COURSE TITLE: ADVANCE ZOOLOGY III (PHYSIOLOGY)

Credit Hours: 3

Aims and Objectives:

- The basic functional expression in animals is the membrane irritability understood in the form of nerve impulse.
- This course particularly imparts the concepts and mechanisms of integration in the different functional systems of the animals.These mainly constitute the mechanisms of nervous system and the hormonal system for the coordination. The motility and locomotion also contributes in the integration of the animal to its environment, therefore, also included in this section.

Course Contents

1. **Central themes in Physiology:** Structure-function relationship, Adaptations, Homeostasis, Conformity and Regulation.

2. **Physiological basis of Membrane Function:** Mechanisms in resting membrane potentials: Electrogenic ion pump, Donnan equilibrium, Diffusional potentials, Ion channels, Ionic mechanisms in action potentials: Roles of ion channels, Properties of action potential. Propagation of action potential in neurons; Synaptic transmission; Structure and function of electrical synapse structure and function of chemical synapse; Neurotransmitters; Synaptic receptors; Excitatory postsynaptic potentials; Inhibitory postsynaptic potentials; Presynaptic inhibitions; Integration at synapses: Facilitation, Posttetanic Potentiation.

3. **Receptors Physiology:** Transduction; Sensory coding; Range fractionation; Sensory adaptations; Mechanoreception: Hair cell mechanism particularly in acoustico-lateralis system of vertebrates; Cutaneous receptors; Cellular and molecular mechanisms in taste and olfactory reception; Photoreception: Ultrasttructure of photoreceptors, Photochemistry, Phototransduction and physiological basis of color vision; Physiological mechanisms in electroreception.

4. **Chemical Messenger and Regulators/Endocrine Physiology:** Types and functions of secretions. An overview of invertebrate endocrine structures, their hormones and physiological roles. An overview of hormones, their chemistry and physiological roles of Hypothalamus, Pituitary, Thyroid, Parathyroid and associated structures, Endocrine pancreas, Gastropancreatic system, Adrenal medulla (Chromaffin Tissue), Adrenal cortex, Ovary, Testis and Placenta. A generalized model account of hormone synthesis, storage and secretion (a peptide hormone model and steroid hormones); Hormonal interactions in metabolic and developmental function; Water and electrolyte balance and reproduction. Integrated endocrine and neural responses in glycemia and calcium homeostasis and reproductive cycles; General account of hormonal regulations, hormonal turnover, recognition; Mechanisms of action in hormones involving membrane receptors and nuclear modulated gene expression; Endocrine functions of kidneys, heart and pineal gland.

5. **Movements and Muscles:** Structural basis of muscle contraction: molecular structures of contractile components and their interaction, sarcoplasmic reticulum, calcium and membrane mechanisms in regulation of contraction.

6. **Cardiovascular Mechanisms:** Electrical activity of heart: Automaticity, Rhythmicity, Electrocardiography, Kymography; Hemodynamics, Blood flow, pressures and resistance and their interrelationships. Control of cardiac activity (cardiac output) and peripheral circulation.

7. **Exchange of Gases:** Transport of O_2 and CO_2 between respiratory surface (the lungs) and body cells. Regulation of lungs respiration; Gas transfer in water (gills) and its regulation. Respiratory responses in extreme conditions as hypoxia; Hypercapnia in air breathing divers.

8. **Excretion and Osmoregulation:** Osmoregulation in aquatic and terrestrial environment. Vertebrate nephron as osmoregulatory organ: Physiological anatomy, Glomerular filtration, Tubular absorption and secretion; Nitrogenous waste products; Patterns of nitrogenous excretion and their phylogenetic development.

9. **Nutrition:** Regulation of digestive secretions; Physiological anatomy of digestive tract (mammalian model), Absorption of water, ions and nutrients; Potential and Movements in gastrointestinal tract; Control of motility.

10. **Temperature Relations:** Temperature classification of animals; Temperature relation of ectotherms in freezing and cold and warm and hot environment; Costs and benefits of ectothermy; Temperature relations of heterotherms and endotherms; Dormancy: Sleep, Torpor, Hibernation, Estivation.
11. Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

Books Recommended

Berne, R. M. & Levy, M. N. (2000).*Principles of Physiology.* (3rded.). Mosby: St. Lious.

Bullock, J., Boyle, J., & Wang, M. B. (2001).*Physiology.* (4thed.). Philadelphia: Lippincott, Williams and Wilkins.

Guyton, A. C. & Hall, J. E. (2000).*Textbook of Medical Physiology*. (10th ed.). Philadelphia: W.B. Saunders Company.

Randall, D., Burggren, W., French, K., & Fernald, R. *Eckert Animal Physiology: Mechanisms and Adaptations* (5th ed.). New York: W.H. Freeman and Company.

Schmidt-Nelsen, K. (1997). *Animal Physiology, Adaptation and Environment*. Cambridge: Cambridge University Press.

Withers, P. C. (1992).*Comparative Animal Physiology.* Philadelphia: Saunders College Publishing.

ADVANCE ZOOLOGY Lab-III (PHYSIOLOGY) PRACTICALS

1. **Muscle and Neuromuscular Activity:** Nerve muscle preparation, Muscle twitch, Comparison of muscle and nerve irritability, effect ofstimulus strength, effect of stimulus frequency (tetany), effect of load or stretch, effect of prolonged activity (fatigue), neuromuscular fatigue, stimulation of motor points in human.

2. **Excitability, Sensation and Behaviour:** Recording of action potential by oscilloscope and demonstration of its various features. Experiments to demonstrate characteristic of reflex arc. Experiment in human (students themselves) to demonstrate some aspect of sensory physiology.

3. **Cardiovascular Activity:** Normal cardiac activity, effect of temperature, effect of drug, heart block, tetanization of heart. Measurement of blood pressure.

4. **Respiration and Exercise:** Oxygen consumption in fish and effect of temperature (by dissolved oxygen meter) and terrestrial animal (mouse). Oxygen consumption (by respirometer), heart rate, blood pressure glycemia altered by exercise.

5. **Endocrine and Reproductive Mechanisms:** Effect of insulin on glycemia, study of stages in estrous cycle.

Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

Books Recommended

Tharp, G., &Woodman, D. (2002).*Experiments in Physiology.*(8thed.). London: Prentice Hall.