SYLLABUS

1. Information about the program

1.1 Higher education institution	Politehnica University Timisoara
1.2 Faculty[1]/ Department [2]	Chemical Engineering, Biotechnologies and Environmental Protection / CAICON
1.3 Field of study (name/code[3])	Chemical Engineering / 10.30.50
1.4 Study cycle	License
1.5 Study program (name/code/qualification)	Chemical Engineering / 10.30.50.60 / engineer

2. Information about the discipline

2.1 Name of discipline/ formative category[4]			Biosynthesis products / DS				
2.2 Coordinator (holder) of course activities			Conf.dr.ing. Anamaria TODEA				
2.3 Coordinator (holder) of applied activities[5]			Asist. Drd Ioana Cristina Benea				
2.4 Year of study[6]	IV	**2.5** Semester	8	**2.6** Type of evaluation	E	**2.7** Regime of discipline[7]	DO

3. Total estimated time – hours / semester: direct teaching activities (fully assisted or partly assisted) and individual training activities (unassisted) [8]

3.1 Number of fully assisted hours / week	4 of which:	**3.2** course	2	**3.3** seminar / laboratory / project	0/2/0
3.1* Total number of fully assisted hours / semester	56 of which:	**3.2*** course	28	**3.3*** seminar / laboratory / project	0/28/0
3.4 Number of hours partially assisted / week	of which:	**3.5** training		**3.6** hours for diploma project elaboration	
3.4* Total number of hours partially assisted / semester	of which:	**3.5*** training		**3.6*** hours for diploma project elaboration	
3.7 Number of hours of unassisted activities / week	6.71 of which:	additional documentary hours in the library, on the specialized electronic platforms and on the field			2.14
		hours of individual study after manual, course support, bibliography and notes			2.5
		training seminars / laboratories, homework and papers, portfolios and essays			2.07
3.7* Number of hours of unassisted activities / semester	94 of which:	additional documentary hours in the library, on the specialized electronic platforms and on the field			30
		hours of individual study after manual, course support, bibliography and notes			35
		training seminars / laboratories, homework and papers, portfolios and essays			29
3.8 Total hours / week [9]	10.71				
3.8* Total hours /semester	150				
3.9 Number of credits	6				

4. **Prerequisites** (where applicable)

4.1 Curriculum	•
4.2 Competencies	•

[1] The name of the faculty which manages the educational curriculum to which the discipline belongs
[2] The name of the department entrusted with the discipline, and to which the course coordinator/holder belongs.
[3] The code provided in HG - on the approval of the Nomenclature of fields and specializations / study programs, annually updated.
[4] Discipline falls under the educational curriculum in one of the following formative disciplines: Basic Discipline (DF), Domain Discipline (DD), Specialist Discipline (DS) or Complementary Discipline (DC).
[5] Application activities refer to: seminar (S) / laboratory (L) / project (P) / practice/training (Pr).
[6] Year of studies in which the discipline is provided in the curriculum.
[7] Discipline may have one of the following regimes: imposed discipline (DI) or compulsory discipline (DOb)-for the other fundamental fields of studies offered by UPT, optional discipline (DO) or optional discipline (Df).
[8] The number of hours in the headings 3.1 *, 3.2 *, ..., 3.8 * is obtained by multiplying by 14 (weeks) the number of hours in headings 3.1, 3.2, ..., 3.8. The information in sections 3.1, 3.4 and 3.7 is the verification keys used by ARACIS as: (3.1) + (3.4) ≥ 28 hours / wk. and (3.8) ≤ 40 hours / wk.
[9] The total number of hours / week is obtained by summing up the number of hours in points 3.1, 3.4 and 3.7.

