



**Faculty of Medicine, University of Rijeka**

**Cours:** Biochemistry II

**Course Coordinator:** Dijana Detel, MD, PhD, Associate professor

**Colaborators:** Jelena Marinić, PhD, Assistant professor

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**Department:** Department of Medical Chemistry, Biochemistry and Clinical Chemistry

**Study:** Integrated Undergraduate and Graduate University Study of Medicine in English

**Year of the study:** Second

**Academic year:** 2021./2022.

## **COURSE SYLLABUS**

**Course information (basic description, general information, teaching overview, required equipment and preparation, etc.)**

Biochemistry II is a compulsory course at the second year of the Integrated Undergraduate and Graduate University Study of Medicine in English. It consists of 42 hours of lectures, 34 hours of seminars, and 34 hours of laboratory practicals, overall 110 hours (9 ECTS). Lectures and seminars are held in lecture halls of the Faculty of Medicine according to the course schedule. Laboratory practicals are held at the Department of Medical Chemistry, Biochemistry and Clinical Chemistry.

The goal of teaching Biochemistry is to understand how the human body works at the molecular level: how it uses energy, how it keeps its structure, how does it recognize different signals and respond to them, how it develops and grows, and how it protects against disease. The focus is on the integrative function of tissues and organs. This curriculum forms biochemical basis of physiology and offers the student the knowledge necessary for understanding biochemical basis of many pathobiochemical processes and diseases. Understanding these principles should help students and physicians in using the appropriate biochemical diagnostic procedure in order to improve health, in disease prevention, and in treatment of disorders at any human age.

Thorough the seminary part, students will gradually acquire and connect topics related to course aims. Students will acquire knowledge and experience in basic laboratory techniques and analytical clinical methods related to physiological and pathological states of the organism thorough laboratory practicals.

### **Content of the course**

01. Introduction
02. Enzymes
03. Bioenergetics
04. Metabolism of carbohydrates
05. Metabolism of lipids
06. Structure and function of DNA and RNA
07. Hormon action and signal transduction
08. Biological membranes and cellular signaling

09. Metabolism of proteins and amino acids
10. Vitamins
11. Oxidative stress
12. Integration of Metabolism
13. Biomedical importance of serum enzymes and proteins

**Required literature:**

1. V.W. Rodwell et al.: Harpers Illustrated Biochemistry, 30th edition, The McGraw –Hill Education, New York 2015.
2. Č. Milin et. all.: Handbook for seminars and Laboratory practicals in Biochemistry II, Department of Chemistry and Biochemistry Faculty of Medicine, University of Rijeka, 2019.

**Recommended for additional reading:**

1. J.M. Berg et al: Biochemistry, 8<sup>th</sup> edition, W.H. Freeman and Company, New York, 2012.
2. D.L. Nelson, M.M. Cox: Lehninger Principles of Biochemistry, Fourth Edition

**Course teaching plan:**

**The list of lectures (with the titles and learning outcomes):**

**L1 Importance of biochemistry in understanding health and disease and the application of biochemistry in clinical practice.**

Understanding the aim of the course. Recognizing the role of Biochemistry in health care.

**L2-3 Enzymes. Classification of enzymes. The kinetics of enzyme catalysis. Regulation of enzymatic activity.**

To explain the structure and the function of enzymes. To explain the structure and the function of catalytic centers. To describe the kinetics and the mechanism of enzyme-catalyzed reactions. To define and describe mechanisms of enzymatic activity regulation.

**L4 Digestion and absorption of carbohydrates.**

To list carbohydrates that appear in the food and carbohydrates that are final products of digestion (hydrolysis catalyzed by an enzyme) being transported into enterocytes. To describe enzymes that catalyze hydrolytic cleavage of oligosaccharides and polysaccharides.

**L5-6 Metabolic pathways of carbohydrates. Glycolysis. Aerobic and anaerobic glycolysis. Regulation of glycolysis.**

To explain anaerobic and aerobic glycolysis pathways and state their final products. To show glycolysis schematically, list glycolysis enzymes, calculate the balance of ATP formation on the substrate level by "aerobic" glycolysis of glucose and glycogen, to describe NAD<sup>+</sup> and NADH + H<sup>+</sup> roles in the glycolysis, glyceraldehyde-3-P oxidation, and pyruvate reduction. To describe the cellular location of anaerobic glycolysis. To describe and discuss the regulation of glycolysis.

**L7 Oxidative decarboxylation of keto acids.**

To show sum equation of oxidative phosphorylation of pyruvate into acetyl-CoA; list all the enzymes, coenzymes, and cofactors involved in the formation of acetyl-CoA from pyruvate and insert them in the metabolic scheme; to state the number of ATP moles generated by formation of acetyl-CoA from one mole pyruvate; to explain the (non)possibility of pyruvate formation from acetyl-CoA.

**L8-9 Citric Acid Cycle. Regulation of Citric Acid Cycle.**

To state the basic role of citric acid cycle (Tricarboxylic Acid Cycle); to show the cycle schematically, to state cycle reactions' cellular locations; to state reactions by which terminal oxidations occur together with corresponding enzymes and coenzymes; to state citric acid. To list regulatory enzymes and reactions catalysed by those enzymes.

**L10 Gluconeogenesis. Cory cycle.**

To describe gluconeogenesis, to define molecules that enter the gluconeogenesis pathway, to display glucose and glycogen formation from proteins and lipids, to list phosphatase involved in gluconeogenesis

but not in glycolysis; to state reversible glycolysis reactions, to state allosteric enzymes involved in gluconeogenesis regulation.

**L11-12 Metabolism of Glycogen. Regulation of Glycogen Metabolism.**

To describe glycogen formation from glucose through glucose-1-P, and to explain the role of UTP and UDP in that reaction; to schematically show glycogen breakdown in glucose-1-P and its hormonal regulation (hormones, receptors, enzymes, second messengers), to explain the chemical background of glycogen breakdown disorders.

**L13 The pentose phosphate pathway.**

Schematically show direct oxidation of glucose-6-P into CO<sub>2</sub> and H<sub>2</sub>O in the pentose phosphate pathway; to state the most important compounds of oxidative and non-oxidative phase; coenzymes that appear in the oxidative phase dehydrogenases, to explain the role of pentose phosphate pathway – formation of NADPH+ H<sup>+</sup> and ribose and their role in metabolism; intermediate compounds that appear both in glycolysis and gluconeogenesis forming the link between those metabolic pathways. To explain the biochemical mechanism and clinical correlation of glucose-6-phosphate dehydrogenase deficiency.

