Course Syllabus

I General Information

Course name	Biochemistry with enzymology
Programme	Biotechnology
Level of studies (BA, BSc, MA, MSc, long-cycle MA)	BSc
Form of studies (full-time, part-time)	part-time
Discipline	Biological sciences
Language of instruction	English

Course coordinator/person responsible	dr hab. Konrad Kubiński prof. KUL

Type of class *(use only the types mentioned below)*	Number of teaching hours	Semester	ECTS Points
lecture	30 (30 remote)	III	8 (2 remote)
tutorial			
classes	60	III	
laboratory classes			
workshops			
seminar			
introductory seminar			
foreign language classes			
practical placement			
field work			
diploma laboratory			
translation classes			
study visit			

Course pre-requisites	General and inorganic chemistry, organic chemistry

II Course Objectives

Gaining knowledge about selected organic compounds (amino acids, proteins, nucleic acids, saccharides and fats) Acquainting students with the methodologies of basic biochemistry and enzymology through their individual execution. Forming skills of observation, asking questions, designing experiments, discuss the results and make proposals Developing ability to use specific vocabulary and terms of biochemistry.

III Course learning outcomes with reference to programme learning outcomes

Symbol	Description of course learning outcome	Reference to programme learning outcome
KNOWLEDGE		
W_01	presents terminology used in biochemistry and enzymology, defines phenomena and biophysical, physiological and biochemical processes occurring in living organisms	K_W01
W_02	knows and understands issues in the field of physics, mathematics and chemistry necessary to understand and interpret basic biochemical processes	K_W02
W_03	presents knowledge in the field of laboratory techniques and research tools used in biochemistry and enzymology	K_W05
W_04	presents issues in the field of biochemistry necessary for practical use in biotechnological processes used in industry and agriculture	K_W08
W_05	presents the principles of health, safety work and ergonomics, indicates the psychophysical possibilities of a human in the work environment	K_W09
SKILLS		
U_01	applies techniques and research tools in the field of biochemistry and enzymology	K_U01
U_02	carries out observations and performs physical, chemical and biological measurements	K_U02
U_03	prepares a written study on issues related to biochemistry and enzymology in the language in which classes are conducted and in another modern language using the scientific language	K_U13
U_04	designs and performs research tasks or expertise in the field of biochemistry and enzymology	K_U15
U_05	learns independently in a targeted manner in the field of biotechnology, updates his knowledge and skills, applies new research techniques and plans his professional development	K_U17
SOCIAL COMPETENCIES		
K_01	is ready to work in the research laboratory during biochemical analyzes	K_K04

IV Course Content

Lectures: Macromolecules found in nature (proteins, nucleic acids DNA and RNA, sugars, fats, steroids, vitamins and dyes). Hierarchy of molecular organization of cell components. Amino acids and proteins - structures and functions, properties and specific reactions of amino acids. Protein properties: denaturation, isoelectric point. Enzymes, regulation of their activity, inhibitors and activators, kinetics, specificity. DNA - structures, role, properties. Replication and transcription. RNA - structure, properties and types. Pre-mRNA maturation. Genetic code, ribosomes - structure and function, translation. Post-translational protein modifications and their significance. General information about genetic engineering and DNA cloning. Metabolism - concepts and organization, obtaining energy. Carbohydrates and fats and their transformation. Structure, properties and

characteristic reactions of monosaccharides and polysaccharides. Structure and properties of nucleic acids. Structure and properties of fatty acids and fats. Classification and enzyme nomenclature. Methods for modifying enzymes. Monomeric, oligomeric and multi-enzyme complexes - their structures and functions. Enzyme cofactors. Comparison of the action of enzymes and inorganic catalysts. Enzymatic units. Influence of temperature, pH of the environment, activators and inhibitors on enzymatic activity. Kinetics of enzymatic reaction. Effect of substrate and enzyme concentration on the enzymatic reaction. Initial reaction speed. Model Michaelis-Menten. Determination of Michaelis constant (Km) and maximum velocities (Vmax) of selected enzymatic reactions in the presence and absence of an inhibitor. Mechanisms of intracellular protein degradation. Industrial and clinical aspects of enzymology. Molecular aspects of the formation of life and functioning of organisms.
Classes: Structure, properties and characteristic reactions of amino acids. Protein structures. Properties of proteins: denaturation, isoelectric point. Quantitative measurement of proteins in solution using colorimetric methods. Structure, properties and characteristic reactions of monosaccharides and polisaccharides. Chemical and enzymatic hydrolysis of starch. Structure and properties of nucleic acids. Quantitative measurement of DNA in solution using colorimetric and fluorescent methods. Structure and properties of fat acids and fats. Comparison enzymes as biological catalysts with inorganic catalysts. Enzymes characteristics: chemical constitution and catalytic mechanisms. Nomenclature and classification. Enzymatic activity units. Identification and quantitative determination of selected enzymes. Methods for the study of enzyme activity and physicochemical properties. Analysis of enzymes specificity e.g. selected hydrolases. The factors influencing enzymatic activity – pH, activators and inhibitors. Kinetics of enzyme reactions. Influence of concentration of substrate and concentration of enzyme on the enzymatic reaction. The initial reaction velocity. Michaelis-Menten model. Determination of Michaelis constant (KM) and maximum velocity (Vmax) of selected enzymatic reactions in without and in the presence of inhibitor.

V Didactic methods used and forms of assessment of learning outcomes

Symbol	Didactic methods *(choose from the list)*	Forms of assessment *(choose from the list)*	Documentation type *(choose from the list)*
KNOWLEDGE			
W_01, W_02 W_03 W_04 W_05	conventional lecture, laboratory analysis,	Written exam, test;	examination card; rated test/exam, protocol
SKILLS			
U_01 U_02 U_03 U_04 U_05	Laboratory classes	observation; test of practical skills, report	Report printout,
SOCIAL COMPETENCIES			
K_01	Laboratory classes	Test of practical skills,	Report printout

VI Grading criteria, weighting factors.....

Very good (5)	the student realizes the assumed learning outcomes at a very good level	the student demonstrates knowledge of the education content at the level of 95-100%
Over good (4.5)	the student accomplishes the assumed learning outcomes an over good level	the student demonstrates knowledge of the education content at the level of 85-94 %
Good (4)	the student accomplishes the assumed learning outcomes at a good level	the student demonstrates knowledge of the education content at the level of 75-84%
Quite good (3.5)	the student accomplishes the assumed learning outcomes at a quite good level	the student demonstrates knowledge of the education content at the level of 65-74%
sufficient (3)	the student accomplishes the assumed learning outcomes at a sufficient level	the student demonstrates knowledge of the education content at the level of 51-64%
insufficient (2)	the student accomplishes the assumed learning outcomes at an insufficient level	the student demonstrates knowledge of the education content below the level of 51%

VII Student workload

Form of activity	Number of hours
Number of contact hours (with the teacher)	90 (30 remote)
Number of hours of individual student work	135 (25 for preparation for remote hours)

VIII Literature

Basic literature
1. Biochemistry Eighth edition by Berg, Jeremy M., Tymoczko, John L., Gatto, Gregory J., Stryer (2015) 2. BIOS Instant notes in Biochemistry third edition by D. Hames, N. Hooper (2005) 3. Practical Enzymology, Second Edition by H. Bisswanger (2012)
Additional literature
Handbook of Biochemistry and Molecular Biology,5th Edition,Roger L. Lundblad, Fiona Macdonald, CRC Press