SYLLABUS

1. Information about the program

1.1 Higher education institution	Politehnica University Timisoara
1.2 Faculty[1]/ Department [2]	Industrial Chemistry and Environmental Engineering / 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]			Biochemistry/ DS				
2.2 Coordinator (holder) of course activities			S.L. dr. ing. Valentin BADEA				
2.3 Coordinator (holder) of applied activities[5]			S.L. dr. ing. Valentin BADEA				
2.4 Year of study[6]	II	**2.5** Semester	4	**2.6** Type of evaluation	D	**2.7** Regime of discipline[7]	DI

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	2 of which:	**3.2** course	1	**3.3** seminar / laboratory / project	1/0/0
3.1* Total number of fully assisted hours / semester	28 of which:	**3.2*** course	14	**3.3*** seminar / laboratory / project	14/0/0
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	1.57 of which:	additional documentary hours in the library, on the specialized electronic platforms and on the field			1
		hours of individual study after manual, course support, bibliography and notes			
		training seminars / laboratories, homework and papers, portfolios and essays			0.57
3.7* Number of hours of unassisted activities / semester	22 of which:	additional documentary hours in the library, on the specialized electronic platforms and on the field			6
		hours of individual study after manual, course support, bibliography and notes			10
		training seminars / laboratories, homework and papers, portfolios and essays			6
3.8 Total hours / week [9]	3.57				
3.8* Total hours /semester	50				
3.9 Number of credits	2				

4. **Prerequisites** (where applicable)

4.1 Curriculum	• Organic chemistry, Structure and properties of molecules, Physical chemistry
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	• Video projection system; • Students will not attend lectures and seminars with their mobile phones turned on. Also, telephone conversations during class or seminar hours will not be tolerated, nor will students leaving the class or seminar room to take personal phone calls; • Students being late for class and seminar will not be tolerated, as this demonstrates disinterest in the educational process.
5.2 to conduct practical activities	• Seminar: Classroom with computer, video projector and board. It is forbidden the use of mobile phones for calls, messages and recording the activities in the classroom

6. Specific competencies acquired through this discipline

Specific competencies	• Understanding of the fundamental concepts and theories of biochemistry applied in the field of chemical engineering. Ability to apply theoretical concepts in practice, to make correlations with other knowledge in biochemistry and other related sciences. • Ability to work in a team to solve problems and to use modern methods to obtain scientific information, including the use of the library.
Professional competencies ascribed to the specific competencies	• - Analyzes production processes for improvement • - Manages chemical analysis procedures • - Tests materials • - Writes technical reports • - Performs chemical experiments • - Approves engineering projects • - Manages the environmental impact of operations
Transversal competencies ascribed to the specific competencies	• - Conducts quality control; • - Applies scientific, technological and engineering knowledge; • - Uses equipment, instruments or technological equipment with precision

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

7.1 The general objective of the discipline	• The biochemistry course for the second year is a common general course, which is addressed to all students who follow the environmental engineering and chemical engineering profiles. The course aims to transmit and form basic knowledge in the field of general biochemistry for all students in the chemical engineering profile, regardless of the specialization section they will follow in the future.
7.2 Specific objectives	• To this end, the course consists of an introduction that presents the molecular logic of living organisms and defines the characteristic properties of biomolecules. Next, a systematic description of the structure, physicochemical properties, including elements related to the biological functions of the main organic biomolecules is made: carbohydrates (sugars or carbohydrates), nucleosides and nucleotides with coenzyme functions, nucleic acids, amino acids, peptides, proteins, lipids and the role of these biomolecules in living organisms. Simultaneously with the systematic description of the main organic biomolecules, a general presentation of the various types of their transformations in living organisms and the main types of metabolism is also made.

8. Content [10]

[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 "(*)".

8.1 Course	Number of hours	Teaching methods [11]
1. Molecular logic of living organisms; biomolecules and cells 1.1. Biomolecules and life 1.2. Axioms of molecular logic of living organisms 1.3. Water – universal metabolite, the role of water in organisms 1.4. Metabolic transformations of biomolecules: catabolism and anabolism; Types of metabolic reactions.	1	Interactive presentation with video support for fixing, consolidating and systematizing knowledge, lecture - debate, discussion, demonstration, problematization, case study, cooperative learning methods and techniques
2. Carbohydrates (sugars or carbohydrates) 2.1. Definition, classification, biological role; 2.2. Monosaccharides: structure and configuration, isomerism, physical and chemical properties, interconversion reactions; biological importance of some pentoses and hexoses; elements of metabolism; 2.3. Disaccharides, trisaccharides and oligosaccharides; 2.4. Structural (cellulose, chitin) and storage (starch, glycogen) polysaccharides.	4	
3. Nucleotides and nucleic acids 3.1. Definition and general structure of nucleic acids; 3.2. Heterocyclic bases (pyrimidine and purine) in nucleic acids; 3.3. Nucleosides and nucleotides; Nucleotides with coenzyme functions: nucleoside phosphates (ATP, ADP, AMP), pyridine nucleotides (NAD+, NADP+), flavin-adenine dinucleotide (FAD) and coenzyme A; 3.4. Structure, configuration and conformation of ribo- and deoxyribonucleic acids; their importance and biological role; 3.5. DNA, RNA, types, characteristics, importance, denaturation of nucleic acids.	2	
4. Natural amino acids 4.1. Definition, structure and nomenclature of natural amino acids; protein and non-protein amino acids; 4.2. Chemical and biochemical methods of obtaining amino acids; 4.3. Physico-chemical properties of amino acids; acid-base properties; 4.4. Amino acids with specific physiological functions, biogenic amines and natural amino alcohols.	2	
5. Peptides and proteins 5.1. Definition, primary, secondary, tertiary and quaternary structure; 5.2. Physicochemical properties; 5.3. Methods of analysis; amino acid analysis, amino acid sequence analysis, chemical and enzymatic methods of peptide chain cleavage; 5.4. Methods of synthesis of peptides and proteins; protection and activation of amino and carboxyl groups of amino acids; Merrifield solid phase synthesis; 5.5. Examples of peptides and proteins of biological importance; complex proteins (proteids)	3	
6. Lipids and membranes 6.1. Definition, classification, biological role; 6.2. Fatty acids: classification, structures, biosynthesis, fatty acid metabolism, biosynthesis of triacylglycerols; 6.3. Simple lipids: triglycerides; waxes, estolides, steroids and terpenes; 6.4. Complex lipids: phospholipids, glycolipids, sphingolipids, cerebrosides, gangliosides, lipoproteins.	2	

