

Course Title	Physiology I				
Course Code	VET-103				
Course Type	Required				
Level	Undergraduate				
Year / Semester	Year 1/ Semester 1 (Fall)				
Teacher's Name	Course Lead: Dr Nikolas Perentos Contributors: Dr Andreas Monoyios				
ECTS	6	Lectures/ week	5 hours	Practical/ semester	8 hours
Course Purpose and Objectives	<p>The main objectives of the course are:</p> <ul style="list-style-type: none"> • To teach students about the form and function of animals and their bodily processes. • To introduce students to Physiology - the scientific investigation of animals' biological systems, along with how these systems operate. • To familiarize students with the anatomy and physiology of animals in order to diagnose and treat disease and dysfunctions. • To explain the students how organs, tissues, and other bodily structures work. 				
Learning Outcomes	<p>The body systems to be covered are: 1) Homeostatic Control Systems, 2) Neurophysiology, 3) Sensory Organs, 4) Muscle Physiology, 5) Cardiovascular system, 6) Haematopoietic system, 7) Respiratory system</p> <p>The following list provides the learning objectives (LOBs) that will be covered in the lectures and practical of each week:</p> <p>Week 1 Introduction to Physiology & Homeostasis (5 hours)</p> <p>LOBs covered during lectures:</p> <ol style="list-style-type: none"> 1. Define the subject of Physiology. 2. Describe the different levels of body organization: atoms and molecules, cellular level, organisms, tissues, organs and body systems 3. Distinguish between the basic and specialized functions 4. List the four primary types of tissue and provide examples of each 5. Identify the special abilities of cells that are part of each tissue 6. Distinguish between endocrine and exocrine glands 7. Define the concept of homeostasis. 8. Distinguish between the external environment, internal environment, intracellular fluid, extracellular fluid, plasma, and interstitial fluid. 				



9. List homeostatically regulated factors and recognise the importance of maintaining those factors stable
10. Define homeostatic control systems
11. Distinguish between Local and Systemic Homeostatic Control Systems
12. Explain how negative feedback is used to maintain homeostasis
13. Explore a common example of positive feedback
14. Identify the thermoregulation mechanisms in different animal species under heat stress and cold stress

Week 2 Neurophysiology & Sensory Organs (5 hours)

LOBs covered during lectures:

15. Describe the overall organization of the CNS.
16. Describe the 3 functional classes of neurons.
17. Describe the properties of neurons, glial cells and astrocytes.
18. Describe the structure and function of the meninges –dura, arachnoid, pia matter.
19. List the functions of the cerebrospinal fluid and describe its production, flow and removal in the brain and spinal cord.
20. Describe the blood–brain barrier and its function.
21. Give an account of neurogenesis.
22. Describe the gross anatomy of the brain and its components.
23. Outline the concept of excitable cells and the terms depolarization, hyperpolarization and repolarization.
24. Outline the generation, spread, characteristics and function of graded potentials.
25. Outline the generation, propagation, characteristics and function of action potentials.
26. Outline the type of connections within the nervous system.
27. Describe the functional anatomy of a synapse.
28. Outline the events occurring at a synapse.
29. Outline the role of neurotransmitters.
30. Outline the generation of postsynaptic potentials and differentiate between EPSPs and IPSPs.
31. Outline the principles and importance of neuronal integration including temporal and spatial summation.
32. Describe presynaptic inhibition/facilitation.
33. Describe neuromodulators and outline their roles.
34. Describe the action of drugs on a synapse.

Week 3 Neurophysiology & Sensory Organs (5 hours)

LOBs covered during lectures:

35. Give an account of the function of the cerebral cortex and its functional divisions.
36. Describe the function of the primary motor cortex and its control of muscles and the sensory and motor homunculus.
37. Describe the concept of plasticity of the brain.
38. Describe the role of basal nuclei in relaying sensory signals and motor control.



39. Outline the role of the hypothalamus.
40. List the neurotransmitters and describe their role in pathways behaviour.
41. Describe the role of the limbic system in learning and memory.
42. Outline the role of the cerebellum in balance, planning and executing voluntary movement.
43. Outline the normal effects of the cerebellum on descending motor systems.
44. Revise the role of the basal ganglia in the control of posture, movement, and locomotion.
45. Describe the role of the brain stem (medulla, pons, midbrain) in linking the spinal cord to higher brain regions.
46. Describe the role of the reticular activating system.
47. Describe the sleep -wake cycle and its components.
48. Describe the method of electroencephalography, sensory evoked potentials and their main uses.

