Sveučilište u Rijeci
University of Rijeka

Sveučilište u Rijeci • Fakultet dentalne medicine
University of Rijeka • Faculty of Dental Medicine

Krešimirova 40/42 • 51000 Rijeka • CROATIA
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University of Rijeka
Faculty of Dental Medicine
Course: Physiology and Patophysiology I
Course coordinator: Assisstant Professor Ljerka Karleuša Mujkić, dipl. ing. bioteh.
Department: Department for Physiology, Imunology and Patophysiology
Study programme: University Integrated Undergraduate and Graduate Study of Dental Medicine (in English)
Study year: 1st year
Academic year: 2026./2027.

SYLLABUS

Course description (a brief description of the course, general instructions, where and in what form the lessons are organized, necessary equipment, instructions for attendance and preparation for classes, student obligations, etc.):

Physiology and Pathophysiology I is a mandatory course in the study of Dental Medicine, and it is taught during the summer semester of the 1st year of the Study. The course is planned for continuous teaching and studying session during total of four weeks (20 working days). It will consist of **30 hours of lectures**, **18 hours of seminars** and **12 hours of practical work**, worth 5 ECTS credits.
The goals and objectives of the course are to enable the student to apply already acquired knowledge in order to acquire new expertise about the basic physiological and pathophysiological aspects of the human organism. The planned outcome of the course is to master the knowledge in the field of basic Physiology and Pathophysiology I, and to acquire the ability to vertically upgrade knowledge in the clinical courses that follow.
The classes will be held **on-site** at the Faculty of Medicine in Rijeka (at the Department for Physiology, Imunology and Patophysiology), with the **option to move online** (Microsoft Teams) if necessary.

Outline of the course:

General physiology and pathophysiology
Functional organization of the human body. Homeostatic mechanisms. Integrative approach to disease. Principles of pathogenetic mechanisms and disease development.

Cellular physiology and pathophysiology:
The cell and its function. Biological membranes, compartments and composition of body fluids. Transport of substances through the cell membrane. Transmembrane signal transmission and signaling molecules. Cellular adaptation, damage and death. Control of cell growth. Malignant transformation and growth. Membrane potentials. Contraction of skeletal and smooth muscle. Stimulation of skeletal muscle: neuromuscular transmission, coupling of stimulation and muscle contraction.

Hematology and body fluids:
Hematopoiesis. Erythrocytes: function of erythrocytes. Iron transport in the body. Disorders of erythropoiesis: basic mechanisms and types of anemia. Leukocytes: physiological roles of different types of leukocytes. Basic role of leukocytes in specific and nonspecific immunity. White blood cell disorders: quantitative and qualitative. Blood groups: ABO system antigens. Rh system antigens. Agglutinins. Platelets: platelet physiology. Hemostasis. Platelet and coagulation disorders. Mechanism of thrombosis. Bleeding

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tendency. Basic laboratory methods for determining hemostasis disorders. Inflammation: definition, name, mechanism of occurrence and classification of inflammation. Chemotaxis. Phagocytosis. The role of cytokines in the inflammatory process. Local and systemic consequences of inflammation. Thermoregulation.

Course organization

Course is comprised from lectures, seminars and practicals. Both seminars and practicals are continuation of topics discussed on lectures. Students are expected to prepare for seminars based on lectures and provided literature, and to actively participate in discussions.

In order to attend Practicals, students have to bring their lab coats.

The student's work is supervised by the course coordinator who has the right and duty to talk with students about potential problems in class and mastering the material.
Consultations are held as needed, and in agreement with the students during and/or after the classes.

Assigned reading

1. Guyton AC, Hall JE. Medical physiology, fourteenth edition
2. Gamulin S, Marušić M, Kovač Z et al. Pathophysiology, Medicinska naklada, eighth edition, Zagreb, 2018.
   All content not covered by the required literature will be published through the Merlin system.

Optional/additional reading

1. Kovač Z, Gamulin, S i sur. Patofiziologija. Zadatci za programske seminare, Medicinska naklada, Zagreb, 2011.

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Course teaching plan:

The list of lectures (with topics and descriptions):

PART I: General physiology and pathophysiology. Cellular physiology and pathophysiology.

Lecture 1: Homeostasis and inner enviroment.

