Department of Animal Resources

College of Agriculture Engineering Sciences

University of Salahaddin-ERBI

Subject: Animal Physiology

Course Book – *YEAR 3* – 1st Semester

Theory Lecturer's name
Dr. Pakiza Hamera Wasman BSc, MSc, PhD (Lecturer)

Practical Lecturer's names

M. Delman Dler Maulood
M. Naz shwan

Academic Year: 2023/2024

Ministry of Higher Education and Scientific research

Course Book

1. Course name	**Animal Physiology**
2. Lecturer in charge	**Assist. Prof. Dr. Mahbuba Abdulghani Mustafa, Dr. Pakiza Hamera**
3. Department/ College	**Animal Resource/Agriculture**
4. Contact	**Pakiza.wasman@su.edu.krd** **Korek Mobil: 07504472821**
5. Time (in hours) per week	**Theory: 2 Practical: 3**
6. Office hours	**Saturday, Sunday, Monday, Tuesday & Wednesday (9.0 to 12 AM.)**
7. Course code	
8. Teacher's academic profile	**Dr.Pakiza HW BSc.,MSc.,PhD.**
9. Keywords	**Animals, physiology, body systems, endocrine**

10. Course overview:

Proper animal physiology is essential for the living & productivity of all animals and is the basis of successful productive and reproductive systems.

The term anatomy has come to refer to the science that deals with the form and structure of all organisms. Literally, the word means to cut apart; it was used by early anatomists when speaking of complete dissection of a cadaver. In contrast to anatomy, which deals primarily with structure, physiology is the study of the integrated functions of the body and the functions of all its parts (systems, organs, tissues, cells, and cell components), including biophysical and biochemical processes. When anatomy and physiology courses are taught separately, the approach to the laboratory portion of each course is considerably different. Study in a typical gross anatomy laboratory is based primarily on dissection of animal cadavers. These usually have been preserved by embalming, and one or more parts of the vascular system have been injected with a colored material to facilitate identification of the vessels. Careful dissection coupled with close observation gives the student a concept of the shape, texture, location, and relations of structures visible to the unaided eye that can be gained in no other way. Similarly, the use of the microscope with properly prepared tissue sections on slides is essential for understanding structures that are so small they cannot be seen without optical or electron microscopic assistance. In the physiology laboratory, the student studies the response of whole animals, isolated organs, or individual cells to changes in their environment (both internal and external). Changes may be induced by almost any agent or manipulation, for example, drugs, changes in temperature or altitude, surgical modifications (such as neutering), and changes in diet. Monitoring of the responses may be as simple as monitoring changes in body weight or as complex as measuring the electrical potential across the cell membrane of a single cell. Anatomists and physiologists working in research use some of the same techniques that are used in teaching laboratories but with considerable refinement. Both types of scientists use equipment and methods developed in the physical sciences, particularly chemistry and physics. The anatomist applies the principles of physics to the use of microscopes and applies knowledge of chemistry in the staining of various parts of cells and tissues. The combination of chemistry and microscopic anatomy is known as histochemistry. Although anatomy and physiology are commonly pursued as more or less independent disciplines, they are both facets of the study of the animal body. Conversely, it is impossible to gain a thorough understanding of function without a basic knowledge of structure.

11. Course objective (Theory):

1. Define general physiology, cell physiology, cell foundation, type of cells and how food transport in and out the cells.
2- Describe the nerve cell, the parts and the functions.
3- Describe the circulatory system, heart, blood.
5- Describe the digestive system and steps of digestion, also the parts of digestive system and their functions.
6- Endocrine and how hormones synthesis in the organs.

Course objective (Practical):

The aim of the course for this article is to try effort possible to students all that is needed in this field and the most important points to be learned from the beginning until the end of the course is:

- The most important actions that take place within the coefficient of animal physiology from the beginning of the internal and external environment.
- The most important actions performed on the body systems.
- Specifications of each organ.
- How to make the blood cells analysis.
- How to anatomization the most systems, the hormones and enzymes that effects.
- Teach students the process of breathing and thermoregulation mechanisms in animals.

12. Student's obligation

Students should attend the lectures (theory and practical) and participate in all quizzes during the course, also monthly examination and home work with reports required.

