

P. G. COURSE STRUCTURE OF THE DEPARTMENT OF  
ZOOLOGY AT A GLANCE

FIRST SEMESTER

<u>Paper No.</u>	<u>Name of the Papers</u>	<u>Credit</u>
ZOO – 101	Nonchordata	4
ZOO – 102	Molecular Cell Biology	4
ZOO – 103	Environmental Biology	4
ZOO – 104	Evolutionary Biology	4
ZOO – 105	Practical	4

SECOND SEMESTER

<u>Paper No.</u>	<u>Name of the Papers</u>	<u>Credit</u>
ZOO – 201	Chordata	4
ZOO – 202	Microbiology & Ethology	4
ZOO – 203	Developmental Biology	4
ZOO – 204	Cytogenetics	4
ZOO – 205	Practical	4
DSE PAPERS		
ZOO – 206A	Physiological Ecology	4
ZOO- 206B	Applied Zoology	4
ZOO- 206C	Medical diagnostics	4

THIRD SEMESTER

<u>Paper No.</u>	<u>Name of the Papers</u>	<u>Credit</u>
ZOO – 301	Physiology – Life sustaining system	4
ZOO – 302	Physiology – Controlling & coordinating system	4
ZOO – 303	Biomolecules & Enzymology	4
ZOO – 304	Biochemistry of metabolic processes	4
ZOO – 305	Practical	4
IDSE Papers		
ZOO – 306A	General Zoology	4
ZOO– 306B	Animal behaviour & applied Zoology	4
ZOO– 306C	Medical diagnostics	4

FOURTH SEMESTER

<u>Paper No.</u>	<u>Name of the Papers</u>	<u>Credit</u>
ZOO – 401	Molecular Biology & Immunology	4
ZOO – 402	Biotechnology	4
ZOO – 403	Biophysics, Biophysical Chemistry, Instrumentation	4
ZOO – 404	Biostatistics	4
ZOO – 405	Practical & Dissertation	4

PG FIRST SEMESTER

Unit-I

- (A) PROTOZOA:  
(i) Nutrition, Locomotion & Reproduction in Protozoans.  
(ii) Parasitic Protozoans with special reference to human host.
- (B) PORIFERA:  
(i) Origin of metazoa  
(ii) Canal system and reproduction in porifera  
(iii) Skeleton in sponges

Unit-II

- (A) COELENTERATA:  
(i) Polymorphism in coelenterate  
(ii) Corals and coral reef formation  
(iii) Ctenophora and its affinities
- (B) HELMINTHES:  
(i) Parasitism and parasitic adaptations in helminthes
- (C) ANNELIDA:  
(i) Origin of coelom in annelida  
(ii) Metamerism and segmental organs in annelida  
(iii) Excretion in annelida

Unit-III

- (A) ARTHROPODA:  
(i) Structural organization and phylogenetic status of Limulus  
(ii) Parasitic castration with reference to the life cycle of Sacculina  
(iii) Larval forms in Crustaceans  
(iv) Vision in arthropods  
(v) Social life in insects  
(vi) Beneficial insects – Silkmoth, Honeybee, Lac insect
- (B) ONYCHOPHORA:  
(i) Structural organization and phylogenetic status of Peripatus

Unit-IV

- (A) MOLLUSCA:  
(i) Respiration in Molluscs  
(ii) Foot in Molluscs  
(iii) Torsion and de-torsion in Gastropoda
- (B) ECHINODERMATA:  
(i) Water vascular system of Echinoderms  
(ii) Larval forms in Echinoderms
- (C) MINOR PHYLA:  
(i) Structure and affinities of Rotifera, Brachiopoda and Phoronida
-

PG FIRST SEMESTER  
ZOO – 102  
MOLECULAR CELL BIOLOGY

FM: 20+80 (4 CH)

- Unit-I
- (i) Chemical composition and Molecular organization of Cell membrane
  - (ii) Membrane modifications and junctions
  - (iii) Membrane transports
  - (iv) Cell adhesion
  - (v) Cell signaling
- Unit-II
- (i) Molecular organization of various cell organelles – Endoplasmic Reticulum, Golgi complex, Mitochondria, Lysosome, Ribosomes
- Unit-III
- (i) Cytoskeleton of the cell
  - (ii) Structural organization and function of nucleus and nucleolus
  - (iii) Ultra structure of chromosome
  - (iv) Chemical nature of chromosome
  - (v) Types of chromosome
- Unit-IV
- (i) Cell cycle and its regulations
  - (ii) Behaviour of chromosome during cell division
  - (iii) Apoptosis
  - (iv) Cytology of Cancer
-

PG FIRST SEMESTER  
ZOO – 103  
ENVIRONMENTAL BIOLOGY

FM: 20+80 (4 CH)

- Unit-I
- (i) Biosphere and its components
  - (ii) Structural and functional nature of ecosystem (Productivity and energy flow in the ecosystem)
  - (iii) Ecological pyramids
  - (iv) Ecological factors – Light and Temperature
  - (v) Biogeochemical cycle – Oxygen, Carbon and Nitrogen
- Unit-II
- (i) Biotic interactions
  - (ii) Characteristic of biotic community
  - (iii) Pedogenesis – Composition and formation of soil, soil profile
  - (iv) Ecosystem development (Ecological succession)
- Unit-III
- (i) Population dynamics – Characteristic and growth of population, factors affecting population growth.
  - (ii) Environmental pollution – Air, Water and Noise pollution.
  - (iii) Biomagnifications and Bioremediations
  - (iv) Solid waste management
- Unit-IV
- (i) Zoogeography – Various geographical regions with flora and fauna
  - (ii) Wild life Odisha and India
  - (iii) Wild life conservations including Wildlife Acts
  - (iv) Biodiversity – Nature, Distribution, Hotspots of Biodiversity
  - (v) Biodiversity conservation
-

PG FIRST SEMESTER  
ZOO - 104  
EVOLUTIONARY BIOLOGY

FM: 20+80 (4 CH)