Learning outcomes:

Describe the levels of organization of the human body. Name, recognize and explain the physiological control mechanisms of positive and negative feedback and the interrelationships of organic systems with the aim of maintaining homeostasis of the organism as a whole.

Lecture 2: Membrane transport.

Learning outcomes:

Explain the structure of the cell and cell membrane, explain the function of membrane proteins and the basic principles of intercellular communication within the organism as a whole.
Describe the basic mechanisms of substance transport through the cell membrane and distinguish between active and passive transport. Distinguish between diffusion and osmosis and isotonic, hypertonic and hypotonic solutions.
Compare the distribution of ions between the cellular and extracellular fluid. Show the importance of the electrochemical gradient and membrane permeability for the initiation of ion currents. Describe ion channels.

Lecture 3: Membrane and action potential.

Learning outcomes:

Explain the physical basis of membrane potentials.
Explain the formation of the resting membrane potential in nerves and calculate the membrane potential under conditions when the membrane permeability to Na^+, K^+ or Cl^- ions changes.
Explain the formation of the action potential in a nerve cell.
Explain the function of voltage-gated Na^+, K^+ and Ca^{2+} channels (threshold of stimulation, activation and inactivation), the methods of excitation of the action potential and the propagation of the action potential along the cell membrane.
Understand the principles of recording membrane and action potentials.
Explain the conduction of the action potential in nerve fibers and the dependence of the conduction velocity in nerve fibers to the myelin sheath.
Explain the formation of plateau in some action potentials, rhythmicity and repeated firing.

Lecture 4: Cell Physiology and Patophysiology. Cellular adaptation, damage and death.

Learning outcomes:

Define the basic forms of cellular adaptation to stress (atrophy, hypertrophy, hyperplasia, metaplasia).
Explain the fundamental differences between apoptosis (programmed death) and necrosis (acute, uncontrolled death) and their molecular triggers.
Describe the phenomenon of autophagy as a process that balances between maintaining cellular homeostasis (survival) and directing cells towards death.
Recognize the role of stem cells as a fundamental reservoir for tissue regenerative capacity.
Show the cascade of events during ischemia-reperfusion injury and explain why reperfusion can additionally damage tissue.
Compare different mechanisms of cell death (apoptosis, necrosis, necroptosis) in the context of clinical consequences for the organism (e.g. inflammatory response vs. silent cell elimination).
Describe the role of stem cells in tissue repair and regeneration.

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Lecture 5: Cell growth control. Tumor growth.
Learning outcomes:
Explain the cell cycle, cell cycle checkpoints, major regulatory proteins in the cell cycle.
Understand the mechanisms of cell cycle regulation by external and intracellular signals.
Understand the role of kinases, retinoblastoma protein (pRb), and the relationship between p53 and p21 proteins.
Explain the role of proto-oncogenes in the control of cell growth and the principles of transformation into oncogenes.

Lecture 6: Skeletal and smooth muscle contraction, neuromuscular junction. Pathophysiology.
Learning outcomes:
Explain neuromuscular junction, synaptic junction, nicotinic cholinergic receptor, skeletal muscle action potential, excitation-contraction coupling.
Describe the formation and secretion of acetylcholine at the molecular level.
Explain the molecular mechanisms of muscle contraction.
Describe the structure of skeletal and smooth muscle and the mechanisms of muscle contraction.
Understand the energetics of muscle contraction, characteristics of whole muscle contraction.
Analyze the causes of muscle fatigue and tiredness, distinguishing metabolic causes (ATP depletion, lactate accumulation) from signaling disorders.
Compare pathophysiological mechanisms in clinical cases of disorders of neuromuscular transmission and muscle function.

PART II: Hematology. Inflammation. Temperature regulation.

Lecture 7: Hematopoesis. Erythrocytes.
Learning outcomes:
Explain the development of blood cells: the location and stages of blood cell differentiation.
Describe erythropoiesis; primary and secondary centers of hematopoiesis, stages of erythrocyte differentiation, growth and differentiation factors (vitamins and iron), and the regulation of erythropoiesis by erythropoietin and the amount of oxygen in the tissues, lymphopoiesis, myelopoiesis, and thrombocytopoiesis.
Describe the formation, shape, size, and concentration of erythrocytes in the blood.
Explain the formation of hemoglobin and its function in erythrocytes (transport of O_2, CO_2).
Explain the mechanism of erythrocyte degradation in the spleen as well as the breakdown of hemoglobin.
Describe iron metabolism, transport and storage in the body.

