UNIVERSITY OF ZAGREB
FACULTY OF VETERINARY MEDICINE
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Ur.br.:

Zagreb, 3rd February 2021

COURSE SYLLABUS

Course name: Physiology of domestic animals II

Academic year 2020/21

Head teacher: Ana Shek Vugrovečki, DVM, PhD, assistant professor

Jasna Aladrović, DVM, PhD, full professor, Ana Shek Vugrovečki, DVM, PhD, assistant professor; Lana Pađen DVM, PhD, assistant professor, Ivona Žura Žaja DVM, PhD, assistant professor

Associate teachers:
Jadranka Pejaković Hlede, DVM

Begin at: February 23rd 2021

End at: June 2nd 2021

Timetable for LECTURES academic year 2020/2021

LECTURES				
Date	**Methodological unit**	**Teacher**	**Location / time**	**Literature**
23/2/2021	**Cardiovascular system** Physiological characteristics of the cardiovascular system in domestic animals Physiological characteristics of the heart muscle The conduction system	Ivona Žura Žaja DVM, PhD, assistant professor	MS Teams 10-12h	(see the list of the required literature)
24/2/2021	**Cardiovascular system** The Phases of the Cardiac Cycle Electrical and mechanical changes in the heart Correlation of the heart excitation and contraction Changes of pressure and volume Sound changes Flow through heart	Ivona Žura Žaja DVM, PhD, assistant professor	MS Teams 15-17h	(see the list of the required literature)
25/2/2021	**Cardiovascular system** Stroke Volume Cardiac output Regulation of the heart rate: a) autoregulation b humoral regulation c) endocrine and nerve regulation	Ivona Žura Žaja DVM, PhD, assistant professor	MS Teams 10-12h	(see the list of the required literature)
26/2/2021	**Cardiovascular system** **Circulation** Arterial blood pressure Venous blood pressure Regulation of blood pressure Peripheral circulation: a) Arterial circulation b) Capillary circulation c) Venous circulation	Ivona Žura Žaja DVM, PhD, assistant professor	MS Teams 13-13:45	(see the list of the required literature)

	Regulation of peripheral circulation			
26/2/2021	**Respiratory system** Functions of respiratory system Ventilation mechanic Ventilation types Ventilation frequency	Ana Shek Vugrovečki, DVM, PhD, assistant professor	MS Teams 13:45-14:30	(see the list of the required literature)
8/3/2021	**Respiratory system** Gases exchange in lungs Gases transport in the blood	Ana Shek Vugrovečki, DVM, PhD, assistant professor	MS Teams 11-12:30	(see the list of the required literature)
12/3/2021	**Respiratory system** Tissue gases exchange Regulation of breathing	Ana Shek Vugrovečki, DVM, PhD, assistant professor	MS Teams 15-15:45	(see the list of the required literature)
12/3/2021	**Digestion** Functions of digestion Characteristics of the digestion in animals with simple stomach and ruminants Hunger and thirst Food intake Digestion In the mouth: mastication and salivation Salivary secretion Swallowing process	Ana Shek Vugrovečki, DVM, PhD, assistant professor	MS Teams 15:45-16:30h	(see the list of the required literature)
15/3/2021	**Digestion in the mouth and simple stomach** Functions of the stomach mucosa Composition and function of the gastric juice Regulation of the gastric juice secretion Vomiting	Ana Shek Vugrovečki, DVM, PhD, assistant professor	MS Teams 13-15h	(see the list of the required literature)
19/3/2021	**Digestion in the simple stomach** Regulation of the gastric juice secretion	Ana Shek Vugrovečki, DVM, PhD, assistant professor	MS Teams 8-9h	(see the list of the required literature)