**L14-15 Bioenergetics. Oxidative Phosphorylation.**

To describe oxidative phosphorylation and electron transport chain, the location of electron transport chain and its topology. To explain the coupling of oxidation of reduced coenzymes with the synthesis of ATP. To explain the ATP synthase mechanism and the regulation of the oxidative phosphorylation.

**L16 Digestion and absorption of lipids.**

To list the part of the digestive tract where lipolytic breakdown of triacylglycerols (lipids and oils) takes place and the factors that stimulate this breakdown; to describe the intraluminal process of triacylglycerol breakdown concerning pancreatic lipase specificity and the action of bile salts; to describe the triacylglycerol metabolism inside enterocytes.

**L17-19 Mobilisation of fatty acids. Oxidation of fatty acids. Biosynthesis of fatty acids.**

To explain how triacylglycerols (lipids) from adipose tissue serve as organism energy reservoir. To describe the processes by which fatty acids are transported through the blood. To explain processes of fatty acid activation and transport into the matrix of the mitochondria. To describe the catabolism of fatty acids and their cellular location.

To calculate energy balance of fatty acid breakdown. List the essential fatty acids and their characteristics.

To describe the reaction catalyzed by acetyl-CoA carboxylase and understand the mechanisms by which its activity is regulated to control the rate of fatty acid synthesis. To explain reactions of fatty acid biosynthesis and the role of the multienzyme complex in that process.

**L20-21 Biosynthesis of triacylglycerols and phospholipids. Glycolipids.**

To outline the general structure of triacylglycerols, phospholipids, and glycosphingolipids and indicate their functions. To explain glycerol origin for the glycerolipid biosynthesis. To explain the role of phospholipases in the degradation and remodeling of phospholipids. To display the phosphatidylcholine, phosphatidylethanolamine, phosphatidylserine, phosphatidylinositol and cardiolipin metabolism; to display sphingomyelin and glycosphingolipid metabolism; to explain the chemical background of sphingolipid metabolism disorders; to describe and to explain the eicosanoid structure, biological role, and metabolism.

**L22-23 Biosynthesis and metabolism of cholesterol. Biosynthesis and metabolism of bile acids.**

To explain the importance of cholesterol as an essential structural component of cell membranes, as a precursor of steroid hormones, bile acids, and vitamin D. To identify stages of cholesterol biosynthesis from acetyl-CoA. Understand the role of 3-hydroxy-3-methylglutaryl CoA reductase in controlling the rate of cholesterol synthesis and explain the mechanisms by which its activity is regulated. To display cholic, glycocholic, and taurocholic acid biogenesis (bile acids); to state physical and chemical characteristics and biosynthesis of C17, C19, and C21 steroid hormones.

**L24 Classification and role of lipoproteins in the metabolism.**

To count transport pathways of lipids and their metabolites from enterocytes to other parts of organism; to define lipoproteins, to count basic types of lipoproteins and state their chemical content, to state their role in exogenous and endogenous lipid transport; to explain the chemical background of lipoprotein metabolism disorders. Indicate major types of apolipoprotein found in different lipoprotein classes.

**L25 Metabolism of xenobiotics.**

To define xenobiotics and to explain the biomedical significance of xenobiotic metabolism. To explain the role of liver cells in the detoxification of xenobiotics. To state and explain the reactions of phase I and II. To explain the role of cytochrome P450 and reactions catalyzed by various enzymes.

**L26-27 Nucleic acid structure and function. RNA synthesis, processing, and modification. Regulation of gene expression.**

To describe the structure and function of nucleic acids; to explain semiconservative replication of DNA, transcription, and protein biosynthesis (translation). Understand the flow of genetic information from DNA to RNA to proteins.

**L28-29 Protein synthesis. Transport of proteins. Ubiquitination of proteins.**

To explain the aim and effects of posttranslational modifications of protein on structure, biochemical activity, and intracellular traffic and sorting of proteins (trans-membrane proteins, peripheral membrane proteins, glycosylphosphatidylinositol anchored proteins); to state the examples; to explain membrane lipids and proteins mobility. To describe the role of ubiquitin in protein degradation.

**L30 Midterm exam****L31 Protein metabolism. Digestion and absorption of proteins.**

To understand the proteolysis in the digestive tract and the absorption of amino acids in the intestine; to know extracellular proteases and their classification (exopeptidase, endopeptidase, aminopeptidase, carboxypeptidases, dipeptidylpeptidases), to know the location of action of proteolytic enzymes, the activation and mechanisms of pepsin, trypsin, and chymotrypsin action.

**L32-33 Metabolism of amino acids. Decarboxylation, transamination and oxidative deamination.**

To name and know the basic pathways of amino acid degradation (decarboxylation, transamination, oxidative deamination); to explain the reaction of amino acid decarboxylation, name enzymes and coenzymes; to list biologically important amines. To explain the processes of oxidative deamination of amino acids, formation of keto acids and ammonia, specify oxidoreductases that catalyze reactions and coenzymes; to explain the formation of ammonia in the combined processes of transamination and oxidative deamination resulting in glutamate; to explain the mechanism of transaminase action.

**L34 Urea cycle**

To indicate from which compounds high-energy carbamoyl phosphate is formed, schematically show intermediates of urea cycle and urea formation; to identify the subcellular locations of the enzymes that catalyses the cycle; to explain the utilization of ATP.

**L35-37 Signal molecules. Role in the regulation of metabolism. Receptors and signal transduction. Hormonal regulation of metabolism.**

To explain the principles of cellular signaling. To list the signal molecules according to solubility. To explain the role of receptors in signal transduction. To describe the classification of hormones. To explain the mechanisms of hormone action and the hierarchy of hormones. To explain the role of receptors and G proteins as well as the generation of second messengers in hormone signal transduction. To explain the hormonal regulation of cellular processes through activation of cAMP and phospholipase C. To understand the mechanism of steroid hormone action; to explain the mechanism of eicosanoids action. To list MAP kinases pathway; to explain the role of the transcription factor NF- $\kappa$ B.

**L38-39 Regulation of metabolic pathways.**

Integrate the metabolic destiny of a food ingredient from its digestion and absorption to complete degradation or conversion into an intermediate product. To describe the peculiarities of metabolic processes present in skeletal muscle, fatty tissue, liver, and brain.