Lecture 8: Blood types.
Learning outcomes:
Describe the main erythrocyte antigens and know the types of agglutinins in plasma. Describe the agglutination process as a result of reaction with corresponding aglutinins and aglutinogens.
Explain the AB0 and Rh antigen systems and describe the genetic model of blood type inheritance. Explain the prediction of blood types of children from parents with known blood types allels.
Understand the development of erythroblastosis fetalis.
Understand the reaction after administration of incompatible blood. Understand and explain the difference between „universal blood donor“ and „universal blood recipient“.

Lecture 9: Erythrocyte disorders.
Learning outcomes:
Explain disorders in the formation and function of erythrocytes.
Explain the pathogenesis of anemia and polycythemia.

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Understand the metabolism and pathophysiological consequences of iron transport disorders.
Know the basic laboratory tests for assessing the number and function of erythrocytes.

Lecture 10: Hemostasis and blood clotting.

Learning outcomes:

Define the term hemostasis and list its four consecutive phases. List the key coagulation factors (physiological cofactors and zymogens) and the main cells involved in the process (platelets, endothelial cells).
Identify the most important natural anticoagulants (e.g. antithrombin, protein C and S, TFPI) and clinical anticoagulants (heparin, warfarin).
Explain the role of local blood vessel spasm (vasoconstriction) and the mechanisms of platelet adhesion, activation and aggregation during platelet plug formation.
Describe the cascade model of coagulation through the activation of the extrinsic, intrinsic and common pathways that lead to the conversion of prothrombin to thrombin and fibrinogen to fibrin.
Explain the process of clot retraction and its importance in wound stabilization and approximation of the edges of the damaged vessel.
Explain the mechanisms by which natural anticoagulant systems prevent clot spread to the undamaged endothelium and how clinical anticoagulants interfere with these processes.

Lecture 11: Hemostasis disorders.

Lecture outcomes:

Define the terms thrombocytopenia, thrombocytopathies, coagulopathy, and vascular purpura.
List the major causes of quantitative platelet disorders (decreased production versus increased consumption or breakdown).
Identify the hereditary coagulopathy (hemophilia A and B, von Willebrand disease) and key vascular disorders that lead to bleeding (e.g., scurvy, senile purpura, congenital hemorrhagic telangiectasia).
Explain the pathophysiological mechanisms that cause qualitative platelet disorders (thrombocytopathies, whether congenital or acquired, such as aspirin exposure).
Apply knowledge of pathophysiology to differentiate the clinical presentation of bleeding: superficial bleeding (petechiae, purpura, ecchymoses, epistaxis) in platelet/vascular disorders versus deep bleeding (hematomas, hemarthroses) in coagulopathy.

Lecture 12: White blood cells.

Lecture outcomes:

Explain the concentration and subtypes of leukocytes in the blood (granulocytes – neutrophils, eosinophils, basophils; and agranulocytes – lymphocytes, monocytes and plasma cells).
Describe the differential blood count and its clinical significance.
Explain the lifespan and recirculation of leukocytes in the body (leukodiapedesis, chemotaxis).
Defensive properties of neutrophils and macrophages (phagocytosis and killing of bacteria, antigen presentation and stimulation of the immune response, secretion of cytokines to promote inflammation).
Describe the role of eosinophils and basophils.

Lecture 13: White blood cell disorders.

Lecture outcomes:

Define the terms leukocytosis, leukopenia, agranulocytosis, leukemia, and lymphoma.
List the most common causes of reactive leukocytosis (neutrophilia, lymphocytosis, eosinophilia).
Relate an isolated increase in a particular type of leukocyte to a general type of stimulus (e.g., neutrophilia in acute bacterial inflammation, eosinophilia in allergic reaction).
Classify leukemias based on the rate of progression (acute vs. chronic) and line of differentiation (myeloid vs. lymphoid).

