



Degree Programme in Medicine and Surgery
Academic Year 2026 / 2027

INTEGRATED COURSE (I.C.): PhysiologyII

NUMBER OF CFU (ECTS credits): 10

SSD (Academic Discipline Code): BIOS-06/A, MEDF-01/B.

COORDINATOR OF THE I.C.: Saviana Antonella Barbati

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MODULE 1: Blood and Hemostasis

NUMBER OF CFU (ECTS credits):1

SSD (Academic Discipline Code): BIOS-06/A

LECTURER: Prof. Cristina Bertollini

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MODULE 2: Physiology of the renal system and urinary, Exercise-induced adaptations

NUMBER OF CFU (ECTS credits):3

SSD (Academic Discipline Code): BIOS-06/A

LECTURER: Danny Adrian Spampinato

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MODULE 3: Sensory Physiology

NUMBER OF CFU (ECTS credits): 2

SSD (Academic Discipline Code): BIOS-06/A

LECTURER: Marta Russo

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MODULE 4: Physiology of the Digestive System, Endocrine system

NUMBER OF CFU (ECTS credits): 2

SSD (Academic Discipline Code): BIOS-06/A

LECTURER: Pietro Renna

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MODULE 5: Thermoregulation and energy balance

NUMBER OF CFU (ECTS credits): 1

SSD (Academic Discipline Code): BIOS-06/A

LECTURER: Saviana A. Barbati

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MODULE 6: Methods and didactic approaches of sports activities

NUMBER OF CFU (ECTS credits): 1

SSD (Academic Discipline Code): MEDF-01/B

LECTURER: Gabriele Pallone

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PREREQUISITE COURSES

None required.

PREREQUISITES

To adequately understand the course content, students are expected to possess basic knowledge and understanding of human anatomy, cell biology, biochemistry and medical physics. In particular, students should be familiar with the anatomical organization of the main organs and systems, the fundamentals of cellular and molecular biology, the principal biochemical and metabolic processes, and the physical principles applicable to biological systems. This knowledge provides the necessary foundation for understanding the physiological mechanisms covered in the course.

LEARNING OBJECTIVES

The integrated course aims to provide students with a comprehensive and in-depth understanding of the main physiological mechanisms that regulate the functioning of the human body and maintain homeostasis. Students will acquire knowledge of the functional principles of the organs that make up the human body and of their dynamic integration into organ systems.

The course also aims to develop students' ability to independently apply their knowledge of organ- and system-level mechanisms to situations involving potential functional alterations. Students will also learn the main indicators and reference parameters of normal body functions, together with the relevant measurement methods.

These objectives will be achieved through lectures, seminars and interactive learning activities designed to facilitate learning and improve students' ability to solve basic problems in systems physiology and applied physiology.

EXPECTED LEARNING OUTCOMES

DD 1: Knowledge and understanding

By the end of the course, students will know and understand the main physiological mechanisms that regulate the functioning of the human body. They will be able to describe the functions of blood and the mechanisms of haemostasis, renal function, sensory processes, gastrointestinal and endocrine functions, thermoregulation, energy balance, and the body's responses to physical exercise.

Students will also understand the functional relationships among cells, tissues, organs and organ systems and explain how their integration contributes to the maintenance of homeostasis. They will know the main physiological parameters, their normal reference ranges and the general principles used for their measurement.

DD2: Applying knowledge and understanding

By the end of the course, students will be able to apply the knowledge acquired to interpret the physiological responses of the human body under different functional conditions, including changes associated with physical exercise, nutrition, and variations in the internal and external environment.

Students will be able to analyse basic physiological data and parameters, identify deviations from normal conditions, and formulate reasoned hypotheses concerning the mechanisms underlying the main functional alterations. They will also be able to integrate knowledge relating to different organs and systems in order to address basic problems in applied physiology and clinically relevant situations.

DD3: Making judgements

By the end of the course, students will be able to critically interpret information, experimental data, and basic cases of physiological or clinical relevance, distinguishing physiological conditions from the main functional alterations.

Through the discussion of applied examples, cases, and reasoning-based questions, students will develop the ability to formulate independent and well-reasoned judgements and identify cause-and-effect relationships between changes in physiological parameters and the body's responses.

DD4: Communication skills

By the end of the course, students will be able to describe and discuss the main physiological mechanisms in a clear, concise, and logically organized manner, correctly using scientific language and discipline-specific terminology.

Students will also be able to illustrate the functional relationships among organs and systems, explain the reasoning underlying their analysis of basic physiological problems, and communicate the knowledge acquired both to specialist audiences and, with appropriate adjustments in language, to non-specialist audiences.

DD5: Learning skills

By the end of the course, students will be able to independently organize and further develop their study of human physiology by linking newly acquired knowledge to previous knowledge in anatomy, biology, biochemistry, and physics.

Students will be able to consult textbooks, teaching materials, and reliable scientific sources to update and expand their knowledge and apply it to situations other than those discussed during the lectures. These skills will provide the foundation for the independent study of pathophysiological and clinical disciplines and for continuing professional development.