**L40-41 Biomedical importance of plasma enzymes.**

To understand the biological and diagnostic importance of serum proteins and enzymes; alanine and aspartate aminotransferase (ALT and AST), glutamate dehydrogenase (GLDH),  $\gamma$ -glutamyltransferase ( $\gamma$ GT), cholinesterase (CHE), creatine kinase (CK), alkaline phosphatase (ALP), lactate dehydrogenase (LDH), lipase, and amylase. To know the application and the role of enzymes in the diagnosis and clinical practice.

**The list of seminars (S) with descriptions:**

**S1 Enzymes**

To explain the kinetics and the mechanism of enzyme-catalysed reactions. To describe and to explain the regulation of enzymatic activity.

**S2 Cofactors. Water soluble vitamins.**

To classify and to describe the structure of cofactors. To explain the modalities of coenzyme action. To explain the role of water-soluble vitamins in enzymatic activity.

**S3 Fat soluble vitamins.**

To explain the biological role of vitamins in human health. To explain the structure, principal functions, and metabolism of fat-soluble vitamins A, D, E, K. To explain the role of vitamin A in the metabolism of rhodopsin (rhodopsin biosynthesis), gene expression, and tissue differentiation. To describe the metabolism of vitamin D in the skin, liver, and kidney. To explain the role of vitamin D in the control of calcium homeostasis. To explain vitamin E antioxidative properties in cell membranes and plasma proteins. To describe the role of vitamin K in blood clotting

**S4 Biochemically important reactions.**

To indicate, explain the physiological role and mechanism of biochemically important reactions.

**S5 Carbohydrate metabolism. Regulation of gluconeogenesis.**

To describe the conversion of galactose, mannose, and fructose into glucose (monosaccharide interconversion); to state enzymes (and coenzymes) involved in the enzyme catalyzed epimerization of galactose into glucose; to explain the chemical background of galactose metabolism disorders; to show and to explain fructose metabolism, to explain the chemical background of fructose metabolism disorders.

**S6 Function and structure of respiratory chain complexes.**

To illustrate the structure of the respiratory chain. List respiratory chain complexes involved in the transfer of electrons. To explain the mechanism of electron transfer and chemiosmotic hypothesis. Understand the role of ubiquinone cycle and synthesis of ATP.

To classify enzymes and cofactors according to the type of catalysed reaction. To explain the role of specific cofactor in biocatalysis.

**S7 Free radicals, oxidative stress, and antioxidants' structure and nature.**

To explain the mechanisms of formation and the role of free radicals as well as the mechanisms of free radicals' elimination.

**S8 Metabolism of lipids.**

To name and understand the structure and chemistry of physiologically important lipids. To define the meaning of the term lipids, and to explain their distribution according to their role and structure; to know the most important representatives of elementary and complex lipids, biological important steroids, biological important terpenes. To identify essential fatty acids and to explain their characteristics. To explain the biosynthesis of polyunsaturated fatty acids. To identify ketone bodies, to describe the reaction by which they are formed and used as a fuel for extrahepatic tissues. Identify pathological conditions when ketosis and ketoacidosis occur. To explain biochemical mechanism and biochemical aspects of clinical disorders of lipoprotein metabolism.

**S9 Metabolism of iron, porphyrins and bile pigments.**

To describe the mechanism of iron absorption, distribution, and storage into tissues. To describe the physiological and clinical role of transferrin, ferritin, iron concentration in serum, and hepcidin in the human organism. To explain the causes and clinical picture of iron deficiency. To explain the pathway of porphyrin biosynthesis. To describe the causes and clinical picture of various porphyrias.

**S10 Metabolic functions of the liver.**

To know and explain synthetic, metabolic, and excretory function of the liver. To explain the mechanisms of heme degradation. To explain metabolic degradation pathway of bilirubin, name and explain related metabolic disorders. To know the synthesis of bile acids.

**S11 Catabolism of carbon skeletons of amino acids. Metabolic transformation of individual amino acids.**

To describe metabolic pathways for glycine, serine, aspartic and glutamic acid, arginine, histidine, phenylalanine, tyrosine, tryptophan, cysteine catabolism; metabolic scheme of aromatic amino acid degradation. To explain the mechanism of phenylketonuria, alcaptonuria, albinism, and disease of metabolism of branched-chain amino acids.

**S12 Plasma proteins and their physiological, biochemical, and diagnostic functions. Biomedical importance of plasma proteins.**

To indicate the composition and the role of blood. To classify plasma proteins. To list and explain the separation methods of plasma proteins. To indicate the causes of changes in the concentration of plasma proteins. To specify and distinguish acute phase proteins. To know the application and the role of haptoglobin, ceruloplasmin,  $\alpha_2$ -macroglobulin, transferrin,  $\alpha_1$ -fetoprotein,  $\alpha_1$ -antitrypsin, fibrinogen, and  $\alpha_1$ -acid glycoprotein in the disease diagnosis and clinical practice. To clarify the diagnostic value of serum proteins in the case of  $\alpha_1$ -antitrypsin deficiency.

**The list of laboratory practicals (LP) with short explanations:**

**LP1 Methods in biochemistry**

To explain the principle of the methods used in biochemical laboratories (chromatography, mass spectrometry, immunochemical methods (ELISA), western blot, DNA analysis). Apply High Performance Liquid Chromatography (HPLC) to separate the analyte in the mixture.

**LP2 Factors affecting enzymatic activity**

To explain the influence of pH and temperature on the ALP enzymatic activity. To explain how substrate concentration and inhibitor affect the rate of enzyme-catalyzed reaction.

**LP3 Qualitative and quantitative analysis of carbohydrates**

To apply a qualitative reaction to detect carbohydrates in biological samples. To measure serum glucose concentration, interpret, and explain the results.

**LP4 Electrophoresis of lipoproteins**

To apply spectrophotometry and electrophoresis in order to determine serum lipid profile. Apply qualitative methods for the detection of pathological components of urine.

**LP5 Determination of iron concentration in serum**

To determine parameters of iron status. To apply qualitative methods for the detection of pathological components of urine.

**LP6 Determination of non-protein nitrogen compounds**

To measure urine and serum renal function parameters, interpret the results, and explain possible causes of hyperuricemia and urinary infections. Apply qualitative methods for the detection of pathological components in the urine.

**LP7 Determination of clinically important enzymes**

To determine serum activities of ALT, AST, ALP, CHA, and  $\gamma$ -GT and to relate their activity with specific physiological and pathological processes.