	Vomiting			
19/3/2021	**Rumen digestion** Basic principle of ruminant-micro population symbiosis Rumen motility Water-dry substances ratio Functions of the oesophageal groove Gases in the rumen	Jasna Aladrović, DVM, PhD, associate professor	MS Teams 9-10h	(see the list of the required literature)
22/3/2021	**Rumen digestion** pH effect on the digestion Feeding Role of bacteria and infusoria in the digestion Rumen digestion efficiency	Jasna Aladrović, DVM, PhD, associate professor	MS Teams 8-9:30h	(see the list of the required literature)
25/3/2021	**Rumen digestion** Metabolism of Carbohydrates Metabolism of Proteins Metabolism of Lipids Ruminohepatic circle of nitrogen Vitamins synthesis Metabolic pathways of volatile fatty acids Abomasum digestion	Jasna Aladrović, DVM, PhD, associate professor	MS Teams 8-9h	(see the list of the required literature)
25/3/2021	**Intestinal digestion** Stomach-duodenum relationship Ph changes and food role Bile function Functions of the pancreatic juice	Lana Pađen DVM, PhD, assistant professor	MS Teams 9-10h	(see the list of the required literature)
29/3/2021	**Intestinal digestion** Regulation of absorption in the small Intestine	Lana Pađen DVM, PhD, assistant professor	MS Teams 13-15h	(see the list of the required literature)
7/4/2021	**Intestinal digestion** Intestinal polypeptide Bile secretion regulation Pancreatic juice secretion regulation Intestinal absorption	Lana Pađen DVM, PhD, assistant professor	Lecture room, Department of Physiology and Radiobiology 12-13h	(see the list of the required literature)
12/4/2021	**Liver**	Lana Pađen DVM,	Lecture room,	(see the list of the required literature)

		PhD, assistant professor	Pharmacology and Toxicology 10-11h	
12/4/2021	**Excretory function of kidneys** Nephron physiology Kidney filtration and filtration factors	Jasna Aladrović, DVM, PhD, associate professor	Lecture room, Pharmacology and Toxicology 11-12h	(see the list of the required literature)
13/4/2021	**Urine formation** Glomerular filtrate Nephron reabsorption Nephron secretion	Jasna Aladrović, DVM, PhD, associate professor	Lecture room, Pharmacology and Toxicology 8-10h	(see the list of the required literature)
15/4/2021	**Urine formation** Concentration and dilution of urine	Jasna Aladrović, DVM, PhD, associate professor	Lecture room, Pharmacology and Toxicology 8-10h	(see the list of the required literature)
3/5/2021	**Carbohydrate metabolism** Glucose functions Maintaining glycaemia Glycaemia regulation: a) endocrine b) nerve Alterations in glycaemia Functions of glucagon Carbohydrate metabolism mechanisms	Ana Shek Vugrovečki, DVM, PhD, assistant professor	Department of Physiology and Radiobiology 14-16h	(see the list of the required literature)
4/5/2021	**Protein Metabolism** Classification of body proteins Half-life of body proteins Protein synthesis and degradation in different animal species regulation	Lana Pađen DVM, PhD, assistant professor	Department of Veterinary Pathology, lecture room 14-16	(see the list of the required literature)
13/5/2021	**Lipids metabolism** Body fats functional classification Storage fat (lipogenesis) Building fats (function and metabolism of phospholipids, glycolipids and cholesterol) Transport fats Lipids metabolism regulation	Ivona Žura Žaja DVM, PhD, assistant professor	Department of Physiology and Radiobiology, lecture room 11-13h	(see the list of the required literature)

14/5/2021	**Vitamins metabolism** Role of minerals in synthesis and metabolism of tissues; Vitamins metabolism Vitamins resorption Vitamins deposition Water soluble and fat soluble vitamins specificities	Ivona Žura Žaja DVM, PhD, assistant professor	Department of Physics and Biophysics 12-14h	(see the list of the required literature)
19/5/2021	**Minerals metabolism** Role of minerals in synthesis and tissues metabolism Microelement metabolism - Na, K, Ca, P, Mg, S Microelement metabolism Fe, Cu, ZN, Mo, Co, Se, I	Ana Shek Vugrovečki, DVM, PhD, assistant professor	Department of Physiology and Radiobiology 12-14h	(see the list of the required literature)
27/5/2021	**Egg-laying physiology** Egg composition Egg development Oviposition Factors effecting egg-laying	Jasna Aladrović, DVM, PhD, associate professor	Department of Physiology and Radiobiology 10-11h	(see the list of the required literature)
27/5/2021	**Mammary gland** Mammary gland functions Mammary gland blood supply and lymph drainage Mammary gland development Lactation Suckling and milking Lactation duration Lactation curves Factors effecting lactation Milk composition	Lana Pađen DVM, PhD, assistant professor	Department of Physiology and Radiobiology 11-12h	
1/6/2021	**Mammary gland**	Lana Pađen DVM, PhD, assistant professor	Department of Physiology and Radiobiology 12-14h	(see the list of the required literature)
2/6/2021	**Thermoregulation and skin physiology**	Jasna Aladrović, DVM, PhD, associate	Department of Physiology and Radiobiology	(see the list of the required literature)

		professor	14-16h	

Timetable for SEMINARS academic year 2020./2021.