13. Forms of teaching

The forms of teaching include data show, power point, well labeled diagrams, graphs, flowcharts and tables have been incorporated systems also white board for explaining the subjects which needs more explanation.

14. Assessment scheme

Theoretical + Practical (100%)

40% = 15% Theoretical +25% Practical

60% = % Theoretical

Two monthly theoretical examination (10+10) marks plus 5 marks (Quizzes)

15. Student learning outcome:

During this semester the student should learn the reasons for studying physiology events of animals, and how each organ or system achieved their functions in different parts of the body, methods of blood determination and breakdown of feeds in the animal digestive system.

Also learn how body systems are classified according to stomach type of diet consumed, steps of digestion.

In addition, the importance and the role of hormones and enzymes in each part of animals body. Finally, the student will learn physiological events, anatomy, growth and reproduction of animals.

16. Course Reading List and References:

1. Anatomy and physiology of farm animal (Rowen D. Frandson, W. Lee Wilke and Anna Dee Fails 7th Edition , 2010)
2. Essential of Animal Physiology (S.C. Rastogi, 4th Edition, 2007)
3. Animal Physiology (Richard W. Hill, Gordon A. Wyse and Margaret Anderson, 3rd Edition 2012)
4. Hormonal regulation of farm animal growth (K.L. Hossner , 2005)
5. Text book of animal physiology (P.B.Reddy, 2015)

Magazines and Review (Internet)

- Journal of Animal Science
- International Journal of Animal Science
- Journal Animal Reproductive

* Endocrinology Journal

17. The Topics: Theory lectures	**Lecturer's name**
Lecture – 1: Introduction **Learning Objectives**	**Dr. PAKIZA** **(2 hrs.) 4/09/2023**

Lecture - 2- Physiology and Cell physiology definition and function. Prokaryotic and Eukaryotic cells Growth, How body tissues grow. Cell division or replication, DNA replication. Absorption, Excretion, Secretion, Irritability, Conductivity and Contractility.	**Dr. pakiza hamira wasman** **(2 hrs.) 11/09/2023**
Lecture - 3- The Cell Membrane is a Fluid Mosaic, How substances move across the Plasma Membrane, The differences between osmosis and diffusion. **Active processes**: Active transport Phagocytosis and pinocytosis Vesicular Transport : Endocytosis and Exocytosis	**Dr. Pakiza Hamira Wasman** **(2 hrs.) 18/09/2023**
Lecture – 4- Cellular physiology and homeostasis: The concept of homeostasis**.** The four different types of tissues in the animal's body that built for a specific function within the body. **Regulation :**It requires three interdependent components: a **receptor**, a **stimulus**, and an **effector**. Negative Feedback mechanism, The mechanism explained by diagram and examples. Positive Feedback mechanisms, The mechanism explained by diagram and examples. Factors effect on Homeostatic imbalance.	**Dr. PAKIZA** **(2 hrs.) 25/9/2023**
Lecture – 5- Body water and body fluids, Biology function of water and the importance of it. Compartmentalization of body water : **Extra cellular fluid (ECF)** : location, actions and important functions. **Intra cellular fluid (ICF)**: location, actions and important functions. Ionic Composition of Body Fluids: The values for the primary ionic constituents of the major fluid compartments. The three major compartments of body fluid differ from each other in their ionic composition.	**Dr. PAKIZA** **(2 hrs.) 2/10/2023**
Lecture – 6- Classification of various digestive systems: One variation between the gastrointestinal (GI) tracts of the common domestic animals is classified into groups based on their type of diet with many sub-groups: **Herbivores** – Animals that consume primarily **plant materials**. **Carnivores** - Animals that **eat other animals**. **Omnivores** - Animals that eat a **combination of plant and animal matter**. "Two " classifying animals based on their digestive physiology: Non- ruminant animals: Poultry: Non-ruminants Dogs and cats: Non-ruminant animals those are carnivorous. Horses and mules: Non-ruminant animals. Rabbits: Non-ruminant animals that is an herbivorous with a complex large intestine. **Ruminant animals:** Capable to consume and digest plant materials and classified as herbivorous. Include **cattle**, **sheep**, **goat**, **deer** and many **other wild species**. Treatment of food **Carbohydrates** like **cellulose**, **starch**, and **glycogen** need to be digested into **glucose** and other **monosaccharides;** **Proteins** need to be digested into **amino acids**. **Fats** or lipids need to be digested into **fatty acids** and **glycerol**. The Gut, the important parts The major functions of the gut.	**Dr. Pakiza Hamira waman (2 hrs.) 9/10/2023**