Week 4 Neurophysiology & Sensory Organs (5 hours)

LOBs covered during lectures:

49. Describe the basic anatomy of the Spinal Cord, grey and white matter, dorsal and ventral horns.
50. Describe the ascending and descending pathways in the white matter of the spinal cord.
51. Describe the role of the spinal cord in integrating reflexes and the reflex arc.
52. Give an account of the categories of reflexes, revise balance.
53. Describe Motor neurons as the final common pathway.
54. Describe the concept of receptor differential sensitivities to various stimuli.
55. List receptors according to their adequate stimulus.
56. Describe the mechanism of graded and action potential generation by receptors.
57. Describe the four features of a stimulus
58. Outline the process of perception.
59. Describe the characteristics and categories of pain receptors.
60. Outline the role of endorphins as the brain's innate analgesic system.

Week 5 Neurophysiology & Sensory Organs (5 hours)

LOBs covered during lectures:

61. Describe protective mechanisms that prevent eye injuries, eyelids, tears.
62. Describe the basic anatomy and constituents of the eye and their function.
63. Outline the function of the iris in controlling light entering, the lens in refraction and accommodation.
64. Describe the different layers of the retina and their properties and photo-transduction.
65. Discuss photoreceptor activity in the light and dark.
66. Describe the function of rods and cones and visual acuity.



67. Describe the process of colour vision and the variation between different species.
68. Describe the processing of visual information and its transmission to the primary visual cortex.
69. Describe the transfer of visual input to other areas of the brain concerned with alertness, external eye muscles and diurnal rhythm.
70. Outline the anatomy and explain the role of the external, middle and inner ear in locating transmitting and amplifying sound.
71. Explain the generation of sound waves and the meaning of pitch, tone, intensity (loudness), quality of sound (timbre) and hearing threshold.
72. Explain the conversion of tympanic membrane vibrations into fluid movements in the inner ear and the function of the cochlea.
73. Explain the transduction of fluid movements into neural signals by the organ of Corti.
74. Describe the role of the CNS in pitch discrimination, loudness and timbre.
75. Describe the structure and role of the vestibular apparatus and its components, the semi-circular canals and the otolith organs.
76. Describe the mechanisms of detection of head position and motion by the vestibular apparatus.
77. Outline the mechanisms of motion sickness and vertigo.

Practical session (2 hours): Simulation exercise on Neurophysiology concepts using PhysioEX 10 simulation software

Week 6 Neurophysiology & Sensory Organs (5 hours)

LOBs covered during lectures:

78. Describe the location and mechanisms of taste receptors in tongue taste buds and the further transfer and processing of taste signals in the gustatory pathway.
79. Describe olfactory receptors in the nose, the mechanism of detection of smell, and the processing in the olfactory bulb.
80. Describe the transfer and processing of smell signals in the olfactory system.
81. Outline the role of the vomeronasal organ in detecting pheromones.
82. Distinguish the autonomic and somatic nervous systems.
83. Describe the autonomic two-neuron chain and the CNS origins of the sympathetic and parasympathetic nervous systems.
84. Distinguish transmitters in the sympathetic and parasympathetic postganglionic fibers.
85. Recognize the dual innervation by para and sympathetic systems in most organs.

86. Describe the concept of sympathetic/parasympathetic tone and dominance by the sympathetic or parasympathetic systems.
87. Recognize the adrenal medulla as a modified part of the sympathetic nervous system.
88. Give an account of receptor types for each autonomic neurotransmitter (cholinergic and adrenergic) and the role of autonomic agonists and antagonists.
89. Describe the role of the CNS in the control of autonomic reflexes and activities e.g., urination, defecation

Week 7 Muscle Physiology (5 hours)

LOBs covered during lectures:

90. Introduction to Muscle physiology
91. List the 3 main types of muscle in the body: skeletal, smooth, cardiac
92. Describe the main microscopic characteristics, functions and clinical importance of skeletal muscle
93. Describe the main microscopic characteristics, functions and clinical importance of Cardiac muscle
94. Describe the main microscopic characteristics, functions and clinical importance of Smooth muscle
95. Distinguish between the three different types of skeletal muscle fibers: red, white and intermediate
96. Describe the connective tissue elements of skeletal muscle: epimysium, perimysium and endomysium
97. Describe the division of muscles into smaller components down to myofibrils
98. Describe the structure of myofibrils and their sarcomeres
99. Identify the protein molecules that are part of the sarcomere
100. Identify the events that take place at the level of the neuromuscular junction leading to muscle contraction
101. Describe the molecular basis of Muscle contraction: filament sliding and power stroke
102. Differentiate between Slow- and fast contracting muscle fibers
103. Define muscle plasticity
104. Define the types of whole muscle contraction: isometric and isotonic
105. Describe motor units and motor neuron pool
106. Define the mechanics of skeletal muscle contraction

Practical session (2 hours): Simulation exercise on Skeletal Muscle Physiology functions using PhysioEX 10 simulation software

Week 8 STUDY WEEK

STUDY WEEK



Week 9 Cardiovascular System, Blood (5 hours)

LOBs covered during lectures:

107. Define blood as a tissue
108. Identify the primary functions of blood, its fluid and cellular components and its physical characteristics
109. Identify the most important proteins and other solutes present in the blood plasma
110. Describe Haematocrit as a test
111. Estimate the mean plasma percentage and packed cell volume (PCV) in humans and animal species
112. Describe the formation of the formed element components of blood
113. Classify and characterized white blood cells
114. Describe the structure of platelets and explain the process of haemostasis
115. Explain the significance of AB and Rh blood groups in blood transfusions
116. Discuss complications following incompatible blood transfusions
117. Identify blood groups in various animal species
118. Discuss blood donation in dogs

Week 10 Cardiovascular System, Blood (5 hours)

LOBs covered during lectures:

119. Overview of the Cardiovascular system,
120. Describe the properties of cardiac muscle fibers.
121. Compare the cardiac muscle to skeletal and smooth muscle
122. Define the basic properties of the heart and vasculature
123. Relate the structure of the heart to its function as a pump
124. Identify and describe the components of the conducting system that distributes electrical impulses through the heart
125. Relate characteristics of an electrocardiogram to events in the cardiac cycle
126. Describe the relationship between blood pressure and blood flow
127. Summarize the events of the cardiac cycle
128. Compare atrial and Ventricular systole and diastole
129. Relate heart sound detected by the auscultation to the action of the heart's valves
130. Relate heart rate to cardiac output
131. Describe the effect of exercise on heart rate
132. Identify cardiovascular centres and cardiac reflexes that regulate heart function
133. Describe factors affecting heart rate
134. Distinguish between positive and negative factors that affect heart contractility
135. Summarize factors affecting stroke volume and cardiac output
136. Describe the cardiac response to variations in blood flow and pressure



Week 11 Cardiovascular System, Blood (5 hours)

LOBs covered during lectures:

137. Distinguish between systolic pressure, diastolic pressure, pulse pressure, and mean arterial pressure
138. Describe the clinical measurement of pulse and blood pressure
139. Identify and discuss five variables affecting arterial blood flow and blood pressure
140. Discuss several factors affecting blood flow in the venous system
141. Identify the primary mechanisms of capillary exchange
142. Distinguish between capillary hydrostatic pressure and blood colloid osmotic pressure, explaining the contribution of each to net filtration pressure
143. Compare filtration and reabsorption
144. Explain the fate of fluid that is not reabsorbed from the tissues into the vascular capillaries
145. Discuss the mechanisms involved in the neural regulation of vascular homeostasis
146. Describe the contribution of a variety of hormones to the renal regulation of blood pressure
147. Identify the effects of exercise on vascular homeostasis
148. Discuss how hypertension, haemorrhage, and circulatory shock affect vascular health

Practical session (2 hours): Simulation exercise on Cardiovascular system using PhysioEX 10 simulation software

Week 12 Respiratory System (5 hours)

LOBs covered during lectures:

149. Describe how the respiratory system processes oxygen and CO₂
150. Compare and contrast the functions of upper respiratory tract with the lower respiratory tract
151. Describe the overall function of the lung
152. Summarize the blood flow pattern associated with the lungs
153. Describe the mechanisms that drive breathing
154. Discuss how pressure, volume, and resistance are related
155. List the steps involved in pulmonary ventilation
156. Discuss the physical factors related to breathing
157. Discuss the meaning of respiratory volume and capacities
158. Define respiratory rate
159. Outline the mechanisms behind the control of breathing
160. Discuss factors that can influence the respiratory rate
161. Compare the composition of atmospheric air and alveolar air
162. Describe the mechanisms that drive gas exchange