**LP8 Clinical laboratory**

**LP9 Midterm exam**

**Student obligations:**

Class attendance, including test attendance, is mandatory. Students may be absent from 30% of each form of teaching provided they have a justifiable cause. If a student is absent for more than 30% of the classes, he/she will have to re-enroll the course.

Absence from seminars is compensated by an oral colloquium. Students are expected to actively participate in all aspects of the course, complete laboratory reports on time, and attend the examinations. Moreover, preparation of the course content, which is going to be discussed during seminars and laboratory practicals, is obligatory. During laboratory practicals, a student is obligated to wear a lab coat, to have tools (a wiping pad, a ruler, and a calculator), and the Handbook for seminars and practicals in Biochemistry II.

**Exam (exam taking, detailed exam description of the oral/written/practical part, point distribution, grading criteria):**

Student grading will be conducted according to the current Ordinance on Studies of the University of Rijeka (approved by the Senate) and the Ordinance on Student Grading at the Faculty of Medicine in Rijeka (approved by the Faculty Council).

**Assessment of the student work**

Student work will be assessed and graded during the course and on the final exam. During the course, students may obtain a total of 100 grade points (credits). Students can achieve up to 70% of the final grade during the classes, and a maximum of 30% of the final grade at the final exam.

Evaluation of students' progress during classes, midterms, and the final exam in academic year 2021/2022 is shown in Table 1.

**Table 1. Distribution of grade points in the course "Biochemistry II"**

|                              | <b>Evaluation</b>                               | <b>Grade points</b> |
|------------------------------|-------------------------------------------------|---------------------|
| <b>Midterm exams</b>         | Midterm exam I                                  | 18                  |
|                              | Midterm exam II                                 | 18                  |
|                              | Midterm exam III                                | 18                  |
|                              | <b>Total</b>                                    | <b>54</b>           |
| <b>Laboratory practicals</b> | Completed practical and accepted written report | 8                   |
| <b>Seminars</b>              | Active participation/short written exams        | 8                   |
| <b>TOTAL</b>                 |                                                 | <b>70</b>           |
| <b>Final exam</b>            | Written exam (30 questions)                     | 15                  |
|                              | Oral exam                                       | 15                  |
|                              | <b>Total</b>                                    | <b>30</b>           |
| <b>TOTAL</b>                 |                                                 | <b>100</b>          |

**Written midterm exams**

During the semester, three written midterm exams are planned, which will include the content of lectures, seminars, and laboratory practicals.

At each midterm exam, the maximum of grade points that a student can obtain is 18.

All written midterm exams consist of 40 multiple choice questions and are evaluated according to the criteria shown in Table 2. In order to obtain grade points, a student should have/gain a minimum 50% of correct answers on each midterm exam. Settled midterm exams are valid for the current academic year in which they are placed.

**Table 2. Evaluation of written midterm exams I-III**

| <b>% of correct answered questions</b> | <b>Grade points/credits</b> |
|----------------------------------------|-----------------------------|
| 50.00 – 54.99                          | 9                           |
| 55.00 – 59.99                          | 10                          |
| 60.00 – 64.99                          | 11                          |
| 65.00 – 69.99                          | 12                          |
| 70.00 – 74.99                          | 13                          |
| 75.00 – 79.99                          | 14                          |
| 80.00 – 84.99                          | 15                          |
| 85.00 – 89.99                          | 16                          |
| 90.00 – 94.99                          | 17                          |
| 95.00 – 100.00                         | 18                          |

**Correction of the midterm exams**

A student can access the correction of the midterm exams if he/she i) did not obtain a minimum criteria (50% on each midterm) or ii) is not satisfied with the obtained credits and iii) in case of absence at the midterm exam due to a justified reason.

If a student retakes the midterm exam because he/she is not satisfied with the obtained grade points, only the credits gained from the retaken midterms will be considered.

Evaluation of the midterm corrections will be performed according to the criteria shown in the Table 2.

Students will have the opportunity to correct one or more midterm exam only once. Correction of the midterm exam I-III will be held after completing regular class in terms set by the course schedule.

**Laboratory practicals**

A student can gain 8 credits throughout laboratory practicals. Evaluation of laboratory practicals implies precisely completed experimental part of laboratory practical (maximum of 4 grade points) and completed and accepted written report (maximum of 4 grade points).

During laboratory practicals, the oral examination of the student can be performed by the teacher.

**Seminars**

Throughout the course, 12 seminars are planned during which students can achieve 8 grade points.

A student can obtain a maximum of 6 grade points through short written exams and additional 2 grade points through active participation.

**Final exam**

The final exam is mandatory and comprises written and oral assessment. During the final exam, students can gain a maximum of 30 credits, 15 credits in the written part and 15 credits during the oral assessment. Students are required to meet the minimum criteria for both parts of the final exam.

The written and the oral part of the final exam cover the entire course content.

The written part of the final exam consists of 30 multiple choice questions. In order to meet minimum criteria and earn grade points, students must have 50% of correctly solved questions.

Achievements during the written part of the final exam will be converted into grade points according to the



criteria shown in Table 3. In case when a student did not achieve the minimum criteria on the written part of the final exam, attending the final exam on the following exam term is mandatory.

Assessment of the oral part of the final exam:

- 7.5 credits: minimum criteria satisfied
- 8 - 9 credits: average criteria satisfied with noticeable errors
- 10 – 12 credits: answer with a few errors
- 13 – 15 credits: outstanding answer.

In order to pass the final exam, a student must achieve at least 50% of positive answers on both written and oral parts of the final exam.

If the student is not satisfied with the final grade, he/she may refuse the grade. In case a student does not accept the grade, he/she must re-enter the final exam.

**Table 3. Evaluation of the written part of a final exam**

| <b>% of correct answered questions</b> | <b>Grade points/credits</b> |
|----------------------------------------|-----------------------------|
| 50.00 – 59.99                          | 7.5                         |
| 60.00 – 64.99                          | 8                           |
| 65.00 – 69.99                          | 9                           |
| 70.00 – 74.99                          | 10                          |
| 75.00 – 79.99                          | 11                          |
| 80.00 – 84.99                          | 12                          |
| 85.00 – 89.99                          | 13                          |
| 90.00 – 94.99                          | 14                          |
| 95.00 – 100.00                         | 15                          |

**Conditions for admission to the final exam**

A student who accomplishes 35 or more grade points during all course classes can access the final exam. If a student achieves less than 35 grade points during all course classes, correction of the midterm exams will be organized.