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

Bibliography [12] 1. C.D. Neniţescu, Chimie Organică, vol I şi II, Ed. didactică şi pedagogică, Bucureşti, ediţia a VIII-a, 1982; 2. Margareta Avram, Chimie Organică, vol I şi II, Ed. Zecasin, Bucureşti, ediţia a II-a, 1994; 3. A.L. Lehninger, Biochimie, Vol I, Ed. Tehnică, Bucureşti, 1987; 4. D. Voet, J. G. Voet, C.W. Pratt, Fundamentals of Biochemistry; John Wiley and Sons 1990; 5. A. Lupea, Complemente de Biochimie, Universitatea "Politehnica" din Timişoara, 1997; 6. A. X. Lupea, Biochimie fundamente; Editura Academiei, Bucureşti, 2007.		
8.2 Applied activities [13]	Number of hours	Teaching methods
1. Carbohydrates (sugars). Monosaccharides – aldoses and ketoses from the D configuration series, Fischer and Howarth structures, anomery, epimery; Oligo- and polysaccharides – mono- and dicarbonyl bonds in oligosaccharides and polysaccharides, enzymatic hydrolysis, examples of enzymes, determination of the structure of some oligosaccharides based on chemical (degradation, specific reactions of aldoses/ketoses) and biochemical (enzymatic hydrolysis) analyses.	5	Interactive oral presentation accompanied by exercises and problems on the course topic, cooperative learning methods and techniques, debate, panel discussion, brainstorming
2. Nucleotides, nucleic acids: structure of a polynucleotide; types and characteristics of RNA; decoding of a peptide sequence encoded by a scDNA sequence	2	
3. Amino acids, peptides and proteins: Natural amino acids, acid-base behavior of amino acids, buffer solutions, calculation of isoelectric pH of amino acids and oligopeptides, net electric charge, peptide electrophoresis, peptide synthesis: protection of amino and carboxyl groups, coupling agents and their additives; identification of the primary structure of a peptide chain by amino acid sequence analysis and chemical/enzymatic methods of its cleavage	6	
4. Lipids and membranes: identification of the structure of simple lipids (triglycerides; cerides, estolides, cardiolipins, plasmalogens, steroids, terpenes) and complex lipids (phospholipids, glycolipids, sphingolipids, cerebrosides, gangliosides), based on the component elements.	1	
Bibliography [14] 1. D.L. Nelson, M.M. Cox, Lehninger - Principles of biochemistry, 7th ed., W. H. Freeman and Company, 2017; 2. A.X. Lupea, Biochimie (Aplicaţii), Ed. Politehnica, Timişoara, 2003; 3. A. Lupea, Complemente de Biochimie, Universitatea "Politehnica" din Timişoara, 1997; 4. A.X. Lupea, M. Pădure, Biochimie şi bazele asimilării. Lucrări practice, Universitatea Tehnică Timişoara, 1995.		

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 subjects of Biochemistry are in agreement with similar subjects in Romania and abroad, and with the expectations of professional associations and representative's employers in the 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	Assimilation of knowledge; solving proposed applications and problems.	Written examination, based on questions an problems with different difficulty degrees to evaluate the knowledges, the way of thinking and the ability of correlation and synthesis	0.66

[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".
[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.)

10.5 Applied activities	**S:** The way of understanding the concepts taught in the course and their translation into applications and theoretical/practical problems.	Discussions, applications and proposed problems, noting the way to solve the problems received as individual study topics; Attendance records.	0.34
	L:		
	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])			
• The resolution of at least 50% of the topics in the evaluation tests and a minimum grade of 5 for ongoing activities.			

Date of completion	**Course coordinator (signature)** S.L. dr. ing. Valentin BADEA	**Coordinator of applied activities (signature)** S.L. dr. ing. Valentin BADEA
Head of Department (signature) S.L.dr.ing. Andra TĂMAȘ	**Date of approval in the Faculty Council** [18]	**Dean (signature)** S.L.dr.ing. Mircea Laurențiu DAN

[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.