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Explain the pathophysiological difference between reactive leukocytosis (leukemoid reaction) and neoplastic (true) proliferation in leukemias.
Describe the mechanisms of leukopenia/neutropenia (reduced production in the bone marrow due to toxins/drugs vs. increased peripheral consumption or sequestration).
To analyze how the uncontrolled proliferation and accumulation of blast cells in the bone marrow leads to suppression of normal hematopoiesis and consequent bone marrow failure.
To compare and contrast the pathophysiological characteristics and clinical course of acute leukemias (non-functional blasts, sudden onset) in relation to chronic leukemias (partially differentiated cells, indolent course).

Lecture 14: Inflammation, damage repair and wound healing.
Lecture outcomes:
Define inflammation as the biological response of the organism to tissue damage and state its main purposes.
Explain the difference between PAMPs (Pathogen-Associated Molecular Patterns) and DAMPs (DamageAssociated Molecular Patterns) in the initiation of the inflammatory response.
Recognize the key mediators of acute inflammation and the role of cytokines and chemokines as communication molecules of white blood cells.
Describe the vascular response and the leukocyte recruitment cascade (rolling, adhesion, diapedesis) as a mechanism for directing cells to the site of damage.
Apply an understanding of chemotaxis to explain how leukocytes find a specific target in the tissue.
Illustrate the time course of acute inflammation, from initiation to the tissue repair phase, emphasizing the transition from proinflammatory to inflammastatic (anti-inflammatory) mediators.
Relate the systemic response of the organism (e.g., fever, acute phase proteins) to the local inflammatory process.

Lecture 15: Thermal control mechanisms. Thermoregulation disorders.
Lecture outcomes:
Explain the mechanisms for heat production (metabolism, shivering), and the mechanisms for heat dissipation from the body surface.
Explain the body's insulation system.
Explain the role of sympathetic innervation in body heat regulation.
Explain the thermostatic center in the hypothalamus – the "set point" in body temperature control.
Explain fever and pyrogens and the characteristics of febrile states.

List of seminars with descriptions:

Seminar 1: Membrane transport.
Learning outcomes:
Describe the basic mechanisms of substance transport through the cell membrane and distinguish between active and passive transport. Distinguish between diffusion and osmosis.
Seminar includes:
- PhysioEx 9.1, Exercise 1 – Activity 1
- PhysioEx 9.1, Exercise 1 – Activity 2
- PhysioEx 9.1, Exercise 1 – Activity 3
- PhysioEx 9.1, Exercise 1 – Activity 5

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Seminar 2: Action potential.

Learning outcomes:

Explain the formation of the resting membrane potential in nerves and calculate the membrane potential under conditions when the membrane permeability to Na^+, K^+ or Cl^- ions changes.
Explain the formation of the action potential in a nerve cell.
Explain the function of voltage-gated Na^+, K^+ and Ca^{2+} channels (threshold of stimulation, activation and inactivation), the methods of excitation of the action potential and the propagation of the action potential along the cell membrane.
Understand the principles of recording membrane and action potentials.
Explain the conduction of the action potential in nerve fibers and the dependence of the conduction velocity in nerve fibers to the myelin sheath.

Seminar 3: Cellular adaptation, damage and death.

Learning outcomes:

Distinguish the basic forms of cellular adaptation to stress (atrophy, hypertrophy, hyperplasia and metaplasia).
Compare apoptosis, necrosis and necroptosis according to the mechanism of occurrence, morphological characteristics and inflammatory
response. Explain the mechanisms of cellular damage and ischemia-reperfusion injury and their consequences for cells and tissues. Relate the role of autophagy and stem cells with the maintenance of homeostasis, survival and regeneration of tissues.

Seminar 4: Tumour growth.

Learning outcomes:

Genome instability and cell cycle disruption in carcinogenesis. Chemical, physical and biological carcinogenesis. Oncogenes and antioncogenes. General properties of malignant cells and tumor growth kinetics. Intercellular relationship between tumor and host. Pathogenetic sequence of events during the growth and metastasis of malignant tumors.

Seminar 5: Physiology of skeletal muscle.

Learning outcomes:

Explain neuromuscular junction, synaptic junction, nicotinic cholinergic receptor, skeletal muscle action potential, excitation-contraction coupling.
Describe the formation and secretion of acetylcholine at the molecular level.
Explain the molecular mechanisms of muscle contraction.
Describe the structure of skeletal and smooth muscle and the mechanisms of muscle contraction.
Understand the energetics of muscle contraction, characteristics of whole muscle contraction.