- Unit-I
- (i) Origin of life
  - (ii) Evidences in favour of evolution
  - (iii) Species concept and evolution above species level
  - (iv) Modes of speciation
- Unit-II
- (i) Evolutionary theories – Lamarckism, Darwinism, Mutation Theory, Modern Synthetic Theory
  - (ii) Evolutionary processes – Isolation, Natural selection, Variation, Genetic drift
- Unit-III
- (i) Adaptations – Cursorial, Desert, Deep Sea and Cave adaptation
  - (ii) Population genetics – Hardy Weinberg Principle, Gene frequency and its equilibrium, Influence of evolutionary forces on gene frequency
- Unit-IV
- (i) Palaeontology – Process of fossilization, Dating of fossils
  - (ii) Fossil records of evolution of Horse, Elephant and Man
  - (iii) Extinction – Mass extinction and its role in evolution
-

PG FIRST SEMESTER

ZOO – 105 PRACTICAL

NONCHORDATA, MOLECULAR CELL BIOLOGY, ENVIRONMENTAL BIOLOGY,  
EVOLUTIONARY BIOLOGY

FM: 100 (4 CH)

1. Preparation of permanent stained slides (TS & WM).  
(Phylum Protozoa to Echinodermata)
2. Study of prepared slides (TS & WM)  
(Phylum Protozoa to Echinodermata)
3. Study of museum specimens  
(Phylum Protozoa to Echinodermata)
4. Stages of mitosis from prepared slides of plant materials (squashing of Onion Root tip) & from permanent slides.
5. Stages of meiosis from prepared slides of animal materials (squashing of grasshopper testis) & from permanent slides.
6. Study of microphotographs of different cell organelles.
7. Estimation of chlorides and sulphates of calcium for hardness of water.
8. To determine dissolved oxygen ( $DO_2$ ) of different samples of water by Winkler's method.
9. To determine free carbon dioxide ( $CO_2$ ) content of different samples of water.
10. To study physical characteristics of soil texture, colour, temperature, moisture, carbonate and nitrate content of soil.
11. Determination of population density in a natural community by quadrat method and calculation of Shannon-Weiner diversity index for the same community.
12. Study of fossil evidences from models and pictures.
13. Demonstration of changing allele frequencies with and without selection.
14. Construction and interpretation of phylogenetic trees with bioinformatics tools.
15. Gram's staining techniques for study of prokaryotic cells.
16. Preparation of permanent slides of Barr body in human female blood cells / cheek cells.

PG SECOND SEMESTER

ZOO - 201

CHORDATA

FM: 20+80 (4 CH)

- Unit-I
- (i) Biology and evolutionary significance of Hemichordates, Cephalochordates and Urochordates
  - (ii) General organization, classification and affinities of Cyclostomata
  - (iii) Structural organization of Petromyzon and its comparison with Myxine
- Unit-II
- (i) Classification of fishes
  - (ii) Biology and affinities of Dipnoi
  - (iii) Biology and Phylogenetic significance of Latimeria
  - (iv) Osmo regulation in fishes
  - (v) Swim bladder and lateral line system in fishes
  - (vi) Origin of Tetrapoda
  - (vii) Parental care in amphibia
  - (viii) Neotony in amphibia
- Unit-III
- (i) Classification of Reptilia on the basis of skull
  - (ii) Structural organization and phylogenetic significance of Sphenodon
  - (iii) Biting mechanism in snake
  - (iv) Origin of birds
  - (v) Flight adaptation in birds
  - (vi) Perching mechanism in birds
  - (vii) Affinities of Prototheria
  - (viii) Affinities of Metatheria
- Unit-IV
- (i) Comparative account of Integument, Jaw suspensorium, Appendicular and Axial skeleton, Heart, Aortic arches, Kidney and Brain
-

PG SECOND SEMESTER  
ZOO – 202  
MICROBIOLOGY & ETHOLOGY

FM: 20+80 (4 CH)

- Unit-I
- (i) Classification of Microbes
  - (ii) General characteristics of Virus
  - (iii) Types of Viruses – Retrovirus, Adenovirus, Oncovirus
  - (iv) Life cycle of Bacteriophage
  - (v) General organization and classification of Protista and Fungi
  - (vi) Viral, Protozoan and Fungal infections
- Unit-II
- (i) Structure and reproduction of Bacteria
  - (ii) Isolation culture and maintenance of Bacteria
  - (iii) Growth in Bacteria
  - (iv) Bacterial infections
  - (v) Role of Microbes in the field of agriculture, industry and environment
- Unit-III
- (i) Ethological concepts
  - (ii) Orientation in animals
  - (iii) Classification and analysis of behaviour pattern
  - (iv) Physiological basis of behaviour
  - (v) Methods of behavioural studies
- Unit-IV
- (i) Social behaviour – Schooling in fishes, flocking in birds and herding in mammals
  - (ii) Reproductive Behaviour - Courtship and mating behaviour
  - (iii) Migration of fishes and birds
  - (iv) Biological rhythms – Circadian clock, Circannual clock
  - (v) Regulation of biological rhythms
-

PG SECOND SEMESTER  
ZOO – 203  
DEVELOPMENTAL BIOLOGY

FM: 20+80 (4 CH)

- Unit-I
- (i) Early embryonic development – Gametogenesis, Fertilisation, Cleavage, Blastulation, Gastrulation
  - (ii) Fate maps, Fate of Germ Layers
  - (iii) Development of frog and chick up to the formation of three germ layers
- Unit-II
- (i) Embryonic induction and organizer concepts
  - (ii) Neural induction
  - (iii) Organogenesis of eye, heart and brain
  - (iv) Formation of extra-embryonic membranes in birds and mammals
- Unit-III
- (i) Implantation of embryo in humans
  - (ii) Placenta (Structure, types and functions of placenta)
  - (iii) Mechanism of Parturition and its hormonal regulation
  - (iv) Metamorphosis in amphibians and its hormonal regulations
  - (v) Regeneration – Modes of regeneration with examples
- Unit-IV
- (i) Ageing – Concepts and models
  - (ii) Teratogenesis – Teratogenic agents and their effects on embryonic development
  - (iii) In vitro fertilization
  - (iv) Twins study
  - (v) Stem cell culture
-

