b.7 Final evaluation. Presentation of homework.		2 hours
Bibliography for applied activities (laboratory): 2. C. Larroche, M. Angeles Sanroman, G. Du, A. Pandey - Current Developments in Biotechnology and Bioengineering. Bioprocesses, Bioreactors and Controls, Editura Elsevier, Amsterdam, 2016. 2. M. Shuler, F. Kargi, M. DeLisa - Bioprocess Engineering: Basic Concepts, 3rd edition, Editura Pearson, 2017. 3. A.C. Blaga, L. Kloetzer, A. Tucaliuc – Aplicaţiile ale enzimelor şi microorganismelor în industria alimentară şi biochimică, Editura Performantica, Iaşi, 2015. 4. D. Caşcaval, C. Oniscu, A.I. Galaction – Inginerie biochimică şi biotehnologie. 3. Procese de separare, Editura Performantica, Iaşi, 2004. 5. C. Oniscu, D. Caşcaval s.a. – Inginerie biochimică şi biotehnologie – Îndrumar pentru lucrări practice, Lit. UTI, 2000		

10. Evaluation

Activity type	10.1 Evaluation criteria	10.2 Evaluation method		10.3 Percentage of the final grade *(recommended to be proportional to the number of hours allocated to each type of activity)*
10.4 Type of evaluation: Final Exam / Assessment	*Completeness and correctness of knowledge.* *Logical coherence, fluency, strength of argumentation.* *Capacity for analysis, personal interpretation, originality, creativity.* *Degree of mastery of specialized terminology and communication skills.* *Ability to apply acquired skills.* *Ability to process data and solve given problems.*	*Systematic observation of students (individual/team assignments – assignments must be completed during the week between lectures, preparation of a report – case study).*	*20 %*	60 %
		Formative assessment test (ongoing evaluations throughout the semester).	*40 %*	
		Summative assessment test (final evaluation).	*40 %*	

10.5b Laboratory	*Laboratory activity – Ability to work in a team, ability to apply learned knowledge in practice, in different contexts.* *Capacity for analysis, personal interpretation, originality, and creativity.*	*Completion of laboratory sheets (all lab works must be completed, allowing the makeup of only one missed lab work);* *Assessment test (laboratory colloquium).*	40 %
10.6 Conditions for passing			
The final evaluation result for a course is determined by considering the scores and weights assigned to each activity within the course. Whole-number grades from 10 to 1 will be awarded, with a grade of 5 certifying the achievement of the minimal learning outcomes required for the course and the awarding of the corresponding study credits.			

Date: 3.09.2025

Course instructor: Professor Dan Cașcaval, Associate Professor bioing. Lenuța Kloetzer

Course instructors for applied activities: Ș.l. dr. bioing. Lenuța Kloetzer

Date of approval by the department: 5.09.2025

Head of Department
Associate professor Corina Cernatescu

Date of approval by the Faculty Council: 8.09.2025

Dean,

Professor Teodor Malutan

Bachelor's / Master's degree.
[2] *For Bachelor's: 1-4; for Master's: 1-2.*
[3] *For Bachelor's: 1-8; for Master's: 1-4..*
[4] *Exam (E), assessment (A) – according to the curriculum.*
[5] *DOB – mandatory course, DOP– optional course, DFA– elective course;*
[6] *Duration equals 14 weeks multiplied by the number of hours listed at point 3.1 (similarly for points 3.5 and 3.6abc).*
[7] *The lines below refer to individual study; total is completed at point 3.7.*
[8] *Between 2 and 6 teaching hours, not included in individual study..*
[9] *Total number of individual study hours (sum of values from previous lines).*
[10] *Total of direct teaching hours (3.4) plus individual study hours (3.7); must equal the number of credits (3.9) multiplied by 27 hours per credit.*
[11] *Prerequisite courses that must be passed previously or their equivalents are indicated.*
[12] *Teaching resources: blackboard, video projector, flipchart, specific teaching materials, etc.*
[13] *Technical equipment: computers, software packages, experimental stands, etc*
[14] *Learning outcomes presented as knowledge, skills, responsibility, and autonomy specific to the course, aligned with level 7 of the National Qualifications Framework (NQF) and adapted to the type of university program. For research master's programs, these include competences necessary for conducting independent scientific research (https://www.aracis.ro/wp-content/uploads/2025/07/Standarde-specifice-masterat.pdf).*
[15] *Titles of chapters and paragraphs.*
[16] *Teaching methods: discussions, debates, presentations and/or paper analyses, exercises and problem solving.*
[17] *Practical demonstrations, exercises, experiments.*
[18] *Case studies, demonstrations, exercises, error analysis, etc.*