Seminar includes:

- PhysioEx 9.1, Exercise 2 – Activity 1
- PhysioEx 9.1, Exercise 2 – Activity 2
- PhysioEx 9.1, Exercise 2 – Activity 3
- PhysioEx 9.1, Exercise 2 – Activity 4
- PhysioEx 9.1, Exercise 2 – Activity 5

Seminar 6: Red blood cell disorders.

Learning outcomes:

Explain disorders in the formation and function of erythrocytes. Explain and define hematological indexes and their role in diagnostics of red blood cell disroders.
Explain the etiopathogenesis of anemia and polycythemia, and the clinical consequences.

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Seminar 7: Hemostasis disorders.
Learning outcomes:
Explain the basic mechanisms of hemostasis, including primary and secondary hemostasis. Describe the process of blood clotting and the role of key clotting factors. Distinguish platelet disorders and coagulation disorders according to the mechanism of occurrence. Relate hemostasis disorders to clinical consequences.

Seminar 8: White blood cell disorders and inflammation.
Learning outcomes:
Explain disorders in the formation and function of leukocytes. Clarify qualitative and quantitative disorders of the white blood cell. Relate changes in the number of individual types of leukocytes to the type of pathological stimulus.
Distinguish reactive leukocytosis from leukemia and explain the basic pathophysiological differences between these conditions.
Compare acute and chronic leukemia according to the speed of the course, the degree of cell differentiation and the consequences of the accumulation of abnormal cells in the bone marrow.

Seminar 9: Thermoregulation and thermoregulation disorders.
Learning outcomes:
Definition of inflammation, basic symptoms and etiology.
Explain the pathogenetic mechanisms of local inflammatory processes in acute inflammation, as well as the systemic reactions of the body to inflammation.
Describe and explain the inflammastatic mechanisms, kinetics and pathogenesis of the inflammatory process, and mediators of the inflammatory process.
Explain the pathophysiological outcomes of inflammatory reactions.
Explain the basic pathophysiological changes in states of hypothermia, as well as in states of heat shock.

List of practicals with descriptions:

Practical 1: Action potential.
Learning outcomes:
Explain the formation of the resting membrane potential in nerves and calculate the membrane potential under conditions when the membrane permeability to Na^+, K^+ or Cl^- ions changes.
Explain the formation of the action potential in a nerve cell.
Explain the function of voltage-gated Na^+, K^+ and Ca^{2+} channels (threshold of stimulation, activation and inactivation), the methods of excitation of the action potential and the propagation of the action potential along the cell membrane.
Understand the principles of recording membrane and action potentials.
Explain the conduction of the action potential in nerve fibers and the dependence of the conduction velocity in nerve fibers to the myelin sheath.
Practical includes:

- PhysioEx 9.1, Exercise 3 – Activity 1
- PhysioEx 9.1, Exercise 3 – Activity 2
- PhysioEx 9.1, Exercise 3 – Activity 3
- PhysioEx 9.1, Exercise 3 – Activity 4
- PhysioEx 9.1, Exercise 3 – Activity 5
- PhysioEx 9.1, Exercise 3 – Activity 6
- PhysioEx 9.1, Exercise 3 – Activity 7

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Practical 2: Erythrocytes. Hemoglobin. Hematocrit. Blood types.
Learning outcomes:
Describe the formation, shape, size, and concentration of erythrocytes in the blood.
Explain the formation of hemoglobin and its function in erythrocytes (transport of O_2, CO_2).
Explain the mechanism of erythrocyte degradation in the spleen as well as the breakdown of hemoglobin.
Describe iron metabolism in the body.
Define and explain hematological indices (MCV, MCH, MCHC). Explain their role in defining blood analysis.
Practical includes:

- counting erythrocytes from blood sample
- demonstration of determining hematocrit from blood sample
- PhysioEx 9.1, Exercise 11 – Activity 3
- determining blood type from blood sample

Practical 3: Platelets and coagulation. Bleeding time. Clotting time.
Learning outcomes: Describe the properties, functions, and formation of platelets.
Explain the mechanism of blood clotting.
Understand the mechanisms of preventing blood clotting in the normal vascular system.
Exercise includes:

- counting platelets from blood sample
- determining bleeding time
- determining clotting time

Practical 4: Leukocytes and inflammation. Leukocyte count. Differential blood count.
Learning outcomes: Explain the concentration and subtypes of leukocytes in the blood (granulocytes – neutrophils, eosinophils, basophils; and agranulocytes – lymphocytes, monocytes and plasma cells).
Describe the differential blood count and its clinical significance.
Explain the lifespan and recirculation of leukocytes in the body (leukodiapedesis, chemotaxis).
Defensive properties of neutrophils and macrophages (phagocytosis and killing of bacteria, antigen presentation and stimulation of the immune response, secretion of cytokines to promote inflammation).
Describe the role of eosinophils and basophils.
Exercise includes:

- counting leukocytes from blood sample
- determining differentail blood count from provided samples and discussing the results

Students' obligations:

Students are required to attend classes and earn sufficient points throughout the course to gain access to the final exam. The points are earned through testing, demonstrating their acquired knowledge. They must also demonstrate sufficient knowledge on the final exam to pass the course.
Attendance will be regulary monitored, and student may be absent from classes for up to 20% of all forms of classes for justified reasons only.

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Exam (method of taking the exam, description of the written/oral/practical part of the exam, scoring method, evaluation criteria):

Student work and acquired competencies are assessed during classes (50%) and at the final exam (50%). Student work and achievements are expressed in points obtained, which are used to form the final grade.

The final grade is based on a total of 100 points, which is the sum of two components:

- points earned during the course - maximum 50 points;
- points from the final exam - maximum 50 points.

I. Continous testing during the course (maximum 70 points).

During the course**,** knowledge will be assessed with two tests of 50 questions. A maximum of 35 points can be "earned" on each test, as shown in the table below. Passing 50% of each Midterm test is NOT a condition for taking the final exam, if the student had collected 35 points during the entire course. The first test (**Midterm 1**) covers the material of lectures **L1-L5**, seminars **S1-S2** and practical **P1**. The second test (**Midterm 2**) covers the material of lectures **L6-L11**, seminars **S3-S5** and practicals **P2-P4**. Up to 25 points can be "earned" on each test, as follows:

Correct answers	Points earned	Correct answers	Points earned
49, 50	**35**	35	**25**
47, 48	**34**	34	**24**
45, 46	**33**	33	**23**
43, 44	**32**	32	**22**
41, 42	**31**	31	**21**
40	**30**	30	**20**
39	**29**	29	**19**
38	**28**	27, 28	**18**
37	**27**	25, 26	**17**
36	**26**	0-24	**0**

MIDTERMS
Midterm 1: June 17th 2027
Midterm 2: July 1st 2027

II. Final exam (maximum 50 points)

Final Exam Eligibility
To be eligible for the final exam, students must fulfil the following conditions:

- Attend at least **80%** of all classes (lectures, seminars and practical combined).
- Take part in both partial tests and earn points on each.
- Achieve a minimum of **35 points** during the course.

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Students are ineligible for the final exam if they:

- Missed more than 20% of all classes.
- Did not take one or more partial tests.
- Achieved 34 or fewer points during the course.

Students who have achieved 35 - 70 points during the course are required to take a final exam, where they receive additional points. The final exam consists of a **multiple choice question (MCQ) test** followed by an **oral exam**.

• Students who have achieved less than 25 points during classes or have missed more than 20% of classes are not eligible to take the final exam (failed F).
• Students can achieve **15-30 points on the final exam**. The final exam consists of a **written exam**, in which the student is required to demonstrate at least 50% of knowledge, skills and competencies. Students who demonstrate more than 50% of knowledge, skills and competencies on the written part of the exam receive points according to the achieved result, which are added to the points achieved during classes. Students can achieve 14-25 points on the written part of the exam according to the following table:

Correct answers	Points earned	Correct answers	Points earned
47-50	**25**	33	**18**
44-46	**24**	31-32	**17**
42-43	**23**	29-30	**16**
40-41	**22**	27-28	**15**
38-39	**21**	25-26	**14**
36-37	**20**	0-24	**0**
34-35	**19**		

MCQ exam is followed by oral exam IF the student scored at least 14 points in the written exam. In the oral part of the exams, student can score 1-5 points, maximum being 5 points, or fail the entire exam if given 0 points. If that were the case, the student **HAS to retake both the MCQ and oral part of the final exam**.