SEMINARS					
Date	**Methodological unit**	**Teacher**	**Group**	**Location / time**	**Literature**
4/3/2021	**Cardiovascular system** Cardiovascular receptors Cardiac muscle metabolism and cardiac work Heart failure Hemodynamic Lymph system	Ivona Žura Žaja DVM, PhD, assistant professor		Department of Physiology and Radiobiology 10-12h	(see the list of the required literature)
12/3/2021	**Circulatory system** Coronary circulation Pulmonary circulation Hepatic circulation Circulatory shock – physiological causes	Ivona Žura Žaja DVM, PhD, assistant professor		Department of Veterinary Pathology 10-12h	(see the list of the required literature)
16/3/2021	**Respiratory system** Coughing, sneezing Pulmonary ventilation Lung volumes Lung capacities	Ana Shek Vugrovečki, DVM, PhD, assistant professor		Department of Physiology and Radiobiology 10-12h	(see the list of the required literature)

	Respiration in fish Respiration in birds				
24/3/2021	**Stomach digestion** Stomach motility Digestion in fish Digestion in birds	Ana Shek Vugrovečki, DVM, PhD, assistant professor		Department of Physiology and Radiobiology 14-16h	(see the list of the required literature)
31/3/2021	**Forestomach digestion** Rumen contractions Reticulum contractions Omasum contractions Abomasum contractions Forestomach contraction regulatory mechanisms	Jasna Aladrović, DVM, PhD, associate professor		Department of Physiology and Radiobiology 12-14h	(see the list of the required literature)
12/4/2021	**Intestine digestion** Colon digestion	Lana Pađen DVM, PhD, assistant professor		Department of Physiology and Radiobiology 8-10h	(see the list of the required literature)
15/4/2021	**Urine** Renal acid-base regulation Bird excretion	Jasna Aladrović, DVM, PhD, associate professor		Department of Physiology and Radiobiology 14-16h	(see the list of the required literature)
6/5/2021	**Neonatal physiology** Blood cells Heart and blood vessels, Respiratory system thermoregulation	Jasna Aladrović, DVM, PhD, associate professor		Department of Veterinary Pathology 12-14h	(see the list of the required literature)
18/5/2021	**Lipid metabolism** Nutrient utilization in the postresorbtive state The role of fat in lipid	Ivona Žura Žaja DVM, PhD, assistant professor		Department of Physiology and Radiobiology 10-12h	(see the list of the required literature)

	metabolism Liner in lipid metabolism				
21/5/2021	**Vitamins metabolism** Fat-soluble vitamins metabolism **Mineral metabolism** Microelements as a coenzyme factor Minerals in cell metabolism	Ivona Žura Žaja DVM, PhD, assistant professor Ana Shek Vugrovečki, DVM, PhD, assistant professor		Department of Physiology and Radiobiology 12-14h	(see the list of the required literature)
25/5/2021	**Exercise physiology** Exercise effect on cardiovascular system Exercise effect on respiratory system Exercise effect on blood count Exercise effect on blood biochemistry	Ana Shek Vugrovečki, DVM, PhD, assistant professor		Department of Physiology and Radiobiology 11-13h	(see the list of the required literature)
27/5/2021	**Bioenergetics** Bioenergetics basic principles Energy turnover Feed gross energy Digestible energy Metabolic energy Basal metabolic energy ATP synthesis in metabolism Production systems efficiency Bio-calorimetry Respiratory Quotient	Ivona Žura Žaja DVM, PhD, assistant professor		Department of Physiology and Radiobiology 8-10h	(see the list of the required literature)

	and its interpretation				
1/6/2021	**The physiology of aging, oxidants and the antioxidant system** Internal and external factors affecting aging Genotypic and phenotypic factors of aging **Influence** of hormones and free radicals on aging Physiological conditions in which free radicals are generated Mechanism of action of free radicals Antioxidant protection system Oxidative stress	Ivona Žura Žaja DVM, PhD, assistant professor		Department of Veterinary Pathology 14-15h	(see the list of the required literature)