A student who achieves less than 35 grade points during all course classes even after the correction of the midterm exams, or is absent for more than 30% of all forms of classes, is graded as unsuccessful (F) and must re-enter the course.

**Final grade**

The final grade represents a sum of all grade points obtained during all course classes and on the final exam. Students are evaluated according to the ECTS (A-F) and numerical (1-5) system.

The ECTS and the numerical grading system are defined by the following criteria:

- A (5) 90 - 100 credits
- B (4) 75 - 89.99 credits
- C (3) 60 - 74.99 credits
- D (2) 50 - 59.99 credits
- F (1) 0 - 49.99 credits

**Other important information regarding the course:**

Teaching is held at the prescribed time and it is not possible to enter after the teacher enters. Food and beverages are not permitted in the classroom or in the laboratory. This includes plate lunches, drinks, candies, etc., whether opened or not. Likewise, cell phones are not allowed in the classroom during the midterm or final exams. Students must arrive on time for exam attendance. Anyone late for more than 15 minutes may be refused to undertake the exam.

### **Academic Honesty**

It is expected that all students and teachers follow the code of academic honesty in accordance with the Code of ethics for the students of the Faculty of Medicine at the University of Rijeka.

Please read the policy regarding academic honesty at:

<http://medical-studies-in-english.com/wp-content/uploads/2016/12/CODE-OF-ETHICS.pdf>

### **Contact information**

For questions and concerns, please feel free to contact us by e-mail or via the Department website. If you want to speak with a teacher during office hours (each working day between 11:00 am and 13:00 am), please let us know by e-mail or in class.

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### **Expected competencies at course enrollment:**

Students are expected to have basic knowledge of biology and chemistry.

## COURSE SCHEDULE for academic year 2021./2022.

| Date                               | Lectures (L)                                  | Seminars (S)                                           | Laboratory Practicals (LP)                    | Lecturer                                                     |
|------------------------------------|-----------------------------------------------|--------------------------------------------------------|-----------------------------------------------|--------------------------------------------------------------|
| 1 <sup>st</sup> week<br>06/10/2021 | <b>L1</b><br>12:00-13:00<br>Lecture room 1    |                                                        |                                               | D. Detel, Associate professor                                |
| 05/10/2021                         |                                               |                                                        | <b>LP1</b> (group I)<br>08:00-11:00*          | I.Potočnjak, PhD, Assistant                                  |
| 05/10/2021                         |                                               |                                                        | <b>LP1</b> (group II and III)<br>12:00-15:00* | L.Batičić, Assistant professor<br>S.Buljević, PhD, Assistant |
| 08/10/2021                         | <b>L2,3</b><br>10:00-12:00<br>Lecture room 1  |                                                        |                                               | D.Detel, Associate professor                                 |
| 2 <sup>th</sup> week<br>11/10/2021 |                                               | <b>S1</b> (group I)<br>09:00-11:00<br>Lecture room 6*  |                                               | D.Detel, Associate professor                                 |
| 12/10/2021                         |                                               | <b>S1</b> (group II)<br>11:00-13:00<br>Lecture room 9* |                                               | D.Detel, Associate professor                                 |
| 13/10/2021                         | <b>L4</b><br>12:00-13:00<br>Lecture room 1    |                                                        |                                               | J.Marinić, Assistant professor                               |
| 15/10/2021                         | <b>L5,6</b><br>10:00-12:00<br>Lecture room 1  |                                                        |                                               | J.Marinić, Assistant professor                               |
| 3 <sup>rd</sup> week<br>18/10/2021 |                                               | <b>S2</b> (group I)<br>08:00-10:30<br>Lecture room 6*  |                                               | I.Potočnjak, PhD, Assistant                                  |
| 19/10/2021                         |                                               |                                                        | <b>LP2</b> (group I)<br>08:00-11:00*          | I.Potočnjak, PhD, Assistant                                  |
| 19/10/2021                         |                                               |                                                        | <b>LP2</b> (group II and III)<br>12:00-15:00* | L.Batičić, Assistant professor<br>S.Buljević, PhD, Assistant |
| 20/10/2021                         | <b>L7</b><br>12:00-13:00<br>Lecture room 1    |                                                        |                                               | D.Detel, Associate professor                                 |
| 21/10/2021                         |                                               | <b>S2</b> (group II)<br>13:00-15:30<br>Lecture room 9* |                                               | I.Potočnjak, Assistant                                       |
| 22/10/2021                         | <b>L8,9</b><br>10:00-12:00<br>Lecture room 1* |                                                        |                                               | R.Domitrović, Full professor                                 |
| 4 <sup>th</sup> week<br>25/10/2021 |                                               | <b>S3</b> (group I)<br>08:30-10:30<br>Lecture room 6*  |                                               | L.Batičić, Assistant professor                               |
| 26/10/2021                         |                                               | <b>S3</b> (group II)<br>11:00-13:00<br>Lecture room 6* |                                               | L.Batičić, Assistant professor                               |
| 27/10/2021                         | <b>L10</b><br>12:00-13:00<br>Lecture room 15* |                                                        |                                               | J.Marinić, Assistant professor                               |
| 29/10/2021                         | <b>L11,12</b><br>10:00-12:00                  |                                                        |                                               | D.Detel, Associate professor                                 |

