Darrang College (Autonomous), Tezpur-784001

Syllabus
M.Sc. 2nd Semester
(CBCS)

Subject: Zoology

Approved by :

Board of Studies meeting held on 19-12-2025
&
Academic Council vide Resolution no. 2, dated 29-12-2025

M.Sc. Zoology Syllabus (CBCS)
Semester-2

Code	Course	Credit	Contact hour	Total marks	Type
ZOO-2014	**Biodiversity**	4	54	40+10	Core (Theory)
ZOO-2024	**Endocrinology**	4	54	40+10	Core (Theory)
ZOO-2034	**Developmental Biology**	4	54	40+10	Core (Theory)
ZOO-2044	**Animal cell Culture And Genetic Engineering**	4	54	40+10	Core (Theory)
ZOO-2054	**Animal behavior**	4	54	40+10	Core (Theory)
ZOO-2064	**Animal Physiology**	4	54	40+10	Core (Theory)
ZOO-2072	**Biodiversity, Animal behavior, Developmental Biology**	2	54	20+5	Practical
ZOO-2082	**Endocrinology, Animal Physiology, Animal cell Culture And Genetic Engineering**	2	54	20+5	Practical

M.Sc. 2nd SEMESTER

Paper-ZOO-2014 (BIODIVERSITY)
(Marks 40+10) Theory credit: 4 Credits

Unit-I

1. Major elements of global diversity, Evolution and distribution
2. Biodiversity in different levels (Country, Global, Regional)
3. Components of Biodiversity (Genetic, Organismal and Ecological)
4. Magnitude and pattern of Biodiversity
5. Carrying capacity and population pressure on Biodiversity
6. Impact of climate Change, Global health and diseases on Biodiversity

Unit-II

7. Value of Biodiversity (Species and Ecosystems), Utilization of Biodiversity
8. Methods and tools for biodiversity conservation (Ex situ, In situ, Restoration and Rehabilitation, land use)
9. Priority setting: Criteria for conservation
10. Women, gender and biodiversity conservation
11. Legal instruments for biological diversity conservation
12. Sustainability, Harnessing and benefit sharing

Suggested Books:

1. M.Kato (Ed); The Biology of Biodiversity: Springer-Verlag, 2000
2. Anne E. Magurran; Measuring Biological Diversity; Blackwell Publishing, 2004
3. K. C. Agrawal: Global Biodiversity, Nidhi Publishers (India), 2002
4. Kelvin J. Gaston & John I Spicer: Biodiversity an Introduction; 2nd Edn. Blackwell Publishing; 2004

M.Sc. 2nd SEMESTER
Paper-ZOO-2024 (ENDOCRINOLOGY)
(Marks 40+10) Theory credit: 4 Credits

UNIT I:

1. Hormone and target organs: hormone receptors and their characteristics. Neurocrine, endocrine, paracrine and autocrine secretion of hormones, Hormonal signal transduction,
2. Hypothalamus: Hypothalamic neurosecretory centres, Hypothalamic hormones, hormonal feedback.
3. Pituitary: Pituitary hormones and their functions.
4. Thyroid: Thyroid hormones biosynthesis and their functions
5. Biosysnthesis of adrenal hormones and their functions, Adrenal Medulla: Catecholamine biosynthesis, release and its physiological functions.
6. Parathyroid: Calcitonin and vitamin D in calcium Homeostasis

7. Endocrine Pancreas: Glucose homeostasis and physiological functions of Insulin and Glucagon

UNIT II:

8. Neurosecretory hormones in insets and crustaceans and their functions
9. Neuroendocrine system of Insect : Neurosecretory cells of brain and ventral nerve cord, synthesis and assemblage of neurohormones, neurohemal organs, release and transport of neurohormones to targets, long distance axonal transport, Hormones produced by Neurosecretory cells and their function
10. Prothoracicotropic hormone, Allatotropin, Allatostanin, Diapause hormone, Bursicon, Eclosion hormone, Proctolin, Diuretic hormone and Heart beat accelerating factor
11. Corpus cardiacum : Structure , Hormones produced by Corpus Cardiacum and their functions, Corpus allatum : structure and functions of JH, JH as a gonadotropin
12. Prothoracic gland and ring gland, ecdysone and its functions; Ovarian ecdysones-structure and function, synthesis of ecdysone. Role of Juvenile hormone analogues and ecdysteroids in pest control