- Unit-I
- (i) Mendelian inheritance
  - (ii) Extension and phenotypic and genotypic modifications of Mendelian genetic analysis
  - (iii) Genetic interaction
  - (iv) Multiple alleles - blood group inheritance, Rh factor inheritance
  - (v) Polygenic inheritance
  - (vi) Cytoplasmic inheritance
- Unit-II
- (i) Linkage and crossing over
  - (ii) Chromosome mapping
  - (iii) Sex determination and sex link inheritance, dosage compensation
  - (iv) Sex limited, sex influenced characters
  - (v) Holandric inheritance
- Unit-III
- (i) Chromosomal changes – Gene mutations, Chromosomal mutations
  - (ii) Variation in genome and composition of chromosome, C-value paradox, Cot value
  - (iii) DNA repair mechanism
  - (iv) Chromosomal disorder in man
  - (v) Genetic mapping by molecular markers (RFLPS, RAPDS, VNTRS)
- Unit-IV
- (i) Population and applied genetics – Behaviour of genes in population, Application of Hardy-Weinberg Law in population genetics
  - (ii) Pedigree analysis
  - (iii) Genetic counseling
  - (iv) Cytogenetic techniques – Insitu hybridization with DNA probes, FISH, Chromosome banding techniques.

PG SECOND SEMESTER

ZOO – 205 PRACTICAL

CHORDATA, MICROBIOLOGY, ETHOLOGY, DEVELOPMENTAL BIOLOGY, CYTOGENETICS

FM: 100 (4 CH)

Unit-I	(i)	
	(ii)	
	(iii)	
	(iv)	
Unit-II	(i)	
	(ii)	
Unit-III	(i)	
	(ii)	
Unit-IV	(i)	
	(ii)	
	(iii)	
—————		

PG SECOND SEMESTER

ZOO – 206A

PHYSIOLOGICAL ECOLOGY

FM: 20+80 (4 CH)

- Unit-I      Adaptation – Levels of adaptation  
Mechanism of adaptation, significance of body size in adaptation.  
Concept of homeostasis, adaptation, acclimation, acclimatization.
- Unit-II      Physiological adaptation to different environments – Marine, Estuaries,  
Freshwater, Terrestrial life, Parasitic habitat.
- Unit-III     Basic concept of environmental stress and strain.  
Concept of elastic and plastic strain.  
Stress resistance, stress tolerance and stress avoidance.  
Mediation, yoga and their effects.
- Unit-IV     Physiological adaptation to osmotic and ionic stress, mechanism of cell volume  
regulation.  
Osmoregulation in aqueous and terrestrial environments.  
Physiological response to oxygen deficient stress.  
Physiological response to body exercise.
-

PG SECOND SEMESTER

ZOO – 206B

APPLIED ZOOLOGY

FM: 20+80 (4 CH)

- Unit-I Fish culture technique – Monoculture, polyculture & monosex c ulture, Induced fish breeding, Integrated fish farming.  
Prawn culture – Site selection, topography location, soil quality, water quality, farm construction, production system, harvesting and processing.  
Pearl culture – morphology and anatomy of pearl oyster, process of pearl formation, pearl oyster farming, production of cultured pearls and pearl culture establishment.
- Unit-II Fish product and byproducts – Liver oil, body oil, fish meal, fish flour, manure, guano, isinglass, fish fin and leather.  
Marketing of fish and fish products.  
Fish pathology – Etiology, treatment of common diseases of fishes.
- Unit-III Poultry farming – Morphology and variety of fowls, classification of fowls based on their use, feeding and management of poultry farming, poultry diseases.  
Dairy farming and its management.
- Unit-IV Sericulture – Silkworm rearing operations, physical and commercial characters of cocoons, reeling operation, importance of by product of sericulture.  
Apiculture – Bee hive, flora for apiculture, selection of bees for apiculture, modern methods of bee keeping, indigenous method and modern methods of extraction of honey, disease of honey bee and their controlling measures.

---

PG SECOND SEMESTER

ZOO – 206C

MEDICAL DIAGNOSTICS

FM: 20+80 (4 CH)

- Unit-I Introduction to medical diagnostics and its importance.  
Brief account of pathogens and diseases caused by them.  
Elementary idea on various systems and physiological processes of human being.  
Common diseases affecting human health.
- Unit-II Diagnostics methods used for analysis of blood – Blood composition, Estimation of Hemoglobin, Preparation of haemin crystal, Preparation of blood smear and identification of various types of cells, Platelet count, Differential Leucocyte Count (DLC), Erythrocyte Sedimentation Rate (ESR), Packed Cell Volume (PCV).  
Diagnostic methods used for urine analysis.  
Diagnostic methods used for stool analysis.
- Unit-III Diagnosis of Diabetes, Tuberculosis, Hepatitis, Hypertension, Cardiac pathology, Brain pathology, Cancer.
- Unit-IV Medical imaging – X-ray, PET, CT scan, MRI, Dexa scan, Ultrasound, Doppler's test.
-

PG THIRD SEMESTER  
ZOO - 301  
PHYSIOLOGY – LIFE SUSTAINING SYSTEM

FM: 20+80 (4 CH)

- Unit-I
- (i) Comparative physiology of Digestion – Feeding mechanism and regulation.
  - (ii) Histology and functions of gastrointestinal tracts and its associated glands of man.
  - (iii) Digestion of various foods.
  - (iv) Absorption of foods.
  - (v) Role of gastrointestinal hormones on secretion of enzymes.
  - (vi) Gastrointestinal disorders.
- Unit-II
- (i) Respiratory organs and respiratory pigments in different phylogenetic groups.
  - (ii) Mechanism of respiration in man
  - (iii) Transport of gases – Oxygen & Carbon dioxide
  - (iv) Buffering action of blood.
  - (v) Control of respiration.
  - (vi) Respiratory disorders.
- Unit-III
- (i) Circulation of body fluids and their regulations.
  - (ii) Blood – Composition, functions, Blood groups, Structure and functions of hemoglobin.
  - (iii) Structure of heart of man, origin and conduction of cardiac impulse.
  - (iv) Cardiac cycle and its regulation.
  - (v) Blood pressure and its regulation.
  - (vi) Disorders of blood.
- Unit-IV
- (i) Patterns of nitrogenous excretion among different animal groups.
  - (ii) Structure of kidney of man.
  - (iii) Physiology of urine formation, Acid base balance.
  - (iv) Osmo regulation in different animal groups.
  - (v) Thermo regulation in poikilothermic and homoeothermic animals.