5. Conditions (where applicable)

5.1 of the course	• Lecture room, equipped with: blackboard, video projector and computer • Students will come to class with their mobile phones turned off • • Student participation in the course according to the regulations in the APPENDIX TO H.S. NO. 233 of 15.09.2016, APPENDIX no. 4 of the UPT Charter in force
5.2 to conduct practical activities	• Spaces and facilities • Specialized laboratory for biotechnologies • Student obligations • Compliance with labor protection rules and instructions in the laboratory • Use of personal protective equipment • The correct use of equipment, utensils and materials from the laboratory equipment • Elaboration and support of a project on a topic assigned at the first laboratory session • The performance of practical laboratory work by students is conditioned by the acquisition of minimum knowledge presented in the laboratory report. In this sense, students will take laboratory tests before each practical work and the minimum grade for the practical performance of the work must be 5.00. Otherwise, the student acknowledges that he cannot participate in the practical work, which will be recovered in separate sessions according to the regulation in the APPENDIX TO H.S. NO. 233 of 15.09.2016, APPENDIX no. 4 of the UPT Charter in force

6. Specific competencies acquired through this discipline

Specific competencies	• Developing the ability to identify applicability for biosynthesis products • Understanding the functions of enzymes and other key molecules involved in biosynthetic processes • Ability to analyze and interpret the metabolic pathways involved in biosynthesis, including the identification and evaluation of key intermediates • Monitoring specific stages, identifying critical points and solving problems under conditions of qualified assistance
Professional competencies ascribed to the specific competencies	• - Analyse production processes for improvement; • - Manage chemical testing procedures; • - Test materials; • - Write technical reports • -Performs chemical experiments • -Approve engineering design • -Assess environmental impact

Transversal competencies ascribed to the specific competencies

- - Conduct quality control;
- - Apply scientific, technological and engineering knowledge;
- - Uses equipment, instruments or technological equipment accurately.

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7. Objectives of the discipline (based on the grid of specific competencies acquired - pct.6)

7.1 The general objective of the discipline	• The main objective is to provide to the students with a detailed understanding of biosynthesis processes, including knowledge of the biochemical mechanisms involved in the production of biological molecules
7.2 Specific objectives	• Gain a deep understanding of the biosynthetic processes involved in the production of bioactive compounds, including analysis of the metabolic pathways and enzymes

	involved. • Understanding how organisms such as plants, fungi or bacteria can be used to produce chemical compounds with potential therapeutic effects. • Evaluation of the factors that can influence the efficiency and quality of the production of biactive products through biosynthesis and the identification of strategies for their improvement

8. Content [10]

8.1 Course	Number of hours	Teaching methods [11]
1. General notions about biotechnologies	2	Lecture, use of video projector, resources in electronic format
2. Microorganisms used in biotechnology Types of microorganisms Selection and improvement of microorganisms	4	
3. Analysis of Molecular Interactions: Examination of key molecular interactions between biosynthesized compounds and biological targets, with an emphasis on structure and mechanisms of action.	4	
4. Use of Genetically Modified Organisms in the Production of Bioactive Compounds	4	
5. Pharmacology and Drug Development: Linking biosynthetic processes with subsequent stages of drug development, including preclinical testing, clinical trials, and drug approval regulations.	6	
6. Biosynthesis of Peptides and Bioactive Proteins: Examining the processes involved in the biosynthesis of peptides and proteins with bioactive potential.	4	
7. Practical Aspects of Large-Scale Production: Detailed approach to the practical challenges associated with large-scale production of bioactive compounds, including issues related to cost, efficiency and sustainability.	2	
8. Study of Bioinformatics in Biosynthesis: Introduction of bioinformatics concepts for analyzing and modeling metabolic pathways involved in biosynthesis, as well as for identifying potential key genes or enzymes	2	
Bibliography [12] 1. Dăescu, C., Produse de bio- şi semisinteză, Editura Politehnica, Timişoara, 2006 2. M. Moo-Young (Editor-in-Chief), Comprehensive Biotechnology, Volume 3: Industrial biotechnology and commodity products, Elsevier, Amsterdam, 2011. 3. M.Thakur, T. Belwal, Bioactive Components A Sustainable System for Good Health and Well-Being, Springer 2022		
8.2 Applied activities [13]	Number of hours	Teaching methods
1. Norms of security technique and labor protection. Presentation of the equipment and the main working techniques in the biotechnological laboratory	4	education
2. Isolation and identification of bioactive compounds: 2.1. Extraction of bioactive compounds from plant materials or microorganisms. 2.2. Use of chromatographic techniques (such as HPLC or GC) for separation. 2.3. Characterization of compounds by spectroscopic methods (NMR, mass spectrometry) for compound identification	8	Individual work
3. Stability and formulation studies: 3.1 Investigating the stability of bioactive compounds under different	4	Individual work

