ΜΟΝΑΔΑ ΔΙΑΣΦΑΛΙΣΗΣ ΠΟΙΟΤΗΤΑΣ Α.Π.Θ.

Biochemistry Theory and Laboratory

1. GENERAL			
SCHOOL	Faculty of Sciences in collaboration with Faculty of Engineering, Aristotle University of Thessaloniki		
DEPARTMENT	Materials Science and Engineering		
LEVEL OF STUDIES	ISCED level 7 (5-year Integrated Master's programme) ISCED level 6 (4-year BSc programme)		
COURSE CODE	**MSEN 732**	**SEMESTER**	7h Semester
COURSE TITLE	**Biochemistry Theory and Laboratory**		
TEACHING ACTIVITIES Lectures, tutorials/problem sessions, laboratory/computer exercises (where applicable), case studies and guided self-study.		**TEACHING HOURS PER WEEK**	**ECTS CREDITS**
		Lectures: 4 theory & 2 lab	6
COURSE TYPE	Background and Scientific Area		
PREREQUISITES	No prerequisites		
TEACHING AND EXAMINATION METHODS	English		
COURSE OFFERED TO ERASMUS STUDENTS			
COURSE URL	https://elearning.auth.gr/course/view.php?id=xxxxx		

2. LEARNING OUTCOMES	
Learning Outcomes	By the end of this course, students will: • understand the structure and function of proteins and enzymes, hence the functioning of living organisms at the molecular level • gain basic knowledge of the nucleic acids (DNA, RNA), the biosynthesis of nucleic acids and their catabolism • learn the genetic code that governs all living organisms • understand the mechanism of protein synthesis and how it is regulated • learn the covalent modifications of proteins and its formation in higher configurations • know the technology of recombinant DNA and its applications.
General Skills	• Searching, analyzing and synthesizing data and information • Decision-making • Independent work • Teamwork • Generate new research ideas

	• Project planning and management emphasizing materials science • Promoting free, creative and inductive thinking • Modeling and solving real-world problems • Working in a multidisciplinary environment

3. COURSE CONTENT

Biochemistry Theory

1. Water (physical properties and hydrogen bonding of water, structure of liquid water, the ion product of water: the pH scale, acids and bases, the fitness of the aqueous environment for living organisms).
2. Amino acids and Proteins

   Acid- base properties of amino acids, the amino acids as building blocks of proteins, common amino acids, rare amino acids, non-protein amino acids. The stereochemistry of amino acids and the absorption spectra. Amino acid reactions of amino groups, carboxyl groups and residue groups. Classification of proteins, Protein structure (covalent backbone and amino acid sequence, peptides, primary, secondary, tertiary, quaternary structure, higher conformation of proteins). Biological role of proteins, structural and functional proteins, protein denaturation, structure function relationship of proteins.
3. Enzymes

   Naming and classification of enzymes, Kinetics, enzyme cofactors, coenzymes, cytochromes, inhibition of enzymic reactions, enzymic specificity, enzyme substrate complexes and covalent enzyme-substrate compounds, enzyme function regulation, isoenzymes
4. Nucleic acids

   Nucleic acids and primary structure. Secondary structure of nucleic acids, DNA, RNA properties in solution, the biosynthesis of nucleotides, nucleic acid catabolism. Recombinant DNA, DNA replication, transcription and repair.
5. Protein synthesis

   The genetic code, the mechanism of protein synthesis, regulation of protein synthesis, covalent modifications, higher conformational structures of proteins and subcellular localization.
6. Cellular defense against viral components.
7. Recombinant DNA technology.

Biochemistry Laboratory

1. Quantitative determination of proteins

2. Study of protein properties (isoelectric point, protein stability, denaturation etc.)
3. Protein purification
4. Protein electrophoresis
5. Enzyme Kinetics, measurement of enzyme reaction rates using spectrophotometry
6. Michaelis–Menten analysis and calculation of $V_{max}$and K_m
7. Study of enzyme inhibitors (competitive, non-competitive)
8. Effect of pH and temperature on enzyme activity
9. Isolation of genomic and plasmid DNA
10. Quality and quantity assessment via spectrophotometry and agarose gel electrophoresis
11. Amplification of a specific DNA fragment using Polymerase Chain Reaction (PCR)
12. Analysis of PCR products by agarose gel electrophoresis
13. Restriction digestion of DNA with specific endonucleases

DNA ligation and *Escherichia coli* transformation

4. LEARNING & TEACHING METHODS – EVALUATION	
Teaching method	Face-to-face.
Use of ICT	Use of ICT in Course Teaching, Use of ICT in Communication with Students Description: Use of Information and Communication Technologies (ICT) in teaching the course with tools of modern distance learning (ZOOM) and asynchronous education (eclass). Use of learning aids based on ICT: Excel, Word, Power Point Use of ICT in student assessment: Electronic grading (eclass, universis). Use of ICT in communication with students: eclass, email, ZOOM.
Teaching organization	The supervised and unsupervised workload per activity is indicated below (total workload complies with ECTS standards).

Activity	Workload/semester (hours)
Lectures	28
Tutorials / problem sessions	14
Bibliographic Research and analusis	74
Laboratory exercises	24
Writing of assignments	8
Final written exam	2
Total	**150**

Student evaluation	Assessment Language: English Assessment Methods: • Short Answer Questions, • Multiple Choice Test • Essay Development Questions, • Problem Solving,

	• Written exams

5. SUGGESTED BIBLIOGRAPHY
Course Bibliography
Lehninger Principles of Biochemistry, David L. Nelson and Michael M. Cox (8th Edition). ISBN: 9781319381493 Voet's Principles of Biochemistry, Donald Voet, Judith G. Voet, Charlotte W. Pratt (Global Edition, 5th Edition). ISBN: 9781119455134
Additional bibliography for study
Teaching material slides