COURSE SYLLABUS

University	**Alexandru Ioan Cuza University of Iaşi**	**Course title**	
Faculty	**Physics**	**Molecular Principles of Bioactive Systems**	
Department	**Physics**		
Domain	**Physics**	**Course category** (FC/SC/CC[1]): **SC**	**Term** (1-4): **2**
Level	**Postgraduate (MA)** **1. Biophysics and Medical Physics**	**Course type** (Co/El/F[2]): **Co**	

I. Course structure

Number of hours/week				Credits	Total class hours/ semester	Total hours of individual activity	Examination type (C/Ex/CE[3])	Teaching language
Course	Seminar	Lab.	Project	**8**	**84**	**156**	**Ex**	**English**
3		**3**						

II. Instructors

	Academic degree[4]	Scientific degree	Name and surname	Faculty position (tenure/ associate - organization)
Course	Professor	PhD	Viorel MELNIG	tenure
Seminar				
Laboratory	Research asistant	PhD	Laura URSU	associate - organization

III. Prerequisites

General Chemistry, Cellular and Molecular Biology, Methods of Structural and Biostructural Analysis

IV. Course objectives

The ability to understand the relationship structure - function (reactivity, affinity, etc.), the main classes of biopolymers (proteins, nucleic acids, lipids, polysaccharides) that provides the morphological structure and functions of cells and supra-cellular structures of animal and vegetal systems. Ability to learn and apply knowledge from formal kinetics which applies in some areas of biological sciences and especially in metabolic processes. The ability to understand and apply knowledge about bioconversion energy issues in metabolic processes, which form the basis of evolution, development and self-organization of all biological organisms. The capacity to prospect, process and analyze information from variety of bibliographic sources and report research elaboration. The ability to generate new ideation concerning experimentally assays of analysis. Team skill worked for solving experimental and technological problems. Critical formulations ability considering the current stage from area, and looms new research directions. Personal and group's projects successfully capacity for initiated and administered; determination and sedulous in the realization of the tasks and of the responsibility.

V. Course content

Course	Types of Biopolymers: Hydrolysis and condensation reactions involved in the synthesis/cleavage of biopolymers; Structure and properties of proteins; Fibrous proteins and globular proteins - specific properties; Structure and properties of nucleic acids; Structure and properties of carbohydrates; Lipids, phospholipids – supramolecular assembly; Structure of membranes. Proteins in solution: Thermodynamic equilibrium of biological aqueous solutions; The nature of weak interactions (physical) in the biological environment (aqueous); The stability and equilibrium of biopolymers self-assembled structures; General properties of enzymes. Kinetics of enzymatic reactions: Chemical mechanisms of enzyme catalysis; The "steady state" approximation; Michaelis - Menten kinetic type; Allosteric kinetic type; Dynamic analysis of enzyme systems: Enzymatic and metabolic control setting; Types of models of Metabolic Control System. Terms of spontaneous evolution of biological processes: Development of independent processes; Energetic of passive transport; Evolution of coupled processes; Active transport energetic. Chemiosmotic theory of protons "flow": Proton electrochemical potential measurements; Stoichiometric reactions

[1] FC – fundamental course, SC – specialty course, CC – complementary course
[2] Co – compulsory, El – elective, F – facultative
[3] C – colloquium, Ex – exam, CE – colloquium AND exam
[4] Professor / Associate professor / Lecturer / Assistant professor / Teaching assistant

	involving proton transfer. Thermodynamics of complex bio-processes: Energy rating bioconversion reactions; Determination of the calorie content of food; Thermodynamics of oxidoreduction processes; Oxidoreduction processes in biological systems; Oxidative phosphorylation; Photosynthesis; glycolysis; regulations of the bioenergetic processes.
Seminar	
Laboratory	L1: Force interactions in biomolecular systems; L2: The desalting of ethanol and water. A colourful illustration of intermolecular forces; L3: Influence of pH of aqueous environment on biomolecules. Amphoteric nature of amino acids and proteins; L4: Liquid – liquid equilibrium. Nernst distribution law; L5: Cellulose degradation; L6: Hydrolysis of starch. Determination of starch grain fraction; L7: DNA denaturation study; L8: Experimental determination of glucose mutarotation constant; L9: Sucrose inversion; L10: Determination of glucose and sucrose by colorimetric method; L11: Determining the caloric content of food by the bomb calorimetric method; L12: Determination of oxygen consumption by suspensions of mitochondria.

VI. Minimal required references

1. *L. Lehniner, "Biochimie", Ed. Tehnică, Bucureşti 1987;
2. Melnig, "Elemente de Termodinamică Chimică", Editura Universităţii "Al. I. Cuza" Iaşi, 1995;
3. R. Contor, P. R. Schimmel, "Biophysical Chemistry – The behaviour of biological macromolecules", Ed. W. H. Freeman &, New York, 1980;
4. Viorel Melnig, Ana Garlea, Laura Obreja, Lucrari de laborator de Biostructura. Partea I: Proprietatile solutiilor apoase, Alexandru Ioan Cuza University Press, Iasi, 2008 ISBN 978 - 973 - 703 - 300 – 0128.
5. Renee R. Alexander &, "Basic Biochemical Methods, John Wiley & Sons, 1985;
6. *Mircea – Odin Apostu, Viorel Melnig, *Bazele termodinamice ale transportului prin membrane*, Ed. Universităţii Alexandru Ioan Cuza, Iasi, 2008 (212 pagini) ISBN 978-973-703-395-6.
7. D. E. Metzler, "Biochemistry – The chemichal reactions of living cells", Ed. Academic Press, New York, San Francisco, London, 1977.

VII. Didactic methods

magisterial lecture; debate; problematization; frontal experiment; conducted revelation

VIII. Assessment

Pre-conditions	course attendance, active participation to class activities; minimum eleven laboratories attendance.	
Exam dates	**1st Assessment**	8th week
	2nd Assessment	16th week

	Assessment means and methods	**Percentage of the final grade**
Exam/Colloquium	written exam	45%
Seminar		
Laboratory	laboratory colloquium; project	20% 35%