SYLLABUS

Syllabus MODULE 1:

- **Blood and Hemostasis**

Characteristics and functions of blood. Plasma and serum. Red blood cells and white blood cells: formation, characteristics, and functions. Platelets: formation, characteristics, and functions. Hemoglobin and blood buffer systems. Blood groups and the Rh factor. Receptors involved in the function of blood cells. Hemostasis and coagulation: from physiology to clinical implications.

Syllabus MODULE 2:

- **Physiology of the renal system and urinary**

Development and structure of the kidney and urinary tract. Vascularization and blood pressure through the kidney. The nephron, Bowman's capsule, proximal tract, Henle's loop, distal tract, collecting tubules, collecting ducts: structure and functions. Elements of renal function: urine formation, haematopoiesis, general, hormonal and bone metabolism, electrochemical balance, blood volume, blood pressure (juxtaglomerular apparatus; intrinsic and extrinsic mechanisms on blood pressure control, including the Renin-Angiotensin-Aldosterone System). Glomerular filtration rate, plasma filtration rate, and renal blood flow: from physiology to clinical impact. NET filtration pressure. Mechanism of filtration, secretion, reabsorption and elimination. Renal clearance. Tubular transport: mechanisms and measurements. Antidiuretic hormone and regulation of water reabsorption and urine concentration. Natriuretic peptides. Acid-base mechanisms and buffer systems. Acidosis and alkalosis.

- **Exercise-induced adaptations**

Integrative Physiology: homeostasis, allostasis, and functional integration in the physiological processes of the organism. Acute versus chronic responses and adaptations to exercise. Skeletal muscle fiber types and their metabolic specialization. Bioenergetics of exercise: ATP-PCr, glycolytic, and oxidative energy systems and their relative contribution across exercise intensity and duration. Cardiovascular adaptations to acute and chronic exercise: cardiac output, stroke volume, heart rate, blood flow redistribution, and training-induced cardiovascular remodeling. Respiratory adaptations to exercise: ventilation, gas exchange, and VO₂max. Neuromuscular adaptations to exercise and their integrative bases, including strength and hypertrophy responses to resistance training. Neuroendocrine regulatory mechanisms (catecholamines, cortisol, growth hormone) and their role in modulating the response to physical and psychological stress.

Syllabus MODULE 3:

- Sensory Physiology
 - Visual System: Anatomy of the visual system, the eyes, photoreceptors, retina, connections between the eye and the brain, encoding of visual information in the retina, extrastriate visual cortex, and associative visual cortex.
 - Auditory System: Anatomy of the ear, auditory pathway, and perception of sound characteristics.
 - Vestibular System: Anatomy of the vestibular apparatus, receptor cells, and vestibular pathway.
 - Olfactory System: Anatomy of the olfactory apparatus, transduction of olfactory information, and perception of odors.
 - Gustatory System: Anatomy of the taste buds and taste receptor cells, perception of gustatory information, and gustatory pathway.

Syllabus MODULE 4:

- **Physiology of the Digestive System**

General principles of the function of the digestive system. Secretory functions of the digestive system. Motility. Role of the autonomic nervous system and gastrointestinal hormones. Digestion and absorption. Liver function.
- **Endocrine system**

Hormones: mechanism of action. Pituitary hormones and their hypothalamic control. Thyroid. Adrenal gland. Growth control. Regulation of calcium and phosphate metabolism. Endocrine pancreas and glycaemic metabolism. Female reproductive system: ovarian cycle and menstrual cycle.

Syllabus MODULE 5:

- Thermoregulation and energy balance

Thermoregulation: core and peripheral body temperature; mechanisms of heat production, conservation and dissipation; heat exchange with the environment; thermoneutral zone; physiological responses to cold and heat; fever. Energy balance. Direct and indirect calorimetry. Respiratory quotient and assessment of energy expenditure. Estimation of protein consumption through the measurement of urinary nitrogen. Basal metabolic rate and total energy expenditure. Energy content of foods. Carbohydrate, lipid and protein metabolism. Hormonal regulation of energy metabolism. Nutrition and nutritional requirements under different physiological conditions, including pregnancy, breastfeeding, childhood and ageing. Physiological regulation of hunger and satiety.

Syllabus MODULE 6:

- **Methods and didactic approaches of sports activities**

- The “workout”; Principles of Training; Overload Components; Motor skills;
- ACSM GUIDELINES
- Energy sources: ATP production and re-synthesis: notes on muscle contraction; The anaerobic threshold and related training; The mechanisms of ATP re-synthesis. Capacity and power: limiting factors and methods of increase
- Supercompensation; Training planning;
- Methodology: Train the Resistance; Train the Strength; Train the Speed; Train coordinative skills.

COURSE STRUCTURE

The course is delivered in person and consists of lectures, interactive learning activities, and discussions of applied examples and cases of physiological or clinical relevance.