Suggested Books:

1. Comparative Vertebrate Endocrinology, Bentley, P. J., Cambridge University Press, UK
2. Vertebrate Endocrinology, Norris D. O., Elsevier Academic Press,
3. Hand Book of Physiology, American Physiological Society, Oxford University Press, Section 7: Multiple volumes set.
4. The Insects: Structure and Function, Chapman, F.R., The English Language Book Society (ELBS) and The English Universities Press Ltd.
5. The Principles of Insect Physiology Wigglesworth, V. B., ELBS and Chapman and Hall.
6. Endocrinology (3 volumes set), *DeGroot* L. J. and Jameson J.L., Editors, (5th Ed., 2006), Saunders Elsevier Press, USA.

7. Molecular Biology of Steroid and Nuclear Hormone receptors, ed. Freedman L. P., (1998), Birkhauser, Boston, USA
8. Biochemical actions of hormones, ed. Litwack, G. (1985), Academic press, New York, USA
Brooks and Marshall: Essentials of Endocrinology, Blackwell Science. 1995
9. Turner and Bagnara: General Endocrinology, W. B. Saunders Company Philadelphia. 1984
10. Larson: Williams Text Book of Endocrinology, 10th edition. W. B. Saunders Company, Philadelphia. 2002.

M.Sc. 2nd SEMESTER
Paper-ZOO-2034 (DEVELOPMENT BIOLOGY)
(Marks 40+10) Theory credit: 4 Credits

Unit-I

1. Principles of experimental embryology: the developmental dynamics of cell specification stem cells and developmental commitment, totipotency and pluripotency.

2. Morphogenesis and cell adhesion-the thermodynamic model of cell interactions, concept of morphogen gradients and morphogenetic fields, cell adhesion molecules
3. Fertilization-pre and post fertilization events, activation of eggs, Gamete fusion and

prevention of phylogeny

4. Nucleo cytoplasmic interaction in development of unicellular organisms and in early development and differentiations of multi cellular organisms, Importance and role of cytoplasm, hybridization experiments, nature of changes in nuclei, cell hybridization and nuclear transplantation experiments.
5. Cell to cell communications in development: Induction and competence, Reciprocal and sequential inductive events, Instructive and permissive interactions, Epithelial and mesenchymal interactions, Genetic specificity of induction, Paracrine Factors; the inducer molecules.

Unit-II

6. Role of maternal contribution in early embryogenic development in Drosophila: Maternal effect genes, gap genes, pair rule genes, segment polarity genes, homeotic genes and hox genes in development.
7. Organogenesis: vulva formation in *Caenorhapditis elegans*.
8. Regeneration: Epimorphic regeneration of Salamander limbs, Morphallactic regeneration in hydra, Compensatory regeneration in Mammalian liver.
9. Different types of stem cells and their applications ,,Regeneration therapy.
10. Role of environment in animal Development: Gravity and pressure, Developmental symbiosis ,Larval settlement. Diapause: suspended development.

Suggested Books:

1. Developmental Biology, Gilbert, (8th Ed., 2006) Sinauer Associates Inc., Massachusetts, USA.
2. Principles of Development, Wolpert, Beddington, Brockes, Jessell, Lawrence, Meyerowitz, (3rd Ed., 2006), Oxford University Press, New Delhi, INDIA.
3. Analysis of Biological Development, Kalthoff, (2nd Ed., 2000), McGraw-Hill Science, New Delhi, INDIA.

M.Sc. 2nd SEMESTER

Paper-ZOO-2044 (ANIMAL CELL CULTURE, AND GENETIC ENGINEERING)
(Marks 40+10) Theory credit: 4 Credits

UNIT 1:

1. Cell culture: Basic techniques of cell culture. Development of primary cell cultures; cell separation, harvesting and maintenance of cell lines; Transformation and differentiation of cell cultures, types of cell culture: monolayer, suspension, clonal and stem cell culture, cryopreservation cell lines.
2. Cell culture Media: Primary and established cell line cultures; Media supplements- their metabolic functions; Serum and protein-free defined media and their applications.
3. Measurement of viability and parameters of growth. Cell cycle analysis and synchronization of cultures; Assessment of cell culture contaminants, safety parameters.
4. Cell proliferation assays: MTT, Trypan Blue exclusion test.