|                                    |                                                          |                                                        |                                              |                                                              |
|------------------------------------|----------------------------------------------------------|--------------------------------------------------------|----------------------------------------------|--------------------------------------------------------------|
|                                    | Lecture room 1*                                          |                                                        |                                              |                                                              |
| 5 <sup>th</sup> week<br>2/11/2021  |                                                          |                                                        | <b>LP3</b> (group I)<br>08:00-11:00          | I.Potočnjak, PhD, Assistant                                  |
| 2/11/2021                          |                                                          |                                                        | <b>LP3</b> (group II and III)<br>11:00-14:00 | L.Batičić, Assistant professor<br>S.Buljević, PhD, Assistant |
| 2/11/2021                          |                                                          | <b>S4</b> (group I)<br>14:30-16:30<br>Lecture room 6*  |                                              | I.Potočnjak, PhD, Assistant                                  |
| 3/11/2021                          | <b>L13</b><br>12:00-13:00<br>Lecture room 15*            |                                                        |                                              | D.Detel, Associate professor                                 |
| 4/11/2021                          |                                                          | <b>S4</b> (group II)<br>12:00-14:00<br>Lecture room 6* |                                              | I.Potočnjak, PhD, Assistant                                  |
| 5/11/2021                          | <b>L14,15</b><br>10:00-12:00<br>Lecture room 1*          |                                                        |                                              | R.Domitrović, Full professor                                 |
| 6 <sup>th</sup> week<br>08/11/2021 |                                                          | <b>S5</b> (group I)<br>08:00-10:30<br>Lecture room 7   |                                              | J. Marinić, Assistant professor                              |
| 9/11/2021                          |                                                          | <b>S5</b> (group II)<br>11:30-14:00<br>Lecture room 6* |                                              | J. Marinić, Assistant professor                              |
| 12/11/2021                         | <b>L16,17</b><br>10:00-12:00<br>Lecture room 1*          |                                                        |                                              | J. Marinić, Assistant professor                              |
| 10/11/2021                         | <b>Midterm exam I</b><br>15:00 – 16:00<br>Lecture room 2 |                                                        |                                              |                                                              |
| 7 <sup>th</sup> week<br>15/11/2021 |                                                          | <b>S6</b> (group I)<br>08:30-11:00<br>Lecture room 7*  |                                              | L. Batičić, Assistant professor                              |
| 16/11/2021                         |                                                          | <b>S6</b> (group II)<br>11:00-13:30<br>Lecture room 6* |                                              | L. Batičić, Assistant professor                              |
| 19/11/2021                         | <b>L18,19</b><br>10:00-12:00<br>Lecture room 1*          |                                                        |                                              | J. Marinić, Assistant professor                              |
| 8 <sup>th</sup> week<br>22/11/2021 |                                                          | <b>S7</b> (group I)<br>08:00-10:00<br>Lecture room 4*  |                                              | J.Marinić, Assistant professor                               |
| 24/11/2021                         | <b>L20,21</b><br>12:00-14:00<br>Lecture room 15*         |                                                        |                                              | D.Detel, Associate professor                                 |
| 25/11/2021                         |                                                          | <b>S7</b> (group II)<br>13:00-15:00<br>Lecture room 5* |                                              | J.Marinić, Assistant professor                               |
| 26/11/2021                         | <b>L22,23</b><br>10:00-12:00<br>Lecture room 1*          |                                                        |                                              | D.Detel, Associate professor                                 |
| 9 <sup>th</sup> week<br>29/11/2021 |                                                          | <b>S8</b> (group I)<br>08:00-10:30<br>Lecture room 9*  |                                              | J.Marinić, Assistant professor                               |
| 29/11/2021                         |                                                          | <b>S8</b> (group II)                                   |                                              | J.Marinić, Assistant professor                               |

|                                     |                                                             |                                                         |                                              |                                                                  |
|-------------------------------------|-------------------------------------------------------------|---------------------------------------------------------|----------------------------------------------|------------------------------------------------------------------|
|                                     |                                                             | 13:00-15:30<br>Lecture room 6*                          |                                              |                                                                  |
| 30/11/2021                          |                                                             |                                                         | <b>LP4</b> (group I)<br>08:00-11:00          | I.Potočnjak, PhD, Assistant                                      |
| 30/11/2021                          |                                                             |                                                         | <b>LP4</b> (group II and III)<br>12:00-15:00 | L.Batičić, Assistant professor<br>S.Buljević, PhD, Assistant     |
| 1/12/2021                           | <b>L24</b><br>12:00-13:00<br>Lecture room 1*                |                                                         |                                              | D.Detel, Associate professor                                     |
| 3/12/2021                           | <b>L25,26</b><br>10:00-12:00<br>Lecture room 1*             |                                                         |                                              | J.Marinić, Assistant professor<br>L.Batičić, Assistant professor |
| 10 <sup>th</sup> week<br>6/12/2021  |                                                             | <b>S9</b> (group I)<br>08:30-11:00<br>Lecture room 9*   |                                              | D.Detel, Associate professor                                     |
| 8/12/2021                           | <b>L27</b><br>12:00-13:00<br>Lecture room 1*                |                                                         |                                              | L.Batičić, Assistant professor                                   |
| 9/12/2021                           |                                                             | <b>S9</b> (group II)<br>11:00-13:30<br>Lecture room 6*  |                                              | D.Detel, Associate professor                                     |
| 10/12/2021                          | <b>L28,29</b><br>10:00-12:00<br>Lecture room 1*             |                                                         |                                              | L.Batičić, Assistant professor                                   |
| 11 <sup>th</sup> week<br>14/12/2021 |                                                             |                                                         | <b>LP5</b> (group I)<br>08:00-10:30          | I.Potočnjak, PhD, Assistant                                      |
| 14/12/2021                          |                                                             |                                                         | <b>LP5</b> (group II and III)<br>11:00-13:30 | L.Batičić, Assistant professor<br>S.Buljević, PhD, Assistant     |
| 15/12/2021                          | <b>L30</b><br>12:00-13:00<br>Lecture room 1*                |                                                         |                                              | D.Detel, Associate professor                                     |
| 17/12/2021                          | <b>L31 Midterm exam II</b><br>10:00-11:00<br>Lecture room 2 |                                                         |                                              | D.Detel, Associate professor                                     |
| 12 <sup>th</sup> week<br>20/12/2021 |                                                             | <b>S10</b> (group I)<br>08:00-10:30<br>Lecture room 9*  |                                              | I.Potočnjak, PhD, Assistant                                      |
| 21/12/2021                          |                                                             | <b>S10</b> (group II)<br>12:00-14:30<br>Lecture room 9* |                                              | I.Potočnjak, PhD, Assistant                                      |
| 22/12/2021                          | <b>L 32,33</b><br>11:00-13:00<br>Lecture room 1*            |                                                         |                                              | D.Detel, Associate professor                                     |
| 23/12/2021                          | <b>L34</b><br>12:00-13:00<br>Lecture room 8*                |                                                         |                                              | D.Detel, Associate professor                                     |
| 13 <sup>th</sup> week<br>10/1/2021  |                                                             | <b>S11</b> (group I)<br>8:00-10:30<br>Lecture room 9*   |                                              | J.Marinić, Assistant professor                                   |
| 11/1/2021                           |                                                             |                                                         | <b>LP6</b> (group I)<br>08:00-11:00          | I.Potočnjak, PhD, Assistant                                      |
| 11/1/2021                           |                                                             |                                                         | <b>LP6</b> (group II i III)<br>12:00-15:00   | S.Buljević, PhD, Assistant                                       |
| 12/1/2021                           | <b>L35</b>                                                  |                                                         |                                              | R.Domitrović, Full professor                                     |

