1. COURSE DECRYPTION – GENERAL INFORMATION			
1.1. Course teacher	Professor Tihana Žanić Grubišić, PhD Professor Karmela Barišić, PhD Professor Lada Rumora, PhD	1.6. Year of study	2nd
1.2. Name of the course	**Biochemistry**	1.7. Credit value (ECTS)	10.5
1.3. Associate teachers	Marija Grdić Rajković, PhD Anita Somborac Bačura, PhD Andrea Hulina, mag. med. biochem.	1.8. Type of instruction (number of hours L+E+S+e-learning)	60+45+15
1.4. Study programme (undergraduate, graduate, integrated)	Medical Biochemistry integrated study programme	1.9. Expected enrolment in the course	25
1.5. Status of the course	Compulsory	1.10. Level of use of e-learning (1, 2, 3 level), percentage of instruction in the course on line (20% maximum)	2nd
2. COURSE DESCRIPTION			
2.1. Course objectives	Student will acquire fundamental knowledge necessary to understand molecular logics of biochemical processes in living organisms; recognise dynamics in the synthesis and degradation of the natural biomacromolecules: proteins, polysaccharides, lipids and nucleic acids, and will be able to analyse and identify important factors that are influencing dynamics, control and regulation of cellular metabolism. Biochemical knowledge and skills acquired are compulsory basis for the further studies, especially in clinical biochemistry, haematology, pharmacology, biochemistry of drug metabolism, nutrition, molecular biology and genetic engineering, molecular diagnostics, identify molecular basis of diseases and therapy and other lessons dealing with metabolism of endogenic macromolecules, drugs and other xenobiotic in health and disease.		
2.2. Enrolment requirements and required entry competences for the course	Enrolment requirements: completed study course Biological Chemistry		
2.3. Learning outcomes at the level of the study programme to which the course contributes	• Students will be able to apply fundamental biochemical knowledge to explain, analyse and evaluate procedures related to the research, development and quality control of diagnostic reagents and diagnostic methods in general. • Implementation of the optimal solutions for practical and everyday problems in monitoring progress of the disease		

	or drug therapy (research and application of new laboratory diagnostic procedures for therapeutic drug monitoring). • Critical evaluation and application of the scientific data and expert knowledge for the problem solving in biochemical systems.
2.4. Expected learning outcomes at the level of the course (4-10 learning outcomes)	After passing the exam students will be able to: 1. Apply expert knowledge of biochemistry, chemistry and biology in biochemical problem solving; 2. Describe and apply basic biochemical principles for relating structure and function of the protein macromolecules; 3. Determine key enzymes regulating reaction rate in the metabolic pathways and asses what diagnostically measurable biochemical changes might indicate disorders in the particular enzyme systems. Estimate what genetic factors might be relevant to diseases and relate enzyme kinetics to regulatory enzyme characteristics; 4. Explain biochemical mechanism of the DNA replication, generation and repair of the DNA mutations, recognise role of all elements in the process of transcription and protein synthesis, in prokaryotes and eukaryotes; 5. Review basic principles of acquiring and processing of data in pharmacogenetics, transcriptomics and proteomics 6. Designing and performing biochemical experiments based on grasped experimental and technical skills; 7. Analyse scientific data bases for the interpretation of the personal results and presentation to the professional audience.
2.5. Course content broken down in detail by weekly class schedule (syllabus)	LECTURES AND SEMINARS: • Dynamic aspects of structure and function of specific proteins: haemoglobin, myoglobin, collagen, elastin, proteins of the extracellular matrix • Structure and function of cell membranes in various tissues, transport of ions, amino acids, sugars • Methods for exploring proteins • Generation, transforming and storing of metabolic energy: basic concepts of metabolism • Glycolysis • Oxidative decarboxylation of pyruvate, citric acid cycle • Cellular bioenergetics and role of ATP generation and expenditure, respiratory chain and oxidative phosphorylation • Gluconeogenesis and pentose phosphate pathway • Glycogen metabolism, glycogenesis and glycogenolysis, reactions and hormone regulation • Biochemistry of hormones: insulin, epinephrine and cortisol • Fatty acid metabolism, degradation and synthesis of triglycerides,biosynthesis and β-oxidation of fatty acid, biosynthesis of ketone bodies