PG THIRD SEMESTER

ZOO - 302

PHYSIOLOGY – CONTROLLING & COORDINATING SYSTEM

FM: 20+80 (4 CH)

- Unit-I
- (i) Contractile elements in different groups of animals.
  - (ii) Ultra structure of skeletal muscle.
  - (iii) Molecular and chemical basis of muscle contraction.
  - (iv) Structure of Neuron, conduction of nerve impulse across the myelinated and unmyelinated nerve fibre.
  - (v) Neurotransmitters, Synaptic transmission.
- Unit-II
- (i) Receptor physiology – Photoreceptor (eye), Phonoreceptor (ear).
  - (ii) Communication among animals – Bioluminescence, Audio signals, pheromones.
  - (iii) Chromatophores and of their functions.
  - (iv) Concept of environmental stress, stress resistance, stress avoidance, stress tolerance.
- Unit-III
- (i) Structure and functions of pituitary, thyroid, pineal, parathyroid, adrenal glands.
  - (ii) Mechanism of hormonal actions.
  - (iii) Signal transduction pathways utilized by steroidal and non-steroidal hormones.
  - (iv) Hormonal disorders.
- Unit-IV
- (i) Histology of male and female reproductive systems of human being.
  - (ii) Puberty and its Hormonal regulations
  - (iii) Menstrual cycle and its Hormonal regulations
  - (iv) Hormonal regulation of reproduction (ovulation, implantation, pregnancy, parturition, lactation)
  - (v) Methods of contraception.

PG THIRD SEMESTER  
ZOO – 303  
BIOMOLECULES & ENZYMOLOGY

FM: 20+80 (4 CH)

- Unit - I
- (i) Structure and classification of carbohydrate (mono, di and polysaccharides)
  - (ii) Structural organisation of proteins.
  - (iii) Classification of proteins.
  - (iv) Structure of amino acids & peptide bond formation.
- Unit - II
- (i) Structural and classification of lipids. (fatty acids, triglycerides, steroids)
  - (ii) Structure and classification of Vitamins.
  - (iii) Structure and classification of hormones.
- Unit - III
- (i) Chemical nature of enzymes
  - (ii) Co enzymes , Iso enzymes and Ribozymes
  - (iii) Classification and nomenclature of enzymes
  - (iv) Mechanism of enzyme action
- Unit - IV
- (i) Kinetic analysis of enzyme catalyzed reaction
  - (ii) Michaelis – Menten equation
  - (iii) Factors affecting enzyme action
  - (iv) Enzyme inhibition
-

PG THIRD SEMESTER  
ZOO – 304  
BIOCHEMISTRY OF METABOLIC PROCESSES

FM: 20+80 (4 CH)

- Unit - I
- (i) Metabolism of carbohydrates – Glycolysis , Citric acid cycle, Gluconeogenesis , Glycogenesis , Glycogenolysis, HMP Shunt, Glycoxylate cycle.
  - (ii) Shuttle systems, (Malate – Aspartate shuttle, Glycerol – 3 – phosphate shuttle)
- Unit - II
- (i) Energy metabolism and high energy compounds
  - (ii) Redox potential
  - (iii) Mitochondrial Electron Transport Chain
  - (iv) Oxidative Phosphorylation
  - (v) Formation and hydrolysis of ATP, Inhibitors, Uncouplers
- Unit - III
- (i) Lipid metabolism –  $\beta$ -oxidation of saturated fatty acids, with even and odd number of carbon atoms
  - (ii) Bio synthesis of palmitic acid
  - (iii) Ketogenesis and its regulation
  - (iv) Metabolism of cholesterol
- Unit - IV
- (i) Protein metabolism – catabolism of amino acids – transamination, deamination
  - (ii) Urea cycle
  - (iii) Fate of C – Skeleton of glucogenic and ketogenic amino acids
  - (iv) Interrelationship of carbohydrate, lipid and protein metabolism
-

PG THIRD SEMESTER

ZOO – 305 PRACTICAL

PHYSIOLOGY, BIOMOLECULES, ENZYMOLOGY, BIOCHEMISTRY

FM: 100 (4 CH)

Unit-I	(i)	
	(ii)	
	(iii)	
	(iv)	
Unit-II	(i)	
	(ii)	
Unit-III	(i)	
	(ii)	
Unit-IV	(i)	
	(ii)	
	(iii)	
—————		

PG THIRD SEMESTER

ZOO – 306A

GENERAL ZOOLOGY

FM: 20+80 (4 CH)

- Unit-I      Origin of life.  
Diversity of life and classification of animals – Nonchordates and chordates.  
Evolution of man and its position in the animal kingdom.
- Unit-II      Elementary idea on various systems and physiological processes of human beings  
and their related disorders.
- Unit-III     Basic concept of food and nutrition  
Classification of food & nutritional deficiencies  
Communicable diseases (measles, polio, rabies, plague, leprosy, AIDS,  
chikungunya)  
Non-communicable diseases (hypertension, heart stroke, diabetes, obesity,  
mental ill health).
- Unit-IV     Beneficial insects ( Honeybee, silk-moth, lac insects).  
Economic importance of honey, silk and lac.  
Common edible fishes of Odisha & fish products.  
Common breeds of domestic animals.  
Transgenic animals.
-

- Unit-I Introduction to Ethology  
Stereotyped Behaviours (Orientation, Kinesis, Taxis)  
Patterns of behaviour (Individual behavioural pattern and homing behaviour)  
Fixed Action Pattern: Characteristics, Mechanism and Evolutionary Features  
Genetics of behaviour (Learning and instinct), Mechanism of learning  
Hormones and Pheromones influencing behaviour of animals.
- Unit-II Individual social interactions (Communication, aggregation, social facilitation)  
Social organization (Dominance, competition, territoriality)  
Reproductive behaviour (Courtship, mating, parental care)
- Unit-III Historical developments in Chronobiology  
Biological Clock  
Evolution of Biological Timing System  
Concept of Average, Amplitude, Phase and Period  
Diversity and Complexity of Clock System  
The relevance of biological clock for human welfare- Clock functions  
Human health and diseases- Chronopharmacology, chronomedicine, chronotherapy
- Unit-IV Characteristics and types of Biological Rhythms, Short term and long term rhythms, Circadian rhythms, Tidal rhythms, Lunar rhythms, Circannual rhythms  
Molecular Biology of the Circadian pacemaker system  
Regulation of biological rhythms, Role of melatonin