Lectures are devoted to the systematic presentation of the contents of the individual modules and to the explanation of the physiological mechanisms regulating the functioning and integration of organs and systems. Interactive activities include reasoning-based questions, analysis of physiological data and parameters, discussion of basic applied cases, and, where appropriate, guided reading of scientific material. These activities are intended to develop students' ability to apply knowledge, make independent judgements, and communicate effectively.

The teaching materials used during the lectures and any supplementary materials are made available through the University's digital platform.

The course comprises 100 hours of classroom-based teaching with 2-3 hours classes and 2.5 hours of practical exercises for each CFU (ECTS credits).

Attendance is mandatory in accordance with the requirements established by the Degree Programme Regulations.

COURSE GRADE DETERMINATION

A chievement of the expected learning outcomes is assessed through a single examination covering the entire integrated course. The examination consists of a written test followed by an oral examination. Separate examinations for the individual modules, followed by the calculation of an average grade, are not permitted.

The written test lasts 30 minutes and consists of 30 multiple-choice questions covering the contents of the different course modules. One point is awarded for each correct answer. Incorrect or unanswered questions are awarded 0 points. No penalty is applied for incorrect answers. The maximum score is 30 points. To be admitted to the oral examination, students must achieve a score of at least 18/30 in the written test.

Passing the written test is a prerequisite for admission to the oral examination. The final grade, expressed on a scale of 30, is determined jointly by the Examination Committee based on the overall outcome of both assessments and on the evaluation of the learning outcomes relating to the integrated course as a whole. Honours may be awarded to students who demonstrate excellent preparation, full command of specialist terminology, a remarkable ability to integrate and apply knowledge, and a high degree of independent judgement.

During the oral examination, the Examination Committee will assess the student's learning skills and ability to apply knowledge and will determine whether the student has acquired the skills required to address and solve problems of a physiological nature. These aspects account for 50% of the assessment. The student's ability to make independent judgements accounts for 25%, while communication skills account for the remaining 25%, in accordance with the Dublin Descriptors.

The examination will be evaluated according to the following criteria:

Fail	Significant gaps and/or inaccuracies in knowledge and understanding of the topics; limited analytical and synthesis skills; argumentation absent or frequently incorrect.
18–20	Barely sufficient knowledge and understanding of the topics, with possible imperfections; sufficient analytical, synthesis, and judgement skills.
21–23	Routine knowledge of the topics; correct analytical and synthesis skills with coherent logical argumentation.
24–26	Fair knowledge and understanding of the topics; good analytical and synthesis skills; rigorously expressed argumentation.
27–29	Complete knowledge of the topics; considerable analytical and synthesis skills; good independent judgement.

30–30L

Excellent level of knowledge and understanding. Considerable analytical, synthesis, and independent judgement skills. Original argumentation expressed with full command of specialized terminology.

OPTIONAL ACTIVITIES

Office hours are available by appointment and must be arranged with the lecturers of the individual modules via their institutional e-mail addresses.

The course may also include thematic seminars, supplementary learning activities, in-depth study sessions, guidance on consulting scientific literature, and optional experiences in research laboratories. These activities are additional to the official syllabus and, unless otherwise specified by the lecturer, their contents are not included in the examination.

READING MATERIALS

Texts MODULE 1

- - Guyton e Hall. FISILOGIA MEDICA. Edizioni Edra, 2021

Texts MODULE 2

- Scott K. Powers, Edward T. Howley. Exercise Physiology: Theory and Application to Fitness and Performance. McGraw-Hill Education.
- Scott K. Powers, Edward T. Howley. Fisiologia dell'esercizio fisico: Teoria e applicazione alla forma fisica e alla prestazione. McGraw-Hill Education.

Texts MODULE 3

- Guyton e Hall. FISILOGIA MEDICA. Edizioni Edra, 2021.
- Purves D.; Augustine G.J.; Fitzpatrick D; Hall W.C.; LaMantia A.-S.; White L.E. NEUROSCIENZE. (V ed. italiana) Zanichelli 2021 (da integrare per il Sistema Nervoso).

Texts MODULE 4

- Silverthorn D.U., Fisiologia umana. Un approccio integrato, Milan, Pearson, 2017, Italian edition, chapters relevant to the topics covered in the module.

Texts MODULE 5

- Boron W.F., Boulpaep E.L., Fisiologia medica, Milan, Edra, 2018, 3rd edition, chapters relevant to the topics covered in the module.

Texts MODULE 6

- Powers Scott K., Howley E. T., FISILOGIA DELL'ESERCIZIO
- Bazzano C, Bellucci M. EFFICIENZA FISICA E BENESSERE: COME VIVERE MEGLIO A TUTTE LE ETÀ. EMSI
- AAVV – ALLENARE L'ATLETA/INSEGNARE LO SPORT – CONI/SDS
- Weineck J. L'ALLENAMENTO OTTIMALE. Calzetti e Mariucci editore