Stomach , Glands , **gastric juice**.	
Lecture – 7- Small Intestine : divided into 3 sections: the **duodenum**, **jejunum** and **ileum**. The duodenum receives 3 different secretions: 1) **Bile** from the liver. 2) **Pancreatic juice** from the pancreas. 3) **Intestinal juice** from glands in the intestinal wall. - **The Rumen stomach:** In ruminant herbivores like cows and sheep the stomach is highly modified to act as a "fermentation vat". It is divided into **four parts**. 1- **rumen**. 2-The **reticulum** 3-The **omasum**. 4-The **abomasum**. The function of the Rumen: Large Intestine : consists of the **caecum**, **colon** and **rectum**, the function of each part. Digestion mechanism: During digestion the large food molecules are broken down into smaller molecules by **enzymes**. The most important groups of enzymes secretions. - Glands secretions and functions: 1- Saliva secreted into the mouth from several pairs of salivary glands. Saliva consists mainly of water but contains salts, mucous and salivary amylase. The function of saliva 2- **Gastric juice** secreted into the stomach from glands in its walls. **Bile** produced by the liver. It is stored in the **gall bladder.** Pancreatic juice: secretions and functions. Intestinal juice: secretions and functions. Mechanism of absorption Liver : The liver is the largest single organ, situated in the abdominal cavity of the body. The most important functions of liver.	**Dr. Pakiza Hamira Wasman** **(2 hrs.) 16/10/2023**
Lecture – 8- - Nervous System: The nervous system is coordinates its voluntary and involuntary actions and transmits signals between different parts of its body. - The basic functions of the nervous system. The neuron : Neurons are cells that have been adapted to carry nerve impulses. A typical **neuron** has a cell body containing a nucleus, one or more filaments called **dendrites** which conduct nerve impulses towards the cell body, and one **long fiber** called an **axon** which carries the impulse away from it. - Neurons types: 1- Sensory neuron: 2- Motor neuron: 3- Relay neuron: The nervous system can be divided into two parts: 1- The central nervous system (CNS), which includes the brain and spinal cord,. 2- Peripheral nervous system (PNS), which consists of cranial nerves and spinal nerves going to and from somatic (body) structures. - A further distinction is the autonomic nervous system (ANS), which coordinates activity of visceral structures (smooth muscle, cardiac muscle and glands). The ANS has elements in both the central and peripheral nervous systems, and it features both sensory and motor components. * Properties of Nerve fiber: 1. Excitability: 2. All or None principle: 3. Differential permeability: 4. Conductivity: 5. Refractory period: 6. Summation. - Physiology of the Nerve Impulse The cell membrane and the electrogenic Na–K–ATPase, or Na–K, pump. Synaptic Transmission: Types of synapses: Chemical synapses: 2- Electrical synapses.	**Dr. Mahbuba AG. Mustafa** **(2 hrs.) 23/10/2023**