PG THIRD SEMESTER

ZOO – 306C

MEDICAL DIAGNOSTICS

FM: 20+80 (4 CH)

- Unit-I Introduction to medical diagnostics and its importance.  
Brief account of pathogens and diseases caused by them.  
Elementary idea on various systems and physiological processes of human being.  
Common diseases affecting human health.
- Unit-II Diagnostics methods used for analysis of blood – Blood composition, Estimation of Hemoglobin, Preparation of haemin crystal, Preparation of blood smear and identification of various types of cells, Platelet count, Differential Leucocyte Count (DLC), Erythrocyte Sedimentation Rate (ESR), Packed Cell Volume (PCV).  
Diagnostic methods used for urine analysis.  
Diagnostic methods used for stool analysis.
- Unit-III Diagnosis of Diabetes, Tuberculosis, Hepatitis, Hypertension, Cardiac pathology, Brain pathology, Cancer.
- Unit-IV Medical imaging – X-ray, PET, CT scan, MRI, Dexa scan, Ultrasound, Doppler's test.
-

PG FOURTH SEMESTER  
ZOO - 401  
MOLECULAR BIOLOGY AND IMMUNOLOGY

FM: 20+80 (4 CH)

- Unit-I
- (i) Nucleic acid as the genetic material.
  - (ii) Organization of DNA – Viral, bacterial and eukaryotic, Types of DNA
  - (iii) DNA replication – General mechanism, enzymes and inhibitors
  - (iv) Structure of RNA, Types of RNA, Regulatory RNAs
  - (v) Split genes, overlapping genes, jumping genes, transposons
- Unit-II
- (i) Genes and Chromosomes – Nature of genetic material – Central dogma
  - (ii) Genetic code – Properties & Deciphering
  - (iii) Transcription – Mechanism and its regulation, post transcriptional modifications and processing of RNA
  - (iv) Translation – Mechanism and post translational modifications
  - (v) Regulation of gene expression ( Operon concept)
- Unit-III
- (i) Immunity – Innate and adaptive, cells, organs and molecules of immune system, B&T cell diversity
  - (ii) Antigens and antibodies – Structure, types, interactions of antigen and antibody in vivo and invitro, Immunoassays
  - (iii) Hybridoma technology – Production of monoclonal antibodies and their applications
  - (iv) Organ transplantation
- Unit-IV
- (i) MHC genes and their products. Endogenous & enogenous pathway of antigen presentation
  - (ii) Complements and their actions
  - (iii) Cytokines – Properties and functions
  - (iv) Immunotolerance, autoimmunity and hypersensitivity concepts
  - (v) Vaccines – Recombinant and DNA vaccines

PG FOURTH SEMESTER

ZOO - 402  
BIOTECHNOLOGY

FM: 20+80 (4 CH)

- Unit-I
- (i) Basic concept of Recombinant DNA technology
  - (ii) Enzymes of genetic engineering – Restriction enzymes, DNA ligase, Polymerase etc.
  - (iii) Cloning and expression vectors
  - (iv) Isolation of DNA, cDNA synthesis, Construction of genomic libraries
  - (v) Introduction of cloned genes into host cells
- Unit-II
- (i) Analysis and expression of cloned genes in host cells :- Blotting techniques, insitu hybridization, DNA sequencing
  - (ii) DNA fingerprinting
  - (iii) Polymerase chain reaction
- Unit-III
- (i) Animal cell culture
  - (ii) Transfection – Gene transfer in animals and production of transgenic animals
  - (iii) Transgenic animals and their applications
  - (iv) Ethical issues concerning transgenesis
  - (v) Biosafety, regulations of genetic engineering – IPR, Biosensing, DNA microarrays
- Unit-IV
- (i) Application and impact of rDNA technology in agriculture:- Gene silencing (Antisense RNA technology)
  - (ii) Application of rDNA technology in medicines – Manufacture of Biopharmaceutical products like insulin, interferon and growth hormones
  - (iii) Diagnosis and cure of diseases by gene therapy
  - (iv) Biotechnology in Forensic medicine
-

PG FOURTH SEMESTER

ZOO - 403

BIOPHYSICS, BIOPHYSICAL CHEMISTRY & INSTRUMENTATION

FM: 20+80 (4 CH)

- Unit-I
- (i) Principles of thermodynamics and their applications in biological system.
  - (ii) Concept of energy, standard free energy, free energy hydrolysis of ATP.
  - (iii) Intermolecular forces, Vander Wall's forces.
  - (iv) Chemical bonding - Ionic and Hydrogen bonding, Bond energy.
  - (v) Dipole – Dipole interactions
- Unit-II
- (i) Chemical foundations of physiology – Solutions, osmotic pressure, diffusion
  - (ii) Acid, bases, PH & PKa, Buffers and buffering action
  - (iii) Properties of water as a biological solvent.
  - (iv) Physical & chemical organization of protoplasm and its properties.
- Unit-III
- (i) Principles and uses of analytical instruments:- Balances, PH meter, calorimeter, spectrophotometer.
  - (ii) Microbial techniques – Media preparation, inoculation and growth monitoring
  - (iii) Microbial assays.
  - (iv) Cryo-techniques – Cryo-preservations of cells, tissues and organs
- Unit-IV
- (i) Microscopy – Principles and working mechanism of light, electron, phase contrast and fluorescence microscopes.
  - (ii) Separations techniques in biology – Molecular separation by chromatography, electrophoresis, organelles separation by centrifugation, cell separation by flow cytometry.
-

PG FOURTH SEMESTER

ZOO - 404

BIOSTATISTICS

FM: 20+80 (4 CH)