UNIT-2

5. Automated sequencing methods; Sanger's dideoxynucleotide method; Shotgun DNA DNA sequencing method; Polymerase chain reaction and its advantages.
6. DNA polymorphism: Types of DNA Polymorphism (SNP, RFLP, VNTR, STR, SNPs), Basis of DNA typing/fingerprinting.
7. Basic biology of cloning vectors: plasmids, phages, single stranded DNA vectors, high capacity vectors, retroviral vectors, expression vectors, and other advanced vectors in use; genomic library and cDNA library
8. RNA interference: History, molecular mechanisms and applications of antisense RNA, microRNA, siRNA, and ribozymes.
9. Gene and somatic cloning techniques
10. Transgenic technology-animals as bioreactors

Suggested Books

1. Principle of Genome Analysis and Genomics, Primrose, S. B. and Twyman R. M., (7th Ed., 2006), Blackwell Publishing Company, Malden, USA
2. Genomes 3, Brown, T. A., Garland Science Publishing, London, UK
3. Cultures of animal cell. R. Freshny
4. Basic cell culture protocol. Cheryl D. Helgason
5. Animal cell culture essential methods. John M. Davis

M.Sc. 2nd SEMESTER
Paper-ZOO-2054 (Animal Behaviour)
(Marks 40+10) Theory credit: 4 Credits

Unit-I

1. Patterns of animal behavior
   a. Objectives and mechanism of behaviours.
   b. Types of reflexes, characteristics of reflexes and complex behaviour.
   c. Orientation: Primary and Secondary Orientation, Sum-Compass Orientation.
   d. Kinesis: Orthokinesis and Klinokinesis.
   e. Taxis: Different kind of taxis.
2. Development of behaviour: Genetic basis of behaviour, Hormone brain relationship
3. Neural basis of behaviour: Key stimuli, Stimulus filtering, Supernormal stimuli, Open and closed IRM, Biological rhythms.
4. Learning Definition, Types of learning, Neural mechanism of learning
5. Communication: Types of communications-Auditory communication; Infrasound communication among Elephants and Whales; Sonar,Navigation,and communications; Vocalization in nonhuman primates; Ecolocation in Bats; Visual communication; Chemical signals; Functions of scent in vertebrates; Tactile communications.

Unit-II

6. Motivational system: Physiological basis of motivation, control of hunger drive and thirst drive in animals. Motivational conflict and decision making, displacement activity, models of motivation, measuring motivation, hormones and pheromones influencing behaviour of animals.
7. Sociobiology: Units of Sociobiology; major social behaviours; Alturism: Reciprocal altruism, group selection, kin selection and concept of inclusive fitness, cooperation , /reciprocation; Selfishness; Eusociality.
8. Reproductive strategies: Sexual selection, intrasexual selection (male rivalry), intersexual selection (female choice), infanticide, mate guarding.
9. Parental Behaviour:Care before birth;Care after birth; Early parental care;Types of parental care ;Factors affecting parental care; Care and attachment; Parent offspring conflict.

Suggested Books:

1. Mechanism of Animal Behaviour, Peter Marler and J. Hamilton; John Wiley & Sons, USA
2 Animal Behaviour, David McFarland, Pitman Publishing Limited, London, UK
3 Animal Behaviour, John Alcock, Sinauer Associate Inc., USA
4 Perspective on Animal Behaviour, Goodenough, McGuire and Wallace, John Wiley & Sons, USA
5 Exploring Animal Behaviour, Paul W. Sherman & John Alcock, Sinauer Associate Inc. ,Massachusetts, USA
6 An Introduction to Animal Behaviour, A. Manning and M.S Dawkins, Cambridge University Press, UK
7. Alcock : Animal Behaviour- An Evolutionary Approach. (7th ed.) Sinaur Associates, Inc. 2001.
8. Drickamer & Vessey: Animal Behaviour –Concepts, Processes and Methods (2nd ed.), Wadsworth, 1986.
9. Gadagkar: Survival Strategies-Cooperation and Conflict in Animal Societies. Universities

Press,1998.

10. Grier : Biology of Animal Behaviour, Mosby, 1984.
11. Hallidy and Slater : Animal Behaviour(vols. I-3) Blackwell Scientific Publ., 1983.
12 Krebs & Davis : Behavioural Ecology. (3rd ed.) Blackwell, 1993.
13. Lehner : Hand Book of Ethological Methods.(2nd ed.) Garland, 1996.
14. Slater & Halliday : Behaviour and Evolution,(1st ed.) Cambridge Univ. Press, 1994.

