ACADEMIC YEAR 2025./2026.

Name od the course

Physiology

Department

Department of Physiology

Address of the department

School of Medicine University of Zagerb, Šalata 3, HR-10000 Zagreb

Course Status

Obligatory

The year of study in which the course is carried out

2. year

The semester in which the subjects are taught

Winter and summer semester

ECTS

12 ECTS

Head of the Course

Assoc. prof. Mirza Žižak, MD, PhD, mirza.zizak@mef.hr; mzizak@sfzg.hr

Other teachers in the course who participate in teaching

Assoc. prof. Vesna Lukinović Škudar, MD, PhD, vesna.lukinovic.skudar@mef.hr

Assist. Prof. Alan Šućur, MD, PhD, alan.sucur@mef.hr

Dr. sc. Domagoj Jakovac, djakovac@sfzg.hr

Number of hours of classes

	Zimski semestar	Ljetni semestar	Ukupno (oba semestra)
Lectures	7	8	15
Seminar	31	26	57
Practical	32	16	48
Total	60	60	120

1 sat = 45 minuta

Type of exercises on the subject

Laboratory practical

Objectives and purpose of the course

Human Physiology is a core biomedical discipline in dental medicine that explores how normal body functions are established and regulated—from the molecular and cellular level to complex organ systems. Building on foundational knowledge from anatomy, histology, biology, biochemistry, and biophysics, the course examines how cells, and organ systems function and are regulated under normal physiological conditions but also in how their function is changed in pathological conditions, since some diseases could arise directly from abnormalities in their regulation.

Through the integration of multiple systems, the human body adapts to various states—such as rest versus exertion, nutritional abundance versus fasting, and fluctuating environmental conditions—preserving homeostasis essential for life. A deeper understanding of physiological imbalances and disorders provides critical insight into pathophysiology and clinical manifestations, offering a natural bridge to clinical medicine.

Physiology curriculum is organized into learning units based on major body systems and functions as:

- cell and membrane physiology, muscle physiology, cardiovascular physiology,
- respiratory physiology, renal physiology,
- gastrointestinal physiology, metabolism and thermoregulation, physiology of endocrine system, physiology of reproduction, sports physiology,
- special senses, general and integrative neurophysiology

Course Enrolment Requirements

Passing the exam in Anatomy is a condition for enrolling and passing the exam in Physiology.

Passing the exam in Biochemistry is a prerequisite for enrolling and passing the exam in Physiology.

Passing the Histology with Embryology exam is a prerequisite for taking the Physiology exam.

Learning outcomes at the level of the integrated undergraduate and graduate study programme in Dental Medicine to which the course contributes:

☐ Knowledge, skills and competences related to communication and social skills

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☒ Knowledge, skills and competencies related to basic knowledge and the ability to collect information from literature

☐ Knowledge, skills and competences related to the collection of clinical information

☐ Knowledge, skills and competencies related to diagnosis and therapy planning

☐ Knowledge, skills and competencies related to the therapy, establishment and maintenance of oral health

☐ Knowledge, skills and competences related to preventive measures and health promotion

Expected learning outcomes

Upon successful completion of the Physiology course, students will be able to:

- Explain the foundational physiological mechanisms that govern life, applying core principles from physics, chemistry, and molecular biology to cellular, tissue, organ, and systemic functions.
- Describe the fundamental processes and normal functioning of all major human organ systems (e.g., cardiovascular, respiratory, renal, gastrointestinal, endocrine, nervous, musculoskeletal), detailing their components, processes, and regulatory pathways.
- Explain the integrative and communicative functions of systems involved in the regulation of vital parameters like blood pressure, respiration, urine concentration, and energy balance, and assess the etiopathogenetic mechanisms underlying their dysfunctions.
- Explain homeostasis and regulation by integrating biological functions across various organizational levels (cellular, tissue, organ, and systemic) to comprehensively explain the principles of homeostasis and how the body maintains its internal environment through intricate feedback loops and adaptive responses.
- Interpret pathophysiology by applying physiological and regulatory mechanisms to interpret the pathophysiology of common systemic disorders, recognizing how these conditions can impact overall patient health.
- Perform and accurately interpret common physiological measurements, including blood cell counts, differential blood counts, hemoglobin concentration, hematocrit, ABO/Rh blood typing, ECG recordings, arterial blood pressure, and salivary flow, pH, and buffering capacity.
- Analyze and discuss deviations of physiological indicators from reference ranges, explaining their potential causes and consequences (e.g., complete blood count analysis, hemostatic test results, ECG interpretation, blood pressure readings, spirometry results, vision/hearing tests, oral glucose tolerance test).