Lecture – Endocrine System Endocrinology is concerned with study of the biosynthesis, storage, chemistry, biochemical and physiological function of hormones and with the cells of the endocrine glands and tissues. • The consists Endocrine and secretion. - Properties of Hormones: - Chemical Nature of Hormones: Chemically hormones are divided into four categories. 1. Polypeptides: 2. Glycoproteins: 3. Amines: 4. Steroids: Types of hormones on the basis of function: It is of three types. 1- Local Hormones: Also known as para-hormones or tissue hormones. They are secreted at one place and work upon adjacent tissue. They reach by diffusion. Ex. Acetyl choline. 2- Synergistic hormones: When hormones work together. Ex: (FSH and LH), (Insulin and glucocorticoids). 3- Antagonistic Hormones: These hormones work against each other. For example Insulin decreases the sugar in the body while glucagon increases it.	**Dr. pakiza hamira wasman** **(2 hrs.) 30/10/2022**
Lecture – 10- Pituitary Gland : Also known as the hypophysis. It is composed of three lobes: anterior, intermediate, and posterior. In many animals, the intermediate lobe is indistinct. 1- **The anterior pituitary:** secrets Antidiuretic hormone (ADH, Oxytocin: The target tissue, principal actions and chemical nature of them.	**Dr. pakiza hamira wasman** **(2 hrs.) 6/11/2023**
Lecture – 11- 2-Anterior lobe of pituitary hormone Growth hormone (GH(,Adrenocorticotropic hormone (ACTH), Thyroid-stimulating hormone (TSH), Luteinizing hormone (LH), Follicle-stimulating hormone (FSH(,Prolactin (PRL(and Melanocyte-stimulating hormone (MSH(,The target tissue, principal actions and chemical nature of them. **Glands and Their Hormones** The target tissue of hormone each tissue, principal actions and chemical nature of them. **Thyroid gland** thyroxine (thyroid hormone(2-calcitonin Parathyroid glands parathyroid hormone Adrenal medulla epinephrine Adrenal cortex: 1-aldosterone 2- cortisol Pancreas: 1- Insulin 2- Glucagon Ovary estradiol and progesterone Testis testosterone Pineal gland melatonin	**Dr. pakiza hamira wasman** **(2 hrs.) 13/11/2023**
Lecture - 12- Animal's body temperature The body must be kept at a constant temperature, within a small range, in order for all of the systems to work properly. A change in the temperature of the body is a sign of ill health. The normal body temperature The body can only work properly at a certain temperature which is (37°C). This normal body temperature is different in different types of animals. The ways by which animals control the temperature of the body: 1- Hair, wool, walking, running, shivering and the burning of energy in feed keep the body warm. 2- Sweating, panting, wallowing in mud, and lying in the shade cool the body.	**Dr. PAKIZA** **(2 hrs.) 20/ 11/2023**

Measuring body temperature. The thermometer How to take the body temperature of animals Normal body temperatures The domestic and camel's body temperature	
Lecture – 13- **• The integumentary system** The integumentary system comprises the skin with its adnexal structures (e.g., hair and glands), horns, hoofs, claws, and other modifications of the epithelial covering of the body.. Specialized integumentary structures, such as hoofs and horns, likewise have homologous superficial epithelial and deep connective tissue components. **1- Skin: Epidermis**: The outer layer of skin, the epidermis, is an avascular stratified squamous epithelium that is nearly free of nerve endings. In most areas it can be divided into several histologic layers. **Dermis** **2- Hair**: Hair is a defining characteristic of mammals. There are three main types of hair on domestic mammals: (1) Guard hairs, which form the smooth outer coat; (2) Wool hairs, also called the undercoat, which are fi ne and often curly. (3) Tactile hairs, long stiff hairs with specialized innervation that renders them effective as organs of touch. 3- **Wool:** Wool hairs lack a medulla or have only a very small one, accounting for their fine, the Angora goat is called mohair.	**Dr. PAKIZA** **2 hrs. 27/ 11/ 2023**
Lecture – 14- • The integumentary system **4- Glands :Sebaceous glands** are oily secretory product, sebum, is produced by disintegration of epithelial cells within the glands. **5- Modified Epidermis :**Modifications of the epidermis give rise to organs such as **hoofs** and **horns. A- Hooves :** Hoofed animals are ungulates (L. unguis, nail), and most common farm mammals fall in this category. **B- Horns:** Horns of cattle and sheep are formed over the corneal process, a bony core that projects from the frontal bone of the skull. **6- Dewclaws:** The accessory digits, commonly known as dewclaws, of ruminants correspond to digits II (medial) and V (lateral). Ruminant dewclaws lack well-developed phalanges; their hoofs have a wall and small bulb. **7- Chestnuts and Ergots:** Chestnuts are hornlike growths on the medial sides of horses' limbs. The front chestnuts are proximal to the carpus, and the hind chestnuts are slightly distal to the hocks. **8- Coat Color in Horses:** The description of equine coat color can vary with the breed or the part of the country. The distinctive pigmentation patterns are common in appaloosa as: (1) The sclera of the eye is white. (2) Skin is mottled black and white (this is most obvious around lips, eyes, and genitalia). (3) Hoofs are striped vertically in black and white.	**Dr. PAKIZA** **2 hrs. 4/ 12/ 2023**