M.Sc. 2nd SEMESTER
Paper-ZOO-2064 (ANIMAL PHYSIOLOGY)
(Marks 40+10) Theory credit: 4 Credits

UNIT I:

1. Body Fluid: Blood, Lymph, Hemolymph: Chemical compositions and Functions
2. Cardiac Cycle, Specialized conducting system of heart, generation and conduction of cardiac impulse, neurohomonal regulation of cardiac amplitude and frequency.
3. Respiratory system in vertebrate: Pulmonary ventilation, alveolar ventilation, diffusion and transport of gases, Basal metabolic rate. Respiratory centers: organization and function
4. Counter current mechanism of urine formation, RAS and hormonal regulation of urine formation. Acid-base balance and homeostasis
5. Nutrition: Gastro intestinal hormones and digestive enzymes: chemical nature and functions.

UNIT II:

6. **Nervous system:** Neurons and types of neurons, Types of synapses and synaptic knobs, Axonal transmission.
7. Membrane potential and generation of action potential. Sodium-potassium pump, Synaptic transmission, neuromuscular junction Excitatory and inhibitory post-synaptic potential, Chemical transmission, neurotransmitters (acetylcholine, or catecholamines, serotonin and GABA), Autonomic nervous system (Sympathetic and parasympathetic)
8. Special sensory system: Eye: Anatomical Organisation of retina, Photoreceptors: Processing of visual impulses Ear: Cochlea, basilar membrane, and organ of Corti. Generation of endochochlear potential. Processing of auditory impulses.
9. Muscle: Contractile proteins, Ultrastructure of skeletal muscles, Properties of muscle: muscle twist, summation, tetanus and fatigue, Sliding filament theory of muscle contraction and regulation.

SUGGESTED BOOKS:

1. Ganong: Review of Medical Physiology (21st Ed.), Lang Medical Publications, 2003
2. 2. Guyton and Hall: Text Book of Medical Physiology (10th Ed.), W.B. Saunders, 2001
3. Keel et al: Samson Wright's Applied Physiology (13th Ed.), Oxford Press, 1989
4. Murray et al: Harper's Illustrated Biochemistry (26th Ed.), Appleton & Lange, 2003
5. West: Best and Taylor's Physiological Basis of Medical Practice (11th Ed.), Williams and Wilkins,1981.

M.Sc. 2nd SEMESTER
Paper-ZOO-2072 (BIODIVERSITY, ANIMAL BEHAVIOUR & DEVELOPMENTAL BIOLOGY) (PRACTICAL)
(Marks 20+5) Theory credit: 2 Credits

1. Collection and identification of egg (at least six different types)
2. Study of life cycle of *Drosophila melanogaster*.
3. Dissection and study of larval pre pupal wing, leg, eye, and antennal imaginal disc in *D. melanogaster.*
4. Preparation and study of frog/mice sperm smear.
5. Detection of SH proteins during various stages in the early development of amphibian embryo.
6. Study of developmental stages of fish from egg to hatchling.
7. In vitro culture of chick embryo.
8. Study of chick embryo using vital staining.
9. Study of cell death during development.
10. Activity budgeting of bird/mammal
11. Effect of toxicant on opercular movement and surfacing in fish.
12. Effect of toxicant on movement of fish.

Paper-ZOO-2082

(ENDOCRINOLOGY, ANIMAL PHYSIOLOGY, BIOTECHNOLOGY AND TISSUE CULTURE)
(Marks 20+5) Theory credit: 2 Credits

1. Neuroendocrine system of cockroach – Dissection and display
2. Prothoracic gland of cockroach – Dissection, display and mounting
3. Mounting of prothoracic gland
4. Thyroid and parathyroid gland of mouse/chicken – dissection and display and slide preparation
5. Pituitary gland of mouse /fish – Dissection, display and permanent slide preparation using metachromatic stains.
6. Demonstration of ELISA
7. Histological study of endocrine glands of vertebrates
8. Detection of uric acid in malpighian tubules
9. Hemocyte count and estimation of protein in hemolymph.
10. Total RBC and WBC count in human blood.

11. Isolation of genomic DNA from mammalian tissue.
12. Restriction-digestion of DNA sample and separation of fragments by performing agarose gel electrophoresis. Interpretation of the results by comparing with the standard digests.
13. MTT cell proliferation assay, cell viability assay.