[10] It details all the didactic activities foreseen in the curriculum (lectures and seminar themes, the list of laboratory works, the content of the stages of project preparation, the theme of each practice stage). The titles of the laboratory work carried out on the stands shall be accompanied by the notation "(*)".

[11] Presentation of the teaching methods will include the use of new technologies (e-mail, personalized web page, electronic resources etc.).

[12] At least one title must belong to the discipline team and at least one title should refer to a reference work for discipline, national and international circulation, existing in the UPT library.

[13] Types of application activities are those specified in footnote 5. If the discipline contains several types of applicative activities then they are sequentially in the lines of the table below. The type of activity will be in a distinct line as: "Seminar:", "Laboratory:", "Project:" and / or "Practice/training".

conditions. 3.2. Development of formulations to increase stability and bioavailability.		Individual work
4. Enzyme kinetics: 4.1 Investigating the kinetics of enzymes involved in biosynthetic pathways. Determination of substrate specificity and optimal conditions for enzyme activity	8	
Bibliography [14] 1. F. Chemat, Microwave-assisted Extraction for Bioactive Compounds Theory and Practice, Springer 2012 2. S. Hanessian, G. Folkers, H.Kubinyi, R. Mannhold, Natural Products in Medicinal Chemistry, Wiley & Sons, 2013		

9. Corroboration of the content of the discipline with the expectations of the main representatives of the epistemic community, professional associations and employers in the field afferent to the program

- The discipline contributes to the development of the necessary skills to understand the obtaining and development of biosynthetic products, being consistent with the requirements of employers in the respective field

10. Evaluation

Type of activity	**10.1** Evaluation criteria [15]	**10.2** Evaluation methods	**10.3** Share of the final grade
10.4 Course	Evaluation of knowledge interest	Assessment: oral exam, including two theoretical subjects and one subject with an applied nature	60%
10.5 Applied activities	**S:**		
	L: Assessment of practical knowledge	Written assessment at each laboratory session	40%
	P[16]**:**		
	Pr:		
10.6 Minimum performance standard (minimum amount of knowledge necessary to pass the discipline and the way in which this knowledge is verified [17])			
• studying course notes; • participation in practical laboratory work • promotion of the subject is conditional on solving 50% of the subjects in the exam and a minimum average of 5 in the Assessment of practical knowledge			

Date of completion	**Course coordinator (signature)** Conf.dr.ing Anamaria Todea	**Coordinator of applied activities (signature)** Asist. Drd Ioana Cristina Benea
Head of Department (signature) S.L.dr.ing. Andra TĂMAȘ	**Date of approval in the Faculty Council** [18]	**Dean (signature)** Ș.L.dr.ing. Mircea Laurențiu DAN

[14] At least one title must belong to the discipline team.
[15] Syllabus must contain the procedure for assessing the discipline, specifying the criteria, methods and forms of assessment, as well as specifying the weightings assigned to them in the final grade. The evaluation criteria shall be formulated separately for each activity foreseen in the curriculum (course, seminar, laboratory, project). They will also refer to the forms of verification (homework, papers, etc.)
[16] In the case where the project is not a distinct discipline, this section also specifies how the outcome of the project evaluation makes the admission of the student conditional on the final assessment within the discipline.
[17] It will not explain how the promotion mark is awarded.
[18] The endorsement is preceded by the discussion of the board's view of the study program on the discipline record.