	<p><u>Practical session (2 hours): Simulation exercise on Respiratory system using PhysioEX 10 simulation software</u></p> <p>Week 13 (2 hours)</p> <p>Revision</p>		
Prerequisites	None	Required	None
Course Content	<p>Topics covered in lectures:</p> <p><u>INTRODUCTION TO PHYSIOLOGY & HOMEOSTASIS:</u></p> <ul style="list-style-type: none"> - The subject of Physiology - The concept of Homeostasis - Homeostatic Control Systems - Thermoregulation <p><u>-NEUROPHYSIOLOGY & SENSORY ORGANS:</u></p> <ul style="list-style-type: none"> -Organization and cells of the CNS -Overview of the CNS & Protection of the brain - Cerebral -Basal Nuclei, Thalamus, Hypothalamus and the Limbic System -The Cerebellum, Brain stem and spinal cord -Spinal cord, reflexes -Age related changes, degeneration and musculoskeletal conditioning -Receptor Physiology -Pain Perception -The Eye – Vision -The Ear- Hearing -The Inner Ear - Equilibrium (Balance) -Chemical senses (Taste and Smell) -Efferent Division the Autonomic Nervous System Sympathetic and Parasympathetic Nervous Systems -Comparison of the Autonomic and Somatic Nervous Systems and Review of Autonomic Nervous System <p><u>MUSCLE PHYSIOLOGY:</u></p> <ul style="list-style-type: none"> -Muscle types -Skeletal Muscle microstructure 		

	<p>-The molecular basis of contraction</p> <p>-slow and fast contracting muscle fibers</p> <p>-Muscle plasticity</p> <p>-Mechanics of muscle contraction</p> <p><u>CARDIOVASCULAR SYSTEM:</u></p> <p>- Cardiac physiology and anatomy- the heart as a pump.</p> <p>- Mechanical events in cardiac cycle, pressure changes and heart sounds.</p> <p>- Concept of preload and afterload.</p> <p>- The ECG, coronary blood flow, atherosclerosis. - Circulation, blood vessels, physics of blood flow. - Blood pressure and its control.</p> <p>- More on Blood pressure control, postural changes, exercise, shock</p> <p>- Cardiovascular adaptation to exercise, cold, heat and shock.</p> <p><u>HAEMATOPOIETIC SYSTEM:</u></p> <p>- The blood, composition and function</p> <p>- Red blood cells, white blood cells, platelets & haemostasis</p> <p>- Plasma, serum</p> <p>- Blood groups</p> <p><u>RESPIRATORY SYSTEM:</u></p> <p>- Anatomy, Mechanics, Upper and Lower airways. - Pulmonary gas exchange.</p> <p>- Control of Respiration - Restrictive and obstructive disease. - Foetal lung, circulation, changes at birth.</p>				
Teaching Methodology	Lectures and laboratory work using a simulations software				
Bibliography	Authors	Title	Ed/Yr	Publisher	ISBN
	<u>Editor:</u> Reece, W.O. <u>Associate</u> <u>Editors:</u> Erickson, H. H., Goff, J.P., Uemura, E.E.	Dukes' Physiology of Domestic Animals,	13 th 2015	Wiley-Blackwell	9781118501399
	Klein., B. G.	Cunningham's Textbook of Veterinary Physiology	6 th 2019	Elsevier	9780323553605



	Zao, P., Stable, T., Smith, L., Lokuta, A., Griff, E.	PhysioEx 10.0: Laboratory Simulation s in Physiology	2 nd 2021	Pearson	97801364 47658
	Betts et al.,	Anatomy and Physiology	2 nd 2022	OpenSta xhttps:// opensta x.org.	978-1- 951693-42-8
	Reece,W. O., Rowe, E.W.	Functional Anatomy and Physiology of Domestic Animals	5 th 2017	Wiley- Blackwell	97811192 70843
	Lauralee Sherwood.	Human Physiology: From Cells to Systems	9 th 2016	Cengage Learning	978285866 932
	Sjaastad, Ø. V., Sand, O., Hove, K.	Physiolo gy of Domestic Animals	2 nd 2010	Scandin avian Veterin ary Press	97882917 43073
Assessment	Participation: 10% Course Assignment(s): 30% Final written exam: 60%				
Language	English				