PHYSICS

Study program	Veterinary Medicine
Year of study	I
Semester	I
Regime of discipline	DOB
Category of discipline	DF
Number of lectures hours per week	2
Number of seminar/laboratory/project hours per week	2
Total number of hours according to the curriculum: lectures/seminars/laboratory/project	28/28
Number of transferable credits	5

SPECIFIC SKILLS

Professional Competence	C_1 Working with notions, theories, principles, specific laws to physics necessary to explain the physiological mechanisms in animals. Using specific investigation methods biophysics, explaining appropriate physiological and pathological mechanisms of disease production and animal health evaluation. C_2 Conducting investigations on microscopic and macroscopic physical parameters used as indicators of animal health C_3 Explaining the biophysical mechanisms of action of veterinary medicinal products on physical parameters C_4 Appropriate use of specific scientific principles and research methodologies applied to physics biomedical sciences

LEARNING OUTCOMES

Knowledge	The student describes the complexity of the properties, structure, chemical composition, molecular organization of the macroscopic and microscopic structure, of the cell, tissues, systems and apparatuses of the animal body and their functioning and statistically interprets medical data.	
Skills	The student applies physicochemical principles and methods to determine chemical and biochemical substances and to assess the health status of living organisms.	
Responsibility and autonomy	The student applies, analyzes and adapts physical methods that allow the implementation and formation of complex concepts regarding biological systems. The student explains, experiments, analyzes and applies fundamental notions of physics in the veterinary medical field.	

COURSE OBJECTIVES

General objective of the course	• The study of physical phenomena involved in the functioning of biological systems at the various levels in interrelated biochemical processes, biological and physiological applications necessary for the understanding of medical practice from the laboratory to the clinic.
Specific objectives	The students will be able: • to communicate information conveyed in the discipline using scientific terminology. • to use the concepts, theories, principles, specific laws to explain the physical processes underlying physiological mechanisms explaining animals • to explain the influence of the ambient physical parameters used in explaining the operation of bio-systems • to select specific work methods and equipment necessary to conduct clinical investigations • to apply techniques and working methods with applications in biophysics clinical investigations • to evaluate physics laboratory determinations made by comparing measured parameter values with values in physiological ranges.

COURSE CONTENT

LECTURES	Number of hours
Introductive Physical Notions. Object and division of Biophysics on national and international level. Atomic physics notions	**2**
Biological Thermodynamics Thermodynamics principles. Energetic balance of the organism. Second principle of thermodynamics applying to the biological systems. Thermodynamic potential. Irreversibility of the biological processes. Stationary states and coupled processes in the biological systems.	**2**
Bioenergetics notions Energy sources for the biological systems. Radiant energy stocking as chemical energy in the photosynthesizing cells. Oxido-reduction phenomena. Rh and its biological significance. Mechanisms of release, conversion and use of the energy at cellular level. Chemiosmosis theory of coupling.	**2**
Molecular Physical Elements Live matter organization at the molecular level. Matter aggregation states. Gaseous state. Gases mixture. Gases solving in liquids. Liquid state. The continuity equation.	**2**
Bernoulli's law. Viscosity. Blood viscosity. Real liquids flow. Blood pressure and rate in sanguine vessels. Solid state. Solid corps deformations. Elasticity's role in Medicine, Animal Sciences and Biology.	**2**
Surface molecular phenomena. Superficial tension. Laplace law. Capillarity phenomena.	**2**
Transport phenomena in liquids. Diffusion. Osmosis. Osmotic pressure's law. Osmotic behavior of live cells. Osmotic pressure of biological liquids.	**2**
Water. Structure and physical properties of water. Water role in the living matter organization. Water role in the thermoregulation process.	**2**
Cell Physics Notions Physical properties of cells. Living membranes. Role and chemical composition of cell's membranes. Cell's membrane permeability. Passive transport. Active transport through the membranes.	**2**
Bioelectrogenesis Electric activity of the cell. Donnan potentials. Rest potential of the cell Action potential. Biophysical mechanisms of synaptic transmission.	**2**
Biocybernetics Notions Elements of information theory. Information's transmission. Automatic regulation systems. Reverse connection.	**2**
Physical Factors Action on Organisms Mechanical factors 'action. Acoustical factors' action. Ultrasounds. Physical and biological effects of ultrasounds. Ultrasounds diagnosis. Biological action of the electric current. Temperature's influence on biological systems. Magnetic and electromagnetic filds'action. Radiations'action: non-ionizing and ionizing radiations on biological systems.	**4**
Physics Applications in Medicine Methods for detection of the ionizing radiations. Scintigraphy. LASER phenomena and applications in medicine. Echography. Doppler effect. Fluorescence spectra and Raman spectra. Methods of magnetic resonance. Tomodensitometry.	**2**
SEMINAR/LABORATORY	Number of hours
Determining some physical constants (superficial tension, viscosity, density)	8
Optical measurements: Refractometry: determining the refraction index and serum protein content establishment; Polarimetry: determining the concentration of some optically active liquids, by determining the rotation angle of the polarized light's plan; Spectroscopy: analysis of hemoglobin and its compounds spectrum; Microscopy: determining the mean diameter of erythrocytes; Colorimetry: determining the specific heat of some solutions with the photocolorimeter;	12
Membrane permeability: erythrocyte osmotic resistance; hemolysis in iso-osmotic solutions;	4
Heat and biologic thermodynamics determinations: Calorimetry – determining the specific heat of a body through calorimetric methods;	2
Radiations and radiology – determining the absorption coefficient of β radiations in the air.	2

BIBLIOGRAPHY:

- Physical Biology of the Cell by Rob Phillips, Jane Kondev, Julie Theriot and Hernan Garcia, 2012
- Biophysics: Searching for Principles by William Bialek , 2012
- Biophysics by Roland Glaser, Berlin, New York: Springer, 2010
- Biophysics by V. Pattabhi, N. Gautham, Boston, London: Kluwer Academic/Narosa, 2002.
- Textbook of biophysics, A. Neagu, M. Neagu, G.I. Mihalas, Eurobit Timisoara, 2005

ASSESSMENT

Activity type	Assessment criteria	Assessment methods	Percentage of final grade
Lectures	Knowledge of concepts, principles, laws of physics used to explain the biophysical processes The argumentation of the answer, the coherence of the explanations, the use of the scientific language, the interdisciplinary integration of the knowledge.	Summative evaluation Exam -oral	60%
Seminar/laboratory/clinical sessions	Description of the specific methodology applied in biophysics laboratory The correct application of the laboratory techniques, interpretation of results.	Periodical assessment - knowledge based tests Summative assessment - practical exam	20% 20%
Other activities			

Course coordinator: S. Lect. PhD. Petcu Mihaela
Practical activities coordinator L/S/P: S. Lect. PhD. Petcu Mihaela