|                                    |                                                                                    |                                                         |                                             |                                                                                               |
|------------------------------------|------------------------------------------------------------------------------------|---------------------------------------------------------|---------------------------------------------|-----------------------------------------------------------------------------------------------|
|                                    | 12:00-13:00<br>Lecture room 1*                                                     |                                                         |                                             |                                                                                               |
| 13/1/2022                          |                                                                                    | <b>S11</b> (group II)<br>12:30-15:00<br>Lecture room 9* |                                             | J.Marinić, Assistant professor                                                                |
| 14/1/2022                          | <b>L36,37</b><br>10:00-12:00<br>Lecture room 1*                                    |                                                         |                                             | R.Domitrović, Full professor                                                                  |
| 14 <sup>th</sup> week<br>17/1/2022 |                                                                                    | <b>S12</b> (group I)<br>13:00-15:30<br>Lecture room 6*  |                                             | I.Potočnjak, PhD, Assistant                                                                   |
| 18/1/2022                          |                                                                                    |                                                         | <b>LP7</b> (group II)<br>08:00-11:00        | I.Potočnjak, PhD, Assistant                                                                   |
| 18/1/2022                          |                                                                                    |                                                         | <b>LP7</b> (group I and III)<br>12:00-15:00 | L.Batičić, Assistant professor<br>S.Buljević, PhD, Assistant                                  |
| 20/1/2022                          |                                                                                    | <b>S12</b> (group II)<br>13:00-15:30<br>Lecture room 4* |                                             | I.Potočnjak, PhD, Assistant                                                                   |
| 19/1/2022                          | <b>L38,39</b><br>11:00-13:00<br>Lecture room 1*                                    |                                                         |                                             | D.Detel, Associate professor                                                                  |
| 21/1/2022                          | <b>L40,41</b><br>10:00-12:00<br>Lecture room 1*                                    |                                                         |                                             | D.Detel, Associate professor                                                                  |
| 15 <sup>th</sup> week<br>24/1/2022 |                                                                                    |                                                         | <b>LP8</b> (group II)<br>08:00-11:00        | Vesna Šupak Smolčić, Assistant                                                                |
| 25/1/2022                          |                                                                                    |                                                         | <b>LP8</b> (group I)<br>08:00-11:00         | Vesna Šupak Smolčić, Assistant                                                                |
| 26/1/2022                          |                                                                                    |                                                         | <b>LP8</b> (group III)<br>8:00-11:00        | Vesna Šupak Smolčić, Assistant                                                                |
| 27/1/2022                          |                                                                                    | <b>S13</b> (group I and II)<br>14:00-17:00              |                                             | D.Detel, Associate professor<br>J.Marinić, Assistant professor<br>I.Potočnjak, PhD, Assistant |
| 31/1/2022                          | <b>Midterm exam III</b><br>(the time and place of the exam will be announced)      |                                                         |                                             |                                                                                               |
| 9/2/2022                           | <b>CORRECTION TEST I-III</b><br>(the time and place of the exam will be announced) |                                                         |                                             |                                                                                               |
| 23/2/2022                          | <b>CORRECTION TEST I-III</b><br>(the time and place of the exam will be announced) |                                                         |                                             |                                                                                               |

\*Taking into consideration the current epidemiological situation of COVID-19, during the winter semester of the academic year 2021/2022 the lectures will be held online at given time (e.g. through the MS Teams app) while the seminars and laboratory practical's will be held onsite. Possible changes in the course timetable will be announced in advance. Students are expected to regularly check the Merlin platform for updates.

**List of lectures, seminars, and laboratory practicals:**

|     | <b>Topics of the Lectures</b>                                                                                            | <b>Teaching Hours</b> | <b>Lecture Room</b> |
|-----|--------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------------|
| L1  | Importance of biochemistry in understanding health and disease and the application of biochemistry in clinical practice. | 1                     | 1                   |
| L2  | Enzymes. Clasification of enzymes. The kinetics of enzyme catalysis.                                                     | 1                     | 1                   |
| L3  | Regulation of enzymatic activity.                                                                                        | 1                     | 1                   |
| L4  | Digestion and absorption of carbohydrates                                                                                | 1                     | 1                   |
| L5  | Metabolic pathways of carbohydrates. Glycolysis.                                                                         | 1                     | 1                   |
| L6  | Regulation of glycolysis.                                                                                                | 1                     | 1                   |
| L7  | Oxidative decarboxylation of ketoacids. Oxidation of pyruvate.                                                           | 1                     | 1                   |
| L8  | The Citric acid cycle: degradation of acetyl-CoA.                                                                        | 1                     | 15                  |
| L9  | Regulation of the citric acid cycle.                                                                                     | 1                     | 15                  |
| L10 | Gluconeogenesis.                                                                                                         | 1                     | 8                   |
| L11 | Metabolism of Glycogen.                                                                                                  | 1                     | 1                   |
| L12 | Regulation of glycogen metabolism.                                                                                       | 1                     | 1                   |
| L13 | The penthose phosphate pathway.                                                                                          | 1                     | 1                   |
| L14 | The respiratory chain.                                                                                                   | 1                     | 8                   |
| L15 | Energetics and principles of the respiratory chain.                                                                      | 1                     | 8                   |
| L16 | Digestion and absorption of lipids.                                                                                      | 1                     | 8                   |
| L17 | Fat mobilization.                                                                                                        | 1                     | 8                   |
| L18 | Oxidation of fatty acids.                                                                                                | 1                     | 1                   |
| L19 | Biosynthesis of fatty acids.                                                                                             | 1                     | 1                   |
| L20 | Biosynthesis of triacylglycerols and phospholipids.                                                                      | 1                     | 1                   |
| L21 | Glycolipids: structure, biosynthesis, and biodegradation.                                                                | 1                     | 1                   |
| L22 | Biosynthesis and metabolism of cholesterol.                                                                              | 1                     | 1                   |
| L23 | Biosynthesis and metabolism of bile acids.                                                                               | 1                     | 1                   |
| L24 | Lipoproteins. Classification and its role in metabolism.                                                                 | 1                     | 1                   |
| L25 | Metabolism of xenobiotics.                                                                                               | 1                     | 1                   |
| L26 | Nucleic acid structure and function.                                                                                     | 1                     | 1                   |
| L27 | Replication. RNA synthesis. Regulation of gene expression.                                                               | 1                     | 8                   |
| L28 | Protein syntesis. Posttranslational modification of proteins.                                                            | 1                     | 15                  |
| L29 | Intracellular traffic and sorting of proteins.                                                                           | 1                     | 15                  |
| L30 | Metabolism of proteins. Digestion and absorption of proteins.                                                            | 1                     | 1                   |
| L31 | Midterm exam                                                                                                             | 2                     | 2                   |
| L32 | Metabolism of amino acids. Decarboxylation.                                                                              | 1                     | 8                   |
| L33 | Transamination. Oxidative deamination.                                                                                   | 1                     | 8                   |
| L34 | Urea cycle.                                                                                                              | 1                     | 1                   |
| L35 | Signal molecules.                                                                                                        | 1                     | 1                   |
| L36 | Receptors and signal transduction.                                                                                       | 1                     | 1                   |