Examination

Q1/A- Draw the rumen of cow then indicate the important parts; also write the function of the most important and largest part. (15 Marks)
B- Write the name, target tissue, principal action and chemical nature of three the followings: 1- ADH 2- PRL 3- ACTH 4- FSH (15 Marks)

Q2/ Complete the following phrases with the suitable words: (27 Marks)
The name hormone was given by ---------- in ----------. He discovered---------- hormone.
Gastric juice that contains ----------; it converts to ---------- by ---------- secretions to make the contents very ---------- to ----------**.**
Cell division involves a single cell called a ---------- dividing into two ----------. This leads to growth in ---------- **organisms**.
The percentage of water in the body is regulated by hormones ----------, ----------, ---------- --.
In general water forms ----------% of the total body weight. However, sometimes it may vary with ----------, ---------- and ----------.
Q3/ A- Numerate the factors that lead to homeostatic imbalance. (15 Marks)
B- There are a number of ways by which animals control their body temperature. (6 Marks)
Q4/ Explain the following:
The camel's body temperature is varying. (7 Marks)
Types of hormones on the basis of function. (15 Marks)

The answers of questions : -

Q1/A-**The Rumen stomach:**

In ruminant herbivores like cows and sheep the stomach is highly modified to act as a "fermentation vat". It is divided into **four parts**.

1-The largest part is called the **rumen**. In the cow it occupies the entire left half of the abdominal cavity and can hold up to 270 litres.
2-The **reticulum** is much smaller and has a honeycomb of raised folds on its inner surface.
3-The **omasum** with a folded inner surface.
4-The **abomasum**. This is the 'true' stomach where muscular walls churn the food and gastric juice is secreted.

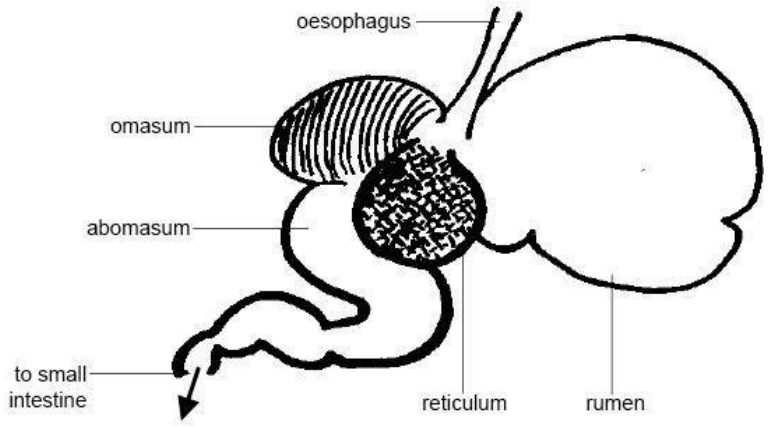

Diagram 2- The rumen

The function of the Rumen:

1- Ruminants swallow the grass they graze almost without chewing and it passes down the esophagus to the rumen

and reticulum. Here liquid is added and the muscular walls churn the food.
2-These chambers provide the main fermentation vat of the ruminant stomach. Here bacteria and single-celled animals start to act on the cellulose plant cell walls. These organisms break down the cellulose to smaller molecules that are absorbed to provide the cow or sheep with energy. In the process, the gases methane and carbon dioxide are produced.
3- Not only do the micro-organisms break down the cellulose but they also produce the **vitamins E, B and K** for use by the animal. Their digested bodies provide the ruminant with the majority of its protein requirements.
B-

Endocrine Gland and Hormone	**Target Tissue**	**Principal Actions**	**Chemical Nature**
Antidiuretic hormone (ADH(	Kidneys	Stimulates reabsorption of water; conserves water	Peptide
Prolactin (PRL(	Mammary glands	Stimulates milk production	Protein
Adrenocorticotropic hormone (ACTH)	Adrenal cortex	Stimulates secretion of adrenal cortical hormones such as cortisol	Peptide
Follicle-stimulating hormone (FSH(	Gonads	Stimulates spermatogenesis in males; stimulates development of ovarian follicles in females	Glycoprotein

Q2/ Complete the following phrases with the suitable words: (27 Marks, 1.5 for each blank)
Starling , **1902**, **secretin**.
Pepsinogen, **pepsin** , **hydrochloric acid** (HCL), **acidic** , **digest protein**.
mother cell, **daughter cells**, **multicellular.**
ADH , aldosterone, angiotensinogen.
65-75% , age, sex , illness.