- Unit-I
- (i) Concept of sample and population, Sampling methods
  - (ii) Frequency Distribution (Normal, Binominal & Poisson)
  - (iii) Graphical representation of Data
  - (iv) Measures of central tendency - mean, median, mode
  - (v) Measures of Dispersion - Range, Quartile deviation, Standard deviation.
- Unit-II
- (i) Standard error of mean
  - (ii) Variance, coefficient of variance
  - (iii) ANOVA. One way classification of ANOVA, Two way classification of ANOVA, F-test
  - (iv) Probability, theorems of Probability.
- Unit-III
- (i) Testing of Hypothesis, Null Hypothesis, Alternate hypothesis
  - (ii) Test of single mean, test of difference of two means, test of significance based on students 't' test
  - (iii)  $\chi^2$  (Chi-square) test.
- Unit-IV
- (i) Correlation, types of correlation, measurement of correlation
  - (ii) Scatter diagram and Karl Pearson coefficient of correlation. Rank correlation
  - (iii) Regression Analysis. Lines of Regression and Regression coefficient.
-

PG FOURTH SEMESTER

ZOO – 405 PRACTICAL & DISSERTATION

MOLECULAR BIOLOGY, IMMUNOLOGY, BIOTECHNOLOGY, BIOPHYSICS, BIOPHYSICAL  
CHEMISTRY, INSTRUMENTATION, BIOSTATISTICS

FM: 100 (4 CH)

Unit-I	(i)	
	(ii)	
	(iii)	
	(iv)	
Unit-II	(i)	
	(ii)	
Unit-III	(i)	
	(ii)	
Unit-IV	(i)	
	(ii)	
	(iii)	
_____		

# **SEMESTER SYSTEM OF M.PHIL ZOOLOGY**

## **SEMESTER – I**

### **Paper – 611**

**(Recent Trends in Zoology)**

**Theory – Compulsory**

**Marks – 80 + 20 (4 CH)**

#### **UNIT-I: BIOPHYSICS AND BIOCHEMISTRY**

Membrane systems and Membrane transport  
Principles of Thermodynamics  
Concept of energy, standard free energy, Free energy hydrolysis of ATP  
Electron Transport System, Oxidative phosphorylation  
Amino group Metabolism  
Oxidation of Fatty acids

#### **UNIT-II : IMMUNOLOGY, BIOTECHNOLOGY AND BIOINFORMATICS**

Major Histocompatibility Complex, Auto immune diseases  
Complement Systems, Cytokines  
Monoclonal antibodies and their applications  
Techniques of Recombinant DNA technology (Blotting Techniques)  
Transfection, Transgenic Animals  
DNA Fingerprinting  
Sequence Analysis (BLAST, FASTA, CLUSTAL)

#### **UNIT –III:PHYSIOLOGY, ENDOCRINOLOGY AND ETHOLOGY**

Homeothermy (Temperature regulation) in mammals  
Hormonal regulation of Reproduction (Ovulation, Implantation, Pregnancy, Parturition, Lactation)  
Mechanism of Hormonal Action and Signal Transduction  
Biological rhythms and factors regulating biological rhythms  
Ageing: causes and theories

#### **UNIT-IV: MOLECULAR BIOLOGY AND CYTOGENETICS**

Ultrastructure of eukaryotic chromosome  
Banding patterns of chromosome  
Chromosomal Diseases in Man  
Transcription in Eukaryotes and Post- transcriptional regulation  
Translation in eukaryotes and Post –translational modifications of polypeptides  
Transposons

**SEMESTER – I**

**Paper – 612**

**(Research Methodology - I)**

**Theory – Compulsory**

**Marks – 80 + 20 (4 CH)**

**UNIT – I : SCOPE OF RESEARCH AND ETHICS:**

Introduction and Scope

Research problem: Identification, Selection, Formulation of research objectives

Research design: Components, Types and Importance

Research ethics, Institutional ethics committee

Plagiarism – Pitfall

**UNIT – II: TECHNICAL WRITING:**

Types of technical documents; Full length research paper, Short / Brief communications, Letters to editor, Book chapter, Review, Conference report, Project proposal

Components of a full length research paper; Title / Topic statement, Abstract/key words, Aims and objectives, Hypothesis building, Rationale of the paper, Work plan, Materials and methodology, Results and discussion, Key issue and arguments, Acknowledgement, Conflict of interest statement, bibliography, Technical Resumes & Cover Letters

Components of a research proposal; Project summary Key words, Origin of the proposal, Major Objectives Methodology, Instrument facility available in the PI's department, Overview of status of Research and Development in the subject, Importance of the proposed project in the context of current status, Bibliography

**UNIT – III: SCIENTOMETRICS:**

How to cite and how to do referencing

Literature search technique, using SCOPUS, Google Scholar, PUBMED, Web of Science, Indian Citation Index, and RG

Styles of referencing; APA, MLA, Oxford, Harvard, Chicago

Annotated bibliography

Tools for citing and referencing, Grammarly, Endnote etc

**UNIT – IV: PRESENTATION AND COMMUNICATION SKILLS:**

Tables, Figures and Pictures using Excel

PowerPoint slide preparation

Preparation of Posters

Electronic submission of manuscripts

Communication skills, oral and poster

# SEMESTER SYSTEM OF M.PHIL ZOOLOGY

## SEMESTER – I

### Paper – 613

#### (Research Methodology - II)

Theory – Compulsory

Marks – 80 + 20 (4 CH)

#### **UNIT – I : IPR AND CYBER LAW:**

Patents

Patent laws, process of patenting a research finding

Intellectual property (IP), Intellectual property right (IPR)

Copyright, Trademarks, GI

Cyber laws

COPE

#### **UNIT – II: QUANTITATIVE DATA ANALYSES:**

Types of data, Data collection - Methods and Tools

Hypothesis testing

Normal and Binomial distributions and their property

Tests of significance: Student t-test, F-test, Chi-square test

Correlation and Regression

ANOVA - One-way and Two-way, Multiple-range test

#### **UNIT – III: COMPUTER FUNDAMENTALS:**

Introduction to MS-Office software: MS-Word (Track change)

MS-Excel

MS-Power Point

MS-Access

Features for Statistical data analysis using computers and software

Microsoft Excel Data Analysis Tool Pak, SPSS

#### **UNIT – IV: ADVANCED TOOLS & TECHNIQUES**

Microscopic techniques – Compound Microscopy, Fluorescence

Microscopic and Electron microscopy

Colorimeter, Spectrophotometer

Principle, protocol and application of Chromatography – GLC & HPLC

Electrophoresis and its application.