|     |                                                              |           |   |
|-----|--------------------------------------------------------------|-----------|---|
| L37 | Hormonal regulation of metabolism.                           | 1         | 1 |
| L38 | Regulation of metabolic pathways.                            | 1         | 1 |
| L39 | Relationships in intermediary metabolism.                    | 1         | 1 |
| L40 | Clinical importance of AST, ALT, GLDH, $\gamma$ GT, and CHE. | 1         | 1 |
| L41 | Clinical importance of CK, ALP, LDH, lipase, and amylase.    | 1         | 1 |
|     | <b>Total number of lectures</b>                              | <b>42</b> |   |

|                              | Topics of Seminars (S)                                                                             | Teaching Hours | Lecture Room              |
|------------------------------|----------------------------------------------------------------------------------------------------|----------------|---------------------------|
| 2 <sup>nd</sup> week<br>S1   | Enzymes                                                                                            | 2              | Group I: 6<br>Group II: 9 |
| 3 <sup>rd</sup> week<br>S2   | Cofactors. Water soluble vitamins.                                                                 | 3              | Group I: 6<br>Group II: 9 |
| 4 <sup>th</sup> week<br>S3   | Fat soluble vitamins.                                                                              | 2              | Group I: 6<br>Group II: 6 |
| 5 <sup>th</sup> week<br>S4   | Biochemically important reactions                                                                  | 2              | Group I: 6<br>Group II: 6 |
| 6 <sup>th</sup> week<br>S5   | Metabolism of carbohydrates                                                                        | 3              | Group I: 7<br>Group II: 6 |
| 7 <sup>th</sup> week<br>S6   | Function and structure of respiratory chain complexes                                              | 3              | Group I: 7<br>Group II: 6 |
| 8 <sup>th</sup> week<br>S7   | Free radicals, oxidative stress, and antioxidants' structure and nature                            | 2              | Group I: 4<br>Group II: 5 |
| 9 <sup>th</sup> week<br>S8   | Metabolism of lipids                                                                               | 3              | Group I: 9<br>Group II: 6 |
| 10 <sup>th</sup> week<br>S9  | Metabolism of iron, porphyrins, and bile pigments                                                  | 3              | Group I: 9<br>Group II: 6 |
| 12 <sup>th</sup> week<br>S10 | Function of the liver in metabolism                                                                | 3              | Group I: 9<br>Group II: 9 |
| 13 <sup>th</sup> week<br>S11 | Catabolism of carbon skeletons of amino acids. Metabolic transformation of individual amino acids. | 3              | Group I: 9<br>Group II: 9 |
| 14 <sup>th</sup> week<br>S12 | Plasma proteins and their physiological, biochemical, and diagnostic functions                     | 3              | Group I: 6<br>Group II: 4 |
| 15 <sup>th</sup> week<br>S13 | Oral colloquium and Consultation(s)                                                                | 2              |                           |
|                              | <b>Total</b>                                                                                       | <b>34</b>      |                           |



|                              | Topics of Laboratory Practicals (LP)                                                                                                                                                                                                                | Teaching Hours | Lecture Room                              |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-------------------------------------------|
| 1 <sup>st</sup> week<br>LP1  | <b>Methods in biochemistry</b>                                                                                                                                                                                                                      | 4              | Online                                    |
| 3 <sup>rd</sup> week<br>LP2  | <b>Factors affecting enzymatic activity</b><br>The influence of pH, temperature, and substrate concentration on the enzymatic activity. Determination of the type of enzyme inhibition.                                                             | 4              | Online                                    |
| 5 <sup>th</sup> week<br>LP3  | <b>Qualitative and quantitative analysis of carbohydrates</b><br>Quantitative determination of glucose in blood.<br>Detection of glucose in urine.                                                                                                  | 4              | Department of Chemistry and Biochemistry  |
| 9 <sup>th</sup> week<br>LP4  | <b>Electrophoresis of lipoproteins</b><br>Quantitative determination of triglycerides in serum.<br>Detection of ketone bodies in urine.<br>Determination of total cholesterol in serum.<br>Determination of serum HDL and LDL cholesterol in serum. | 4              | Department of Chemistry and Biochemistry  |
| 11 <sup>th</sup> week<br>LP5 | <b>Determination of iron concentration in serum</b><br>Determination of TIBC and UIBC.<br>Detection of hemoglobin/bilirubin in urine.                                                                                                               | 3              | Department of Chemistry and Biochemistry. |
| 14 <sup>th</sup> week<br>LP6 | <b>Determination of non-protein nitrogen compounds:</b><br>urea, creatinine, and uric acid in urine.<br>Detection of nitrites in urine.                                                                                                             | 3              | Department of Chemistry and Biochemistry  |
| 15 <sup>th</sup> week<br>LP7 | <b>Determination of clinically important enzymes:</b><br>ALT, AST, ALP, CHE, and $\gamma$ Gt.                                                                                                                                                       | 4              | Department of Chemistry and Biochemistry  |
| 16 <sup>th</sup> week<br>LP8 | <b>Clinical laboratory</b><br>Biological material and processing in clinical biochemistry<br>Biochemical results and their interpretation                                                                                                           | 4              | Clinical Hospital Center Rijeka           |
| LP9                          | <b>Midterm exam</b>                                                                                                                                                                                                                                 | 4              |                                           |
|                              | <b>Total</b>                                                                                                                                                                                                                                        | <b>34</b>      |                                           |

|    | Final exam dates |
|----|------------------|
| 1. | 11.02.2022.      |
| 2. | 25.02.2022.      |
| 3. | 08.07.2022.      |
| 4. | 02.09.2022.      |
| 5. | 16.09.2022.      |