III. Final grade (maximum 100 points)

The final grade is determined by adding up the points earned during classes and the final exam (both MCQ and oral part) based on the absolute distribution according to the following scale:

90 - 100 points	A	excellent (5)
75 - 89,99 points	B	very good (4)
60 - 74,99 points	C	good (3)
50 - 59,99 points	D	sufficinet (2)
less than 50 points	F	insufficient (1)

A student who fails the final exam will receive an insufficient grade for the course regardless of their total points.

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Other notes (related to the course) important for students:

Any use of someone else's text or other form of copyrighted work, as well as the use of ChatGPT or any other tool whose functionality is based on artificial intelligence technology, without a clear and unambiguous indication of the source, is considered a violation of someone else's copyright and the principle of academic honesty and represents a serious violation of student obligations, which entails disciplinary liability and disciplinary measures in accordance with the Regulations on Student Disciplinary Liability.
Consultation times: By arrangement with prior notice by e-mail.

Students will be able to find all information and study materials on the Merlin platform.

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COURSE SCHEDULE (for the academic year 2026/2027)

Date	Lectures (time and place)	Seminars (time and place)	Practicals (time and place)	Nastavnik
June 8th 2027	**L1** (10.15-11.45)			Assisst. Prof. Ljerka Karleuša Mujkić, dipl. ing. bioteh.
June 8th 2027	**L2** (12.00-13.30)			Assisst. Prof. Ljerka Karleuša Mujkić, dipl. ing. bioteh.
June 9th 2027		**S1** (8.15-9.45)		Assist. Prof. Daria Kveštak, dipl. ing. mol. biol.
June 9th 2027	**L3** (10.00-11.30)			Assisst. Prof. Ljerka Karleuša Mujkić, dipl. ing. bioteh.
June 10th 2027	**L4** (9.00-10.30)			Prof. dr. sc. Pero Lučin, dr. med.
June 10th 2027		**S2** (10.45-12.15)		Assist. Prof. Daria Kveštak, dipl. ing. mol. biol.
June 11th 2027			**P1** (10.15-11.45)	Assist. Prof. Daria Kveštak, dipl. ing. mol. biol.
June 11th 2027		**S3** (12.00-13.30)		Assisst. Prof. Ljerka Karleuša Mujkić, dipl. ing. bioteh.
June 14th 2027	**L5** (9.00-10.30)			Assisst. Prof. Ljerka Karleuša Mujkić, dipl. ing. bioteh.
June 14th 2027	**L6** (10.45-13.00)			Prof. dr. sc. Pero Lučin, dr. med.
June 15th 2027		**S4** (9.00-10.30)		Doc. dr. sc. Daria Kveštak, dipl. ing. mol. biol.
June 15th 2027		**S5** (10.45-12.15)		Assisst. Prof. Ljerka Karleuša Mujkić, dipl. ing. bioteh.
June 16th 2027	**L7** (9.00-10.30)			Assisst. Prof. Ljerka Karleuša Mujkić, dipl. ing. bioteh.
June 16th 2027	**L8** (10.45-11.30)			Izv. prof. dr. sc. Tamara Gulić, mag. biol.
June 16th 2027	**L9** (11.45-13.15)			Prof. dr. sc. Hana Mahmutefendić Lučin, dipl. ing. biol.
June 17th 2027	MIDTERM 1			
June 17th 2027			**P2** (10.30-13.30)	Assist. Prof. Daria Kveštak, dipl. ing. mol. biol.
June 18th 2027	**L10** (9.00-10.30)			Assisst. Prof. Ljerka Karleuša Mujkić, dipl. ing. bioteh.
June 18th 2027		**S6** (10.45-12.15)		Izv. prof. dr. sc. Tamara Gulić, mag. biol.
June 21st 2027	**L11** (9.00-10.30)			Assist. Prof. Daria Kveštak, dipl. ing. mol. biol.
June 21st 2027			**P3** (10.45-13.00)	Assist. Prof. Marina Marcelić, mag. pharm. inv.
June 23rd 2027	**L12** (9.00-10.30)			Assisst. Prof. Ljerka Karleuša Mujkić, dipl. ing. bioteh.