PCR, Real time PCR

DNA microarray, DNA sequencing

# SEMESTER SYSTEM OF M.PHIL ZOOLOGY

## SEMESTER – I

### Paper – 614

Marks – 100 (4 CH)

## TEACHING ASSIGNMENT

## SEMESTER – II

### Paper – 621

Marks – 150 + 25+25 (8 CH)

## DISSERTATION

(Thesis + Seminar Presentation of the Thesis + Viva – Voce)

### Books Recommended:

- |  |  |
|--|--|
| Alberts, B., Johnson A., Lewis J, et al. | Molecular Biology of the Cell  |
| Andreoli, T.E, Hoffman, J.F. et al       | Membrane transport process in organized system   |
| Barret, K.E et al.                       | Gangong's Review of Medical Physiology   |
| Baxevanis, A.D. and Ouellete, F.F        | Bioinformatics: A practical guide to the analysis of gene and proteins                     |
| Buranen L and Roy AM                     | Perspective on Plagiarism and intellectual Property in a Post-Modern World                 |
| Campbell RC                              | Statistics for biologists  |
| Cassel P et al.                          | Inside Microsoft Office Professional   |
| Chatwal and Chatwal                      | Instrumentation  |
| Coleman P and Dyson P                    | Mastering Internets  |
| Cooper, Geoffrey M                       | The Cell: A molecular Approach   |
| Cox, M.M and Nelson, D.L                 | Principles of Biochemistry   |
| Epplen,J. And Lubjuhnn,T.                | DNA profiling and DNA Fingerprinting   |
| Gilmore B                                | Plagiarism: why it happens, how to prevent it?   |
| Gralla P                                 | How the Internet Works   |
| Gupta, P.K.                              | Molecular Biology  |
| Gupta, P.K.                              | Biotechnology and Bioinformatics   |
| Guyton and Hall                          | A textbook of Medical Physiology   |
| Habraken J                               | Microsoft® Office 2003 All in one, Microsoft ® Office 2010 in Depth                        |
| Hall, J.E                                | Guyton and Hall : Textbook of Medical Physiology   |
| Kaufman, Myron                           | Principles of thermodynamics   |
| Kothari, CR                              | Research Methodology   |
| Kirby,L.T                                | DNA Fingerprinting: An Introduction  |
| Kreitzman, Leon &Foster, R.              | The Rhythms of Life: The biological clocks that control daily lives of every living thing. |
| Kuby, Janis                              | Immunology   |
| Kumar Anupa P                            | Cyber Law  |
| Kumar, Pranav                            | Biophysics and Molecular Biology   |
| Lewin, B                                 | Genes IX   |
| Lodish, H., Berk,A. et al.               | Molecular Cell Biology   |
| Olander, D.R.                            | General Thermodynamics   |
| Power, C.B.                              | Cell Biology(Vol-II)   |
| R Panneerselvam                          | Research Methodology   |

Rao, Y.V.C  
Russel  
Sharma, B.K  
Shelly GB, Vermaat ME, Cashman TJ  
Shourie, Abhilasha & Chapadgaonkar, Shilpa S.  
Shukla, A.N.  
Singh, B.D. and Singh, R.P.  
Stryer, Lubert  
Tortora, G.J and Derrickson, B.  
Voet, D and Voet, J.G  
Vogel, AL  
Watson, J.D  
Wilson, K. And Walker, J.

An Introduction to thermodynamic  
i-Genetics: A molecular approach  
Instrumental method of analysis  
Microsoft® 2007, Introductory Concepts and Techniques.  
Bioanalytical techniques  
Textbook of Chronobiology  
Biotechnology  
Biochemistry  
Principles of Anatomy and Physiology  
Biochemistry  
Analytical chemistry  
Molecular Biology of the Gene  
Biochemistry and Molecular Biology

# SEMESTER SYSTEM OF Ph.D ZOOLOGY

## Paper – 711

(Recent Trends in Zoology)

Theory – Compulsory

Marks – 80 + 20 (4 CH)

### **UNIT-I: BIOPHYSICS AND BIOCHEMISTRY**

Membrane systems and Membrane transport  
Principles of Thermodynamics  
Concept of energy, standard free energy, Free energy hydrolysis of ATP  
Electron Transport System, Oxidative phosphorylation  
Amino group Metabolism  
Oxidation of Fatty acids

### **UNIT-II : IMMUNOLOGY, BIOTECHNOLOGY AND BIOINFORMATICS**

Major Histocompatibility Complex, Auto immune diseases  
Complement Systems, Cytokines  
Monoclonal antibodies and their applications  
Techniques of Recombinant DNA technology (Blotting Techniques)  
Transfection, Transgenic Animals  
DNA Fingerprinting  
Sequence Analysis (BLAST, FASTA, CLUSTAL)

### **UNIT –III:PHYSIOLOGY, ENDOCRINOLOGY AND ETHOLOGY**

Homeothermy (Temperature regulation) in mammals  
Hormonal regulation of Reproduction (Ovulation, Implantation, Pregnancy, Parturition, Lactation)  
Mechanism of Hormonal Action and Signal Transduction  
Biological rhythms and factors regulating biological rhythms  
Ageing: causes and theories

### **UNIT-IV: MOLECULAR BIOLOGY AND CYTOGENETICS**

Ultrastructure of eukaryotic chromosome  
Banding patterns of chromosome  
Chromosomal Diseases in Man  
Transcription in Eukaryotes and Post- transcriptional regulation  
Translation in eukaryotes and Post –translational modifications of polypeptides  
Transposons