<table>
<tr><td></td><td colspan="6">
• Protein turnover and amino acid catabolism, urea cycle
• Biosynthesis of macromolecular precursors, amino acids, ribonucleotides and deoxyribonucleotides
• Information in biological systems: DNA - structure and genetic role, genome organisation, chromosomes and genes
• Methods for exploring genome
• Histones and DNA packing, conformation of DNA molecule, DNA replication, fidelity of replication
• DNA mutations and repair
• RNA in translation of genetic message
• Synthesis and modification of functional RNA molecules: mRNA and transcription, t-RNA, activation and role in protein synthesis, structure of ribosomes and rRNA
• Genetic code and relation of genes and proteins, protein synthesis and and protein sorting
• Control of gene expression in prokaryotes: Lac-operon and Trp-operon
• Chromosomes in eukaryotes and control of gene expression in eukaryotes, introns and exons
• Integration of biochemical processes in the cell - basic concepts and design, strategy, control and regulation of metabolism
LABORATORY PRACTICALS:
• Determination of initial velocity v_o in acetylcholine reaction
• Alkaline phosphatase
• Homogenisation, differential centrifugation, determination of DNA and lactate in cellular fractions
• Isolation of plasmid DNA from the transformed bacteria
• Rate of glycolysis in various tissues
• Electrophoresis of haemoglobin
• Evaluation of cytotoxicity with MTT test
• Determination of thiols group and glutathione concentration
</td></tr>
<tr><td>2.6. Type of instruction</td><td colspan="3"><u>lectures</u>
<u>seminars</u> and workshops
<u>exercises</u>
online in entirety
mixed e-learning
field work</td><td colspan="2"><u>independent study</u>
multimedia and the internet
<u>laboratory</u>
work with the mentor
(other)</td><td>2.7. Comments:</td></tr>
<tr><td>2.8. Student responsibilities</td><td colspan="6">Regular attendance at the lectures, obligatory attendance at the seminars and laboratory practice, active participation in seminars with individual presentations.</td></tr>
<tr><td rowspan="6">2.9. Screening of student’s work (specify the proportion of ECTS credits for each activity so that the total number of CTS credits is equal to the credit value of the course)</td><td>Class attendance</td><td>0.5</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td>2</td><td>Report</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1</td><td>Semestral written tests</td><td>1.5</td></tr>
<tr><td>Tests</td><td>1</td><td>Oral exam</td><td>2.5</td><td>(Other—describe)</td><td></td></tr>
<tr><td>Written exam</td><td>2</td><td>Project</td><td></td><td>(Other—describe)</td><td></td></tr>
</table>

2.10. Grading and evaluation of student work over the course of instruction and at a final exam	Seminars are organised as a problem solving practice, teachers are guiding the discussion and evaluating student achievements. During the lecture course two tests are organised, and marked for the final grade. Two additional tests are organised for laboratory practicals, before and after completing exercises. At the end of the complete lecture program written and oral exam are organised for the whole program and final grade is decided.
2.11. Required literature (available at the library and via other media)	**Title**
	JM Berg, JL Tymoczko, L. Stryer: Biochemistry, 7th edition, Školska knjiga, Zagreb, 2013.
	TM Devlin: Texbook of Biochemistry with Clinical Correlation, J. Wiley & sons, New York, 2011.
2.12. Optional literature	C. Smith, AD Marks: MMarks' basic Medical Biochemistry, A Clinical Approach. Lippincott Williams & Wilkins, Philadelphia, 2005.
2.13. Methods of monitoring quality that ensure acquisition of exit competences	Learning outcomes 1 and 6 are tested during experimental work in laboratory practicals and tests, outcome 7 during seminars, and outcomes 2-5 with written and oral exam.