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June 23rd 2027	**L13** (10.45-12:15)			Assist. Prof. Daria Kveštak, dipl. ing. mol. biol.
June 24th 2027		**S7** (9.00-10.30)		Assisst. Prof. Ljerka Karleuša Mujkić, dipl. ing. bioteh.
June 24th 2027		**S8** (10.45-12.15)		Assisst. Prof. Ljerka Karleuša Mujkić, dipl. ing. bioteh.
June 25th 2027			**P4** (9.00-11.15)	Assist. Prof.. Daria Kveštak, dipl. ing. mol. biol.
June 28th 2027	**L14** (9.00-10.30)			Assisst. Prof. Ljerka Karleuša Mujkić, dipl. ing. bioteh.
June 28th 2027	**L15** (10.45-12.15)			Assisst. Prof. Ljerka Karleuša Mujkić, dipl. ing. bioteh.
June 29th 2027		**S9** (9.00-10.30)		Assist. Prof. Marina Marcelić, dipl. ing. mol. biol.
July 1st 2027	MIDTERM 2			

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List of lectures, seminars and exercises:

	LECTURES (lecture topic)	Teaching hours	Room
P1	Homeostasis and inner enviroment.	2	Seminar room Dpt. of Phys.
P2	Membrane transport.	2	Seminar room Dpt. of Phys.
P3	Membrane and action potential.	2	Seminar room Dpt. of Phys.
P4	Cellular physiology and pathophysiology - Cellular adaptation, damage and death.	2	Seminar room Dpt. of Phys.
P5	Cell growth control. Tumor growth.	2	Seminar room Dpt. of Phys.
P6	Skeletal and smooth muscle contraction, neuromuscular junction. Pathophysiology.	3	Seminar room Dpt. of Phys.
P7	Hematopoiesis. Erythrocytes.	2	Seminar room Dpt. of Phys.
P8	Blood types.	1	Seminar room Dpt. of Phys.
P9	Red blood cell disorders.	2	Seminar room Dpt. of Phys.
P10	Hemostasis and blood clotting.	2	Seminar room Dpt. of Phys.
P11	Hemostasis disorders.	2	Seminar room Dpt. of Phys.
P12	White blood cells.	2	Seminar room Dpt. of Phys.
P13	White blood cells disorders.	2	Seminar room Dpt. of Phys.
P14	Inflammation, damage repair and wound healing.	2	Seminar room Dpt. of Phys.
P15	Thermal control mechanisms. Thermoregulation disorders.	2	Seminar room Dpt. of Phys.
	Total teaching hours	**30**	

	SEMINARS (seminar topic)	Teaching hours	Room
S1	Membrane transport.	2	Seminar room Dpt. of Phys.
S2	Action potential.	2	Seminar room Dpt. of Phys.

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S3	Cellular adaptation, damage and death.	2	Seminar room Dpt. of Phys.
S4	Tumor growth.	2	Seminar room Dpt. of Phys.
S5	Physiology of skeletal muscle.	2	Seminar room Dpt. of Phys.
S6	Red blood cell disorders.	2	Seminar room Dpt. of Phys.
S7	Hemostasis disorders.	2	Seminar room Dpt. of Phys.
S8	White blood cell disorders and inflammation.	2	Seminar room Dpt. of Phys.
S9	Thermoregulation and thermoregulation disorders.	2	Seminar room Dpt. of Phys.
	Total teaching hours	**18**	

	Practicals (topic of practical)	Teaching hours	Room
V1	Action potential	2	Seminar room Dpt. of Phys.
V2	Erythrocytes, hemoglobin, hematocrit, blood groups	4	Practical room Dpt. of Phys.
V3	Platelets and blood clotting. Bleeding time. Clotting time.	3	Practical room Dpt. of Phys.
V4	Leukocytes and inflammation. Leukocyte count. Differential blood count.	3	Practical room Dpt. of Phys.
	Total teaching hours	**12**	

	EXAM DATES (final exam)
1.	July 5th 2027
2.	
3.	
4.	
5.	

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Subject	Physiology and Pathophysiology I			
Teaching format	Lectures	Seminars	Practicals	Total
Total number	30	18	12	60
On line	0	0	0	0
Percentage	0%			