Timetable for EXCERCISES (PRACTICALS) academic year 2020/2021

EXCERCISES/PRACTICALS						
Date	**Methodological unit**	**Leader**	**Type of exercises** (čl. 34 Pravilnika o integriranom studiju)	**Group**	**Location / time**	**Literature**
01/3/2021	Physiology of the cardiovascular system Cardiac automatism and rhythmicity. Compare the length of the period of relative refractory period of the heart muscle and skeletal muscle - it is not possible to tetanize	Teachers and associates	Construction exercise – computer simulations		Department of Pathophysiology, computer hall 12-16h	(see the list of the required literature)

	the heart muscle. Extrasystole Blood flow, cardiac cycle, end diastolic volume, end systolic volume, stroke volume, and minute volume. The effect of blood pressure on blood flow. Peripheral resistance and factors affecting peripheral resistance. Differences between individual tissues with respect to blood requirements.					
11/3/2021	**ECG** Depolarization and repolarization Three standard ECG leads Interpretation of electrocardiograms **The Einthoven Triangle Bipolar ECG recording**	Teachers and associates	Exercise in practicum		practical hall, Department of Physiology and radiobiology 12-16h	(see the list of the required literature)
17/3/2021	**Blood pressure measurement Blood vessels and blood pressure - computer simulations** blood pressure Measurement by auscultation method. Influence	Teachers and associates	Exercise in practicum		practical hall, Department of Physiology and radiobiology 12-16h	(see the list of the required literature)

	of temperature on pulse and arterial blood pressure. Influence of body position on pulse and arterial blood pressure.					
23/3/2021	**Spirometry** Explain terms: breathing, exhale, inhale, maximal exhale Pulmonary volume Pulmonary capacity Tidal volume. Vital capacity Expiratory reserve volume, inspiratory reserve volume, residual volume, pneumothorax hyperventilation Variations in breathing and their effect- Biopac. Changes in respiratory rate after hyperventilation and hypoventilation, measurement of breath holding time after calm breathing, rapid breathing, and physical activity. The role of the respiratory system in the regulation of acid-base balance. Observation and auscultation of the chest in dogs.	Teachers and associates	Construction exercise		practical hall, Department of Physiology and radiobiology 1418h	(see the list of the required literature)
6/4/2021	**Oral digestion**	Teachers and	Laboratory		practical hall,	(see the list of the

	Dog - teeth, carnivorous eating Salivary amylase Effects of external factors on salivary amylase activity Salivary amylase activity by Wohlgemuth. Student presentations: food intake in animals, calculus on pet teeth, lagomorph teeth and rodents.	associates	exercise		Department of Physiology and radiobiology 12-16h	required literature)
8/4/2021	**Frequency and quality of rumen contractions** Observation of rumination, auscultation of content-mixing and contractions for the removal of gases from the pre-stomach. Taking food by ruminants, observing defecation and urination in ruminants.	Teachers and associates	Construction exercise		Department of Physiology and radiobiology+stables of Clinic for obstetrics and reproduction 12-16h	(see the list of the required literature)
14/4/2021	**Digestion in ruminants** Evidence of nitrite degradation Proof of urea Proof of lactic acid Digestion of milk The formation of gas in the rumen Observation of microorganisms in	Teachers and associates	Laboratory exercise		practical hall, Department of Physiology and radiobiology 12-16h	(see the list of the required literature)

	rumen content					
26/4/2021	**Stomach and intestine digestion** Gastric juice: effect of pepsin, influence of external factors on pepsin, titration of gastric juice Pancreatic juice: action of pancreatic lipase Bile: evidence of bile salts and bile colors	Teachers and associates	Laboratory exercise		practical hall, Department of Physiology and radiobiology 10-14h	(see the list of the required literature)
07/05/2021	**Urine Physical analysis** Urine sediment analysis **Chemical analysis of urine** sugars proteins bile colours bile acids blood pigment ketones indican	Teachers and associates	Laboratory exercise		practical hall, Department of Physiology and radiobiology 12-16h	(see the list of the required literature)
11/5/2021	**The physiology of excretion** To study the factors that affect glomerular filtration. The concept of maximum carrier transport - glucose. Effect of aldosterone and ADH on renal function. Urine concentration. Kidney function in acid-base balance.	Teachers and associates	Construction exercise		Department of Pathophysiology, computer hall 12-16h	(see the list of the required literature)