Course content

Lecture

	Topics of lectures in the winter semester	**Number of hours of classes**
1.	Introduction & Membrane Transport	1
2.	Electrocardiogram	2
3.	Blood clotting	2
4.	Body fluid compartments, edema	1
5.	Pulmonary ventilation	1
	Topics of lectures in the summer semester	**Number of hours of classes**
1.	Acid base regulation	2
2.	Liver & dietary balances	2
3.	Organization of nervous system, neuron as a basic functional unit of nervous system, synapses and neurotransmitters	2

4.	Introduction to sensory systems: integration of sensory information (types of sensations, sensory receptors and sensory pathways)	1
5.	Autonomic nervous system	1

1 sat = 45 minute

Seminar

	Topics of the seminar in the winter semester	**Number of hours of classes**
1.	Membrane physiology, membrane potential, Excitation of skeletal muscle, neuromuscular transmission	3
2.	Structure of skeletal, smooth muscle, mechanism of contraction, control of skeletal muscle contraction excitation – contraction coupling, mechanics and energetics of skeletal muscle contraction, smooth muscle	3
3.	Cardiac muscle, cardiac cycle Electrophysiology of the heart, heart sounds	3
4.	Arterial pressure and circulation Fluid dynamics, the microcirculation and lymphatics;	3
5.	Regulation of arterial pressure, Local control of blood flow	3
6.	Cardiac output and venous return; Coronary circulation, skeletal muscle circulation	3
7.	Structure of kidney and nephrons, Urinary system Glomerular filtration rate; Renal hemodynamics; Renal clearance	2
8.	Transport and processing properties of tubular segments; Urine concentration and dilution; Regulation of extracellular fluid volume and osmolarity;	3
9.	Regulation of potassium, calcium, phosphate and magnesium;	2
10.	Pulmonary circulation; pulmonary edema Alveolar gas exchange; Diffusion through the respiratory membrane	3
11.	Oxygen and carbon dioxide transport; Regulation of respiration	3
	Seminar topics in the summer semester	**Number of hours of classes**
1.	Alimentary tract, motility, nervous control, blood circulation; Reflexes, Propulsion and mixing of food Secretory functions; Digestion and absorption;	3
2.	Regulation of body temperature	1
3.	Pituitary hormones	2
4.	Mineralocorticoids; Glucocorticoids	2
5.	Calcium and phosphate metabolism, vitamin D;	2

	PTH and Calcitonin	
6.	Insulin, glucagon	2
7.	Male hormone; Female hormone	2
8.	Somatosensory system I – tactile sense and proprioception, Somatosensory system II –pain and thermal sensations	3
9.	Visual system; auditory system; chemical senses (taste and smell)	3
10.	General organization of motoric systems; Spinal and supraspinal motoric mechanisms and reflexes: cortical and brain stem control of motor function; basal ganglia and cerebellum	3
11.	Organization of cerebral cortex, intellectual functions of the brain, learning and memory. Behavioral and motivational mechanisms of the brain – The limbic system and the hypothalamus; States of brain activity (sleep and brain waves)	3

