<table>
<tr><td colspan="2">NAME OF THE COURSE</td><td colspan="5">Animal Physiology</td></tr>
<tr><td>Code</td><td>PMB036</td><td>Year of study</td><td colspan="4">3</td></tr>
<tr><td>Course teacher</td><td>Professor Mate Šantić, PhD</td><td>Credits (ECTS)</td><td colspan="4">7.5</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">Assistant Professor Antonela Paladin, PhD</td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>E</td><td>F</td></tr>
<tr><td>45</td><td></td><td>45</td><td></td></tr>
<tr><td>Status of the course</td><td>Mandatory</td><td>Percentage of application of e-learning</td><td colspan="4">10%</td></tr>
<tr><td colspan="6">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="5">Adopt knowledges and concepts which are important for understanding fundamental physiological principles. Special emphasis will be given to integrative principles of physiology (from molecules to organisms) and fundamental physiological mechanisms in animals and people.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="5">Passed exams in General zoology, Avertebrates, Human anatomy and completed Vertebrates.</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="5">Student will be able to:
1. adopt basic concepts of feedback control system and understand homeostasis mechanisms in animal body.
2. understand mechanisms for transmembrane movements
3. understand basic properties of action potential and feature for transport of signal.
3. explain way of communications between cells and tissues.
4. understand the function of skeletal, smooth and cardiac tissues.
5. describe basic principle of gas exchange between respiratory membranes in animal body.</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="5">Lectures:
1. Introduction in animal physiology. Development of physiological science. Homeostasis. Feedback control system as fundamental principles of homeostasis. Cell physiology and macromolecules. Physiology of membranes – membranes structures. Membranes movements. Diffusion. Facilitated diffusion.
2. Active transport (primary and secondary active transports). The Na/K pump. Cotransport. Symporters, Antiporters. Membrane channels selectivity for electrolytes and nonelectrolytes. Endocytosis and exocytosis. Electrical appearance on membranes. Nernst and Goldman equation.
3. Action potential – the answer of membrane to electrical stimulus. Action potential and principle of all or nothing. Mechanism formation of AP. Voltage-gated Na and K-channels. Permeability od membrane during AP. Hodgkins cycle, role of tetradotoxin, flow of electricity through the channels, spreading of AP through the neuron, role of myelin (4).
4. Electrical and chemical synapses. Neuromuscular junction. Neurotransmitters.
5. Neurophysiology. The structural and functional organization of the nervous system. The spinal cord. The brain. Mammalian cerebral cortex. The autonomic nervous system. Sympathetic and parasympathetic divisions.</td></tr>
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	6. Sensory system. Properties of receptor cells. The chemical senses, taste and smell. Mechanoreceptors, hair cells. Vertebrate ear and equilibrium. Vision and vertebrate eye. 7. Glandes and hormones. 8. Muscles and animal movement. Skeletal muscle contraction. Mechanism and regulation of contraction. Physiology of smooth muscle. 9. Function of blood. Immunology system. Nonspecific and specific immune response. Lymphoid organs and lymphocyte types. Lymphocyte receptors, B and T-cells. Cell mediated and antibody mediated immune responses. Allergy. 10. Physiology of heart. Electrical and mechanical properties of heart. The Frank-Sterling mechanism. Comparative and functional morphology of Vertebrate hearts. 11. Circulation. Hemodinamics. Arterial and venous system. Capilares and microcirculation. Control of microcirculation. The lymphatic system. 12. Ionic and osmotic balance. Anatomy of mammalian kidney. Urine production. Regulation of pH by the kidney. Excretion of nitrogenous wastes. Problems of osmoregulation. External osmoregulatory organ in vertebrates, Salt glands and fish gills. 13. Ecophysiology. Physiological classification using thermal biology. Endotherms, ectotherms and heterotherms. Ectotherms in cold and warm environment. Thermal biology of heterotherms. Thermal biology of endotherms. Endotherms on cold and warm environment. 14. Breathing and gas exchange. Oxygen and carbon dioxide in blood. Gas transfer in lungs and other systems. Gas transfer in gills. Regulation of gas transfer. Swimbladers. The rete mirabile. Oxygen secretion in swimbladers. 15. Digestion and absorption of food. Animal energetics and metabolism. Feeding methods. Alimentary system. Motility and gastrointestinal secretions. Absorption. Nutrient uptake in the intestine. Exercises: 1. Laboratory animals. 3R. 2. Ways of giving substances to laboratory animals, anestysia and analgesia. 3. Osmotic resistance of red blood cells. 4. The erythrocytes and calculating haematological index. 5. The leukocytes and the differential blood count. 6. Haemostasis and blood clotting. 7. Review of the differential blood count. The types of blood cells - vertebrates and invertebrates comparison. 8. Getting serum and plasma, proving protein in plasma and serum, proving fibrinogen. 9. Hematocrit, determination of hemoglobin by Sahli, determination of hemoglobin with spectrophotometer, Teichmans crystals, erythrocytes sedimentation rate. 10. Breathing I. Pneumogram and breathing frequency. 11. Breathing II. PhysioEx. 12. Buffers and acid-base balance. Diuresis and initiating intravenous diuretics. PhysioEx. 13. Centres of heart automation, Staniuses ligatures, the impact of various factors on the heart.

	14. Muscles, myographic curve, contraction of the heated and the cooled muscle, dependence on the strength of contraction of the stimulus, summation of impulses. 15. Neuromuscular transmission, stopping the impulse conduction through the anesthetized nerve, Dubois - Raymond's rule.					
Format of instruction	☒ lectures ☐ seminars and workshops ☒ exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work		☐ independent assignments ☐ multimedia ☐ laboratory ☐ work with mentor ☐ (other)			
Student responsibilities	Attendance of lectures and exercises.					
Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*	Class attendance	4	Research		Practical training	0.5
	Experimental work		Report		(Other)	
	Essay		Seminar essay		(Other)	
	Tests		Oral exam	2	(Other)	
	Written exam	1	Project		(Other)	
Grading and evaluating student work in class and at the final exam	Tests during semester and written and oral exams					

	Title	**Number of copies in the library**	**Availability via other media**
Required literature (available in the library and via other media)	D. Randall, W. Burggren, K. French (2002): "Eckert Animal Physiology: Mechanisms and Adaptations", 5th ed. W.H. Freeman, New York, SAD.		
	A. Gayton, J.E. Hall. Medicinska fiziologija. Medicinska naklada Zagreb, 12 izdanje, 2012.		
	C. D. Moyes, P.S. Schulte. Principles of Animal Physiology. 2nd ed. Benjamin Cummings, 2007.		
	P. Zao, T. N. Stabler, L.A. Smith, A. Lokuta, E. Griff. PhysioEx Laboratory Simulations in Physiology Pearson, 2013.		
Optional literature (at the time of submission of study programme proposal)	R.M. Berne, M.N. Levy (1993). Fiziologija, Medicinska naklada Zagreb. K. Scmidt -Nielsen (1997): Animal Physiology- Adapation and environment, 5th ed. Cambridge University press.		
Quality assurance methods that ensure the	Students surveys and consultation.		

acquisition of exit competences	
Other (as the proposer wishes to add)	