17/5/2021	**Serum carbohydrates and protein analysis** Serum glucose determination Total protein and albumin determination Serum protein electrophoresis	Teachers and associates	Laboratory exercise		Department of Physiology and radiobiology 12-16h	(see the list of the required literature)
20/5/2021	**Serum lipids determination** **Hepatic enzymes** AST, ALT and GGT determination Total bilirubin determination	Teachers and associates	Laboratory exercise		practical hall, Department of Physiology and radiobiology 12-16h	(see the list of the required literature)
24/5/2021	**Exercise physiology** Energy metabolism during exercise Hormonal regulation during exercise Neuromuscular system during exercise Astrand's test Blood lactate concentration determination Anaerobic threshold	Teachers and associates	Laboratory exercise		Department of Physiology and radiobiology 8-12h	(see the list of the required literature)
28/5/2021	**Reproduction physiology** Gonad activity hormonal regulation puberty, reproduction physiology in male and female, gravidity	Teachers and associates	Laboratory exercise		practical hall, Department of Physiology and radiobiology 12-16h	(see the list of the required literature)
31/5/2021	**Behaviour physiology** Hormonal effect in	Teachers and associates	Laboratory exercise		practical hall, Department of	(see the list of the required literature)

	feeding behaviour, sexual and maternal behaviour, learning and memory. **Student's presentations**				Physiology and radiobiology 10-14h	

About possible course syllabus' amendments the students will be informed in time.

STUDENT RESPONSABILITIES

Attendance at lectures	During semester a student must attend 23 lecture lessons in order to gain minimal 3 points. The maximum number of points from this evaluation element is 6.
Attendance at seminars	During the course the student must be present at 18 seminar lessons to achieve a minimum of 4 points. The maximum score of this evaluation element is 6 points. If the student, upon the completion of the course, makes up for nonattendance (excused and approved) of the missed seminar from the first try, he gains points which are added to the previously gained points. If the student makes up for the unattended seminars in further tries the points are not added.
Attendance at exercises	During semester a student must attend 12 from 17 exercise lessons in order to gain minimal 4 points. The maximum number of points from this evaluation element is 6. If the student, upon the completion of the course, makes up for nonattendance (excused and approved) of the missed exercise (excused and approved), points are added to the gained ones. If the student makes up for the unattended exercise in further tries, the points do not count.
Active participation in seminars and exercises	During the 60 hours of the exercises classes, the student must complete the assigned tasks for which he / she is given the signature of the teacher (associate). A student can earn up to 2 points per seminar, and a total of 4 points for producing and successfully presenting a seminar paper. For six positive answers (three oral and three written) the student earns an additional 6 points. During the course of seminars and exercises, the student must achieve at least 5 points and a maximum of 10 points.

Final exam	The final exam starts with a student's short analysis of results gained from the first four evaluation elements. At the final exam the student answers the questions in oral form. The final exam comprises the material from lessons and it estimates the capability of a student to connect physiological processes. The maximum gained number of points at the final exam is 40 points. Regardless the gained number of points from the first four evaluation elements, the student must show minimal knowledge at the final exam in order to earn minimal 24 points. If the student did not satisfy the final part of the exam, he/she can retake the final exam in previously determined terms.
Conditions for obtaining signatures	Student obligations are defined with the Regulations on the integrated undergraduate and graduate study of veterinary medicine. Given the above, the student must acquire a minimum number of points from all elements of assessment in order to pass the course. **Article 45:** student can reasonably be absent from teaching activities, as follows: up to 50 % of the lectures; up to 30% of the seminars and 30 % of the exercises.