1 sat = 45 minuta

Practical

	Topics of exercises in the winter semester	**Number of hours of classes**
1.	Membrane potential (interactive simulation program)	6
2.	ECG. Measuring arterial blood pressure.	6
3.	Blood groups; Leukocyte count; DKS	4
4.	Exercise induced changes in cardiovascular system. Astrand. EMG	4
5.	Erytrocyte count. Haemoglobin. Hematocrit. Sedimentation rate. calculate blood parameters (ib, psv, blood clotting tests, se (erythrocyte sedimentation)	4
6.	Calculate osmolarity and volume of body fluids	4
7.	Spirometry; static and dynamic	4
	Topics of exercises in the summer semester	**Number of hours of classes**
1.	Measuring the rate of basal metabolism in human. Analysis of Endocrine Cases.	7
2.	Saliva, Regulation of secretion, pH changes and flow , Glucose Tolerance Test	4
3.	Vision test, 3D vision, Perimetry, Hearing tests with tuning fork, Autonomic Nervous System	5

1 sat = 45 minuta

Student obligations

Students are required to attend classes and complete the tasks entrusted to them.

Reading assignments are given for each lecture. Students are responsible for preparing the reading assignment regardless of whether or not the material is discussed in lectures or seminars. The purpose of lectures and seminars is to guide students to focus on and understand the important concepts rather than the minutiae. To obtain the best results from the lectures, seminars, and practical, students should read over and prepare the material before class.

Teaching sessions and class attendance: The Physiology course includes lectures, seminars, and practical sessions. Attendance at all components—lectures, seminars, and practicals—is mandatory. The course runs continuously through the winter and summer semesters, starting in October and concluding in June of the academic year.

The Physiology course uses a flipped classroom approach. This means that students are expected to come prepared for lectures, seminars, and practical sessions—ready to actively participate in discussions and answer questions. For seminars, students may be assigned pre-class tasks that must be completed in advance. They may be asked to present their work in class

Any missed lecture, seminar, or practical session must be compensated by taking the corresponding colloquium, which is mandatory.

Monitoring Student Performance

Evaluations: Student performance is continuously monitored throughout the academic year by recording class attendance, observing student engagement during sessions (such as answering or asking questions), and through written colloquia conducted after the completion of individual topics or units. Continuous learning and active participation are further encouraged through the assignment of individual or group tasks related to seminar or practical topics. These tasks are either presented orally to the rest of the group or completed in written form and submitted to the instructor.

Student engagement during the year is positively taken into account during the final exam. However, their engagement alone cannot secure a passing grade unless the student demonstrates sufficient knowledge on the final examination.

Exam Assessment Method

The exam consists of:

1. **Written exam** (computer-based or paper-based)
2. **Oral exam**

To qualify for the oral exam student must pass the written exam.

Exam Policy

- The following textbook chapters are not required for the exam: 1, 2, 3, 13, 22, 24, 32, 34, 35, 43, 44, 45, 67, 68, 69, 70, 83, 84. In the remaining chapters, disorders of physiological mechanisms (which are a subject of clinical medicine) are excluded—unless explicitly listed in the learning outcomes.
- Exam questions will cover material presented in lectures, assigned textbook readings as well as the readings from practical and case studies distributed during class or posted on the course LMS site.

- Exam questions are different types. Each question accounts for one point and there is no penalty for incorrect answers.
- The exam (written and oral) may be conducted either online and/or in person.

Major colloquium quizzes:

There are four major colloquium quizzes named colloquium Ph1, Ph2, Ph3 and Ph4. Each major colloquium quiz is made up of 40 multiple-choice questions equally distributed through textbook obligatory chapters.

Colloquium Ph1 - includes general physiology, muscle physiology, cardiovascular physiology, blood

Colloquium Ph2 - includes physiology of kidney and respiratory system,

Colloquium Ph3 - includes physiology of digestive system, metabolism and endocrinology

Colloquium Ph4 - includes physiology of neural system and sensory system

Exam writers are given 60 minutes to complete each major colloquium quiz. Each major colloquium quiz contributes to the final grade in the course. Students who successfully pass any major colloquium will be exempt from retaking the corresponding part (quiz) of the final written exam for the remainder of the current academic year.

Examination procedure

Specific rules will be given by the proctors.

1. Before the Exam
   - Students must arrive on time. Late arrivals may not be permitted to enter.

   Desk Preparation:
   - Only approved items are allowed (e.g., pens, pencils, erasers, or permitted calculators).
   - Prohibited/unauthorized items must be handed to the proctor before the exam begins.