Q3/ A- homeostatic imbalance
Many diseases involve a disturbance of homeostasis.
Ageing also causes disturbances in homeostasis. As the organism ages, the efficiency in its control systems becomes reduced. The inefficiencies gradually result in an unstable internal environment that increases the risk of illness, and leads to the physical changes associated with aging.
High core temperature, a high concentration of salt in the blood, or low concentration of oxygen, can produce homeostatic emotions (such as warmth, thirst, or breathlessness), which motivate behavior aimed at restoring homeostasis (such as removing a sweater, drinking or slowing down).

B/ 1-Hair, wool, walking, running, shivering and the burning of energy in feed keep the body warm.
2- Sweating, panting, wallowing in mud, and lying in the shade cool the body.

Q4/ 1- The camel's body temperature is **vary** with the time of **day and water availability**. When a camel is **watered daily** its body temperature **rises** from **36.5°C in the morning to 39.5°C at noon**, if the animal has **no water** the temperature range is **34.5°C to 41°C.**

2- <u>Types of hormones on the basis of function</u>: It is of three types.
1- Local Hormones: Also known as para-hormones or tissue hormones. They are secreted at one place and work upon adjacent tissue. They reach by diffusion. Ex. **Acetyl choline.**
2- Synergistic hormones: When hormones work **together**. Ex: **(FSH** and **LH)**, **(Insulin** and **glucocorticoids)**.
3- **Antagonistic Hormones**: These hormones work **against** each other. For example **Insulin decreases the sugar** in the body while **glucagon increases** it.

18- Practical lectures

1: Introducing animal cells, The Structure and function of Cytoplasm organelles.
2: Blood: including: Functions of the blood, Composition of blood,
The major types of blood cells and Anticoagulants types
3: Collection of Blood samples from animals in the field, plasma and serum preparation, Ta
4:Osmosis: Kinds of membranes, Preparation of different solutions (hypertonic, hypotonic and isotonic solutions) then application of osmotic fragility experiment.
5: Blood CBC: Red blood cell count. White blood cell count.
6: Packet Cell Volume (PCV)
7:Blood groups (ABO system and Rh system)
8: Erythrocytes Sedimentation Rates (ESR)
9: Hemoglobin Determination (HB).
10: Bleeding and clotting Times (3 experiments).
11: Respiratory system: Lung volumes and respiration abnormality.
12: Digestive system: Parts of digestive tracts in ruminant and study their functions
13: Circulatory system: Cardiac cycle and blood pressure.
14: Thermoregulation of animal body: Measuring of body Temp. in animals.
15: Cardiac cycle and blood pressure.

19- Sample of practical examination

Q\ Explain the following sentence: For example
Plasma membrane is semi permeable membrane.
Answer\ Movement of water across a semi-permeable membrane from an area of high water potential to an area of low water potential.
Q\ define this following term:
For example
Osmosis:
Answer\ The movement of water molecules from an area of high concentration to an area of low concentration.
Q\ write the function of these following items:
For example
Blood plasma:
Answer\ Plasma transports materials needed by cells and materials that must be removed from cells:
Various ions (Na^+, Ca^{2+}, HCO_3^-, etc.)
glucose and traces of other sugars
amino acids
other organic acids
cholesterol and other lipids
hormones
urea and other wastes
What is the principle of HB estimation?
Answer: Principle: this method based on conversion of hemoglobin to acid hematin, which is brown in color.
Fill the blanks with correct answer:
There two methods blood clotting measurement ……. And……
(test tube method and capillary method)
Answer by true or false and correct the false words:
If RBCs number increase this lead to decrease Hb and PCV. (False)

20. Extra notes:

Here the lecturer shall write any note or comment that is not covered in this template and he/she wishes to enrich the course book with his/her valuable remarks.

21. Peer review **پێداچوونەوەی هاوەڵ**

This course book has to be reviewed and signed by a peer. The peer approves the contents of your course book by writing few sentences in this section.