GRADING AND EVALUATING STUDENT WORK

Continuous knowledge checking (colloquia)	During the course of the Physiology of Domestic Animals II, two assessment of knowledge (colloquia) will be organized. The first colloquium includes cardiovascular and respiratory physiology and the second examination involves the digestion end excretory physiology. At each colloquium, the student must achieve at least 10 points to achieve the required 20 points. The maximum number of points scored from this grading element is 32 points. A student who does not achieve the necessary points during the course of instruction is entitled to three times access to a correctional colloquium that will be organized in certain terms. **The terms of the colloquium from the Physiology of Domestic Animals II in the academic year 2020/2021.** **Cardiovascular and respiratory systems physiology (April 15th 2021) at 13h** **Digestive and excretory systems physiology (May 25th 2021) at 13h** **The terms of repeated colloquium from the Physiology of Domestic Animals I during the winter semester and the winter exam period of the academic year 2020/2021 will be held according to the following schedule:**

	June 9th 2021 at 11 am **June 23th 2021 at 12 am** **September 8th 2021 at 12 am**
Final exams (dates)	**June 15th 2021; June 29th 2021; July 9th 2021; 31st August 2021; September 14th 2021; September 23rd 2021**
Form of final exam	oral exam

LITERATURE

Obligatory literature	1. Sjaastad Ø. V., O. Sand, K. Hove: Physiology of Domestic Animals. The 12th ed. Scandinavian veterinary press, 2010. 2. Cunningham, J. G.: Textbook of veterinary physiology. 3rd edition, W. B. Saunders Company, 2002. 3. Dukes' physiology of domestic animals (William O. Reece, Ed.). The 12th ed. Cornell University Press. Ithaca and London, 2004. 4. Vander, A. J., J. H. Sherman, D. S. Luciano: Human physiology. The mechanisms of body function. The 5th ed. McGrow-Hill Publishing Comp. New York, 1990.
Supplementary literature	1. Feldman, B. F., J. G. Zinkl, N. C. Jain: Schalm´s Veterinary Hematology. 5th ed. Lippincott Williams & Wilkins, 2000. 2. Kaneko, J. J., J. W. Harvey, M. L. Bruss: Clinical Biochemistry of Domestic Animals. Academic Press. San Diego, Boston, New York, Sydney, Tokyo, 1987. 3. Payne, J. M., S. Payne: The Metabolic Profile Test. Oxford University Press. Oxford, New York, Tokyo, 1987. 4. Schmidt-Nielsen, K.: Animal Physiology. Adaptation and Environment. Cambridge University Press, 1997.

OBJECTIVES AND LEARNING OUTCOMES

Course objectives	Course of Physiology of domestic animals II qualifies students for progressive development of knowledge from physics, chemistry, biochemistry, histology and anatomy and understanding of basic principles and facts of physiological processes from cell to the total body, understanding and correlating of regulatory mechanisms, understanding of homeostasis keeping, acid-base

	balance, development of knowledge and skills related to body liquids in special regard of blood physiology, understanding of physiological function of muscle/nervous system, physiological function of hormones in context of the whole homeostatic system. The goal is to provide the progressive development of skills in collecting, preparing, and interpreting the results of the different sample analysis, to provide modern trends in veterinary physiology so that students will achieve a working knowledge of physiology; development of abilities for interpretation, and conclusion about information; the abilities of searching for information in the literature.
Learning outcomes	After successfully mastering the course students will be able to: - describe the basic principles and the facts of the physiological processes from the cell to the whole organism in ruminant , non ruminant species and poultry - explain the physiological functions of the body systems - explain the physiological functions of rumen and the other forestomachs - recognize the importance of maintaining continuous function of heart, lungs guts, kidneys, skin, and reproductive organs - connect the regulatory mechanisms throughout body - use the skills of obtaining and analyzing urine, plasma, serum, rumen content - to evaluate whether the obtained values are within physiological limits for certain species of domestic animals, and - to conclude how tests can indicate certain pathological changes or certain disease Stages -explain egg laying -explain lactogenesis

GRADING OF STUDENT WORK

Points	*Grade*
Up to 59	1 (F)
60-68	2 (E)

69-76	2 (D)
77-84	3 (C)
85-92	4 (B)
93-100	5 (A)

Head teacher:

Ana Shek Vugrovečki

Head of Department/Clinic:

Marinko Vilić

Note: The head teacher is required to submit a Course Syllabus to all teachers and associates on the Course.