   Prohibited items include:
   - Notes, books, or any written/printed material (unless explicitly allowed).
   - Electronic devices (smartphones, smartwatches, tablets, recording devices, etc.).
   - Any communication or internet-enabled devices.

2. During the Exam
   - Instructions: Student need to listen carefully to the proctor's verbal/written guidelines.
   - No Communication: Talking, signaling, or sharing materials is strictly prohibited.
   - No Recording/Filming: Capturing exam content in any form is forbidden.

3. Submitting the Exam
   - No Early Exit: Students must wait until the exam officially ends unless permitted by the proctor.
   - Leave the exam area quietly to avoid disturbing others.

4. Violations & Consequences
   - Academic misconduct (cheating, plagiarism, unauthorized aids) will result in penalties per institutional policies.
   - Proctors may inspect desks/devices at any time.

Final Exam

For final exam can apply:

- students who attended classes (seminars and practical) regularly,
- students who passed colloquium (for seminars and practical that were unattended)
- students who have signature in index for Physiology course (to get your index signed you must regularly attend classes and pass all colloquiums for classes unattended)

The written part of the final physiology exam

- it is composed of four quizzes: Ph1 + Ph2 + Ph3 + Ph4.
  - Each quiz contains 40 questions equally distributed through the textbook obligatory chapters. Students are given 60 minutes to complete each quiz part.
- students who have successfully passed the corresponding major exam are exempt from writing the relevant quiz of the final written part for the duration of the current academic year.
- students who pass any of the quizzes (Ph1, Ph2, Ph3 and/or Ph4) that are part of the final written exam do not need to retake that quiz until the end of the current academic year.
- written part of exam has the elimination threshold - student need to have score 55% or more on each part of the written exam before taking the oral part of the exam.
- during final examination term student might approach to the next written quiz only after passing the previous one.

The oral part of the final physiology exam

- oral exam is obligatory for the students who earned ≥55% and <85% of the total score on the written exam. Students who earned an average 85% and more of the total score on the written exam are exempt from taking oral exam.
- The final grade will depend on the grade given at the end of oral exam.

Grading Criteria

Grades from the written quiz will be determined on the basis of an objective standard of absolute difficulty of the test (called MPR) at:

≥85% of the total score on the test for excellence,

75% of the total score on the test for very good,

65% of the total score on the test for good,

55% of the total score on the test for satisfactory

Exam results:

Exam results will be posted on the Department of Physiology LMS page.

Academic Honesty

All students are expected to help to maintain an environment of academic honesty. The following behaviors are strictly forbidden during the administration of the exam: talking, cell phone use, and passing of papers or notes. Before written quizzes begin students need to place all backpacks, coats, cell phones, etc. in the front of the room.

Exam date(s)

	Izvanredni ispitni rokovi			Redovni ispitni rok ZIMSKI	Izvanredni ispitni rokovi		Redovni ispitni rok LJETNI		Redovni ispitni rok JESENSKI	
	Studeni	Prosinac	Siječanj	Veljača	Travanj	Svibanj	Lipanj	Srpanj	Kolovoz	Rujan
Datum (i)							**29.06.26.**	**9.07.26.**		**7.09.26.** **16.09.26.**

Required textbook

- Guyton AC, Hall JE: Textbook Of Medical Physiology, 14th Edition.
- Exercises will partly rely on the manual “Practicum for physiology course”. (2006.) ur. Žižak M, Zagreb: Medicinska naklada, whose chapters are posted on the course LMS.
- Professional-scientific articles and other peer-reviewed teaching materials posted on the LMS pages of the Department of Physiology

Additional literature

- R.M. Berne and M.N. Levy. Physiology 7th Edition, ISBN:9780323393942
- D.R. Bell. Core Concepts in Physiology. Lippincott-Raven, ISBN: 0-316-08868-4
- Linda S. Costanzo. Physiology 6th Edition, ISBN: 9780323478816