**Paper – 712**  
**(Research Methodology - I)**  
**Theory – Compulsory**  
**Marks – 80 + 20 (4 CH)**

**UNIT – I : SCOPE OF RESEARCH AND ETHICS:**

Introduction and Scope

Research problem: Identification, Selection, Formulation of research objectives

Research design: Components, Types and Importance

Research ethics, Institutional ethics committee

Plagiarism – Pitfall

**UNIT – II: TECHNICAL WRITING:**

Types of technical documents; Full length research paper, Short / Brief communications, Letters to editor, Book chapter, Review, Conference report, Project proposal

Components of a full length research paper; Title / Topic statement, Abstract/key words, Aims and objectives, Hypothesis building, Rationale of the paper, Work plan, Materials and methodology, Results and discussion, Key issue and arguments, Acknowledgement, Conflict of interest statement, bibliography, Technical Resumes & Cover Letters

Components of a research proposal; Project summary Key words, Origin of the proposal, Major Objectives Methodology, Instrument facility available in the PI's department, Overview of status of Research and Development in the subject, Importance of the proposed project in the context of current status, Bibliography

**UNIT – III: SCIENTOMETRICS:**

How to cite and how to do referencing

Literature search technique, using SCOPUS, Google Scholar,

PUBMED, Web of Science, Indian Citation Index, and RG

Styles of referencing; APA, MLA, Oxford, Harvard, Chicago

Annotated bibliography

Tools for citing and referencing, Grammarly, Endnote etc

**UNIT – IV: PRESENTATION AND COMMUNICATION SKILLS:**

Tables, Figures and Pictures using Excel

PowerPoint slide preparation

Preparation of Posters

Electronic submission of manuscripts

Communication skills, oral and poster

## **SEMESTER SYSTEM OF Ph.D ZOOLOGY**

**Paper – 713**  
**(Research Methodology - II)**  
**Theory – Compulsory**  
**Marks – 80 + 20 (4 CH)**

**UNIT – I : IPR AND CYBER LAW:**

Patents

Patent laws, process of patenting a research finding

Intellectual property (IP), Intellectual property right (IPR)

Copyright, Trademarks, GI

Cyber laws

COPE

**UNIT – II: QUANTITATIVE DATA ANALYSES:**

Types of data, Data collection - Methods and Tools

Hypothesis testing

Normal and Binomial distributions and their property

Tests of significance: Student t-test, F-test, Chi-square test

Correlation and Regression

ANOVA - One-way and Two-way, Multiple-range test

**UNIT – III: COMPUTER FUNDAMENTALS:**

Introduction to MS-Office software: MS-Word (Track change)

MS-Excel

MS-Power Point

MS-Access

Features for Statistical data analysis using computers and software

Microsoft Excel Data Analysis Tool Pak, SPSS

**UNIT – IV: ADVANCED TOOLS & TECHNIQUES**

Microscopic techniques – Compound Microscopy, Fluorescence

Microscopic and Electron microscopy

Colorimeter, Spectrophotometer

Principle, protocol and application of Chromatography – GLC & HPLC

Electrophoresis and its application.

PCR, Real time PCR

DNA microarray, DNA sequencing

# SEMESTER SYSTEM OF Ph.D ZOOLOGY

## Paper – 714

Marks – 150+25+25=200 (8 CH)

### REVIEW WORK

(Report Writing + Seminar Presentation of the Report  
+ Viva – Voce)

#### Books Recommended:

- Alberts, B., Johnson A., Lewis J, et al.  
Andreoli, T.E, Hoffman, J.F. et al  
Barret, K.E et al.  
Baxevanis, A.D. and Ouellete, F.F
- Buranen L and Roy AM
- Campbell RC  
Cassel P et al.  
Chatwal and Chatwal  
Coleman P and Dyson P  
Cooper, Geoffrey M  
Cox, M.M and Nelson, D.L  
Epplen, J. And Lubjuhn, T.  
Gilmore B  
Gralla P  
Gupta, P.K.  
Gupta, P.K.  
Guyton and Hall  
Habraken J
- Hall, J.E  
Kaufman, Myron  
Kothari, CR  
Kirby, L.T  
Kreitzman, Leon & Foster, R.
- Kuby, Janis  
Kumar Anupa P  
Kumar, Pranav  
Lewin, B  
Lodish, H., Berk, A. et al.  
Olander, D.R.  
Powar, C.B.  
R Panneerselvam  
Rao, Y.V.C  
Russel  
Sharma, B.K  
Shelly GB, Vermaat ME, Cashman TJ  
Shourie, Abhilasha & Chapadgaonkar, Shilpa S.  
Shukla, A.N.  
Singh, B.D. and Singh, R.P.  
Stryer, Lubert
- Molecular Biology of the Cell  
Membrane transport process in organized system  
Gangong's Review of Medical Physiology  
Bioinformatics: A practical guide to the analysis of gene and proteins  
Perspective on Plagiarism and intellectual Property in a Post-Modern World  
Statistics for biologists  
Inside Microsoft Office Professional  
Instrumentation  
Mastering Internets  
The Cell: A molecular Approach  
Principles of Biochemistry  
DNA profiling and DNA Fingerprinting  
Plagiarism: why it happens, how to prevent it?  
How the Internet Works  
Molecular Biology  
Biotechnology and Bioinformatics  
A textbook of Medical Physiology  
Microsoft® Office 2003 All in one, Microsoft ® Office 2010 in Depth  
Guyton and Hall : Textbook of Medical Physiology  
Principles of thermodynamics  
Research Methodology  
DNA Fingerprinting: An Introduction  
The Rhythms of Life: The biological clocks that control daily lives of every living thing.  
Immunology  
Cyber Law  
Biophysics and Molecular Biology  
Genes IX  
Molecular Cell Biology  
General Thermodynamics  
Cell Biology(Vol-II)  
Research Methodology  
An Introduction to thermodynamic  
i-Genetics: A molecular approach  
Instrumental method of analysis  
Microsoft® 2007, Introductory Concepts and Techniques.  
Bioanalytical techniques  
Textbook of Chronobiology  
Biotechnology  
Biochemistry

Tortora, G.J and Derrickson,B.  
Voet, D and Voet, J.G  
Vogel, AL  
Watson,J.D  
Wilson,K. And Walker,J.

Principles of Anatomy and Physiology  
Biochemistry  
Analytical chemistry  
Molecular Biology of the Gene  
Biochemistry and Molecular Biology