COURSES OF STUDIES

FOR POST GRADUATE DEGREE

IN ZOOLOGY

(SEMESTER SYSTEM)

Session: 2020-21

GANGADHAR MEHER UNIVERSITY,

AMRUTA VIHAR, SAMBALPUR-768004

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

FIRST SEMESTER

Paper No.	Name of the Papers	Credit
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

Paper No.	Name of the Papers	Credit
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

Paper No.	Name of the Papers	Credit
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		4
ZOO – 306A	General Zoology	4
ZOO– 306B	Animal behaviour & applied Zoology	4
ZOO– 306C	Medical diagnostics	

FOURTH SEMESTER

Paper No.	Name of the Papers	Credit
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

ZOO – 101

NONCHORDATA

FM: 20+80 (4 CH)

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

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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

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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)	Palaentology – 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

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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 quadrate 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.

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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)	Ethlogical 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

PG SECOND SEMESTER

ZOO - 204

CYTOGENETICS

FM: 20+80 (4 CH)

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.

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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)	
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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.

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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.

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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.

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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) Pole 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.

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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, Gluconeo genesis , 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 – β-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

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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)	
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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.

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PG THIRD SEMESTER

ZOO – 306B

ANIMAL BEHAVIOUR & CHRONOBIOLOGY

FM: 20+80 (4 CH)

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.

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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

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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 ligage, 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 engineerting – 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

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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.

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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) x^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.

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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 – 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, Parturtion, 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

Componentsof a fulllength 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 – 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
Powar, C.B.	Cell Biology(Vol-II)
R Panneerselvam	Research Methodology

Rao,Y.V.C	An Introduction to thermodynamic
Russel	i-Genetics: A molecular approach
Sharma, B.K	Instrumental method of analysis
Shelly GB, Vermaat ME, Cashman TJ	Microsoft® 2007, Introductory Concepts and Techniques.
Shourie, Abhilasha & Chapadgaonkar, Shilpa S.	Bioanalytical techniques
Shukla, A.N.	Textbook of Chronobiology
Singh, B.D. and Singh, R.P.	Biotechnology
Stryer, Lubert	Biochemistry
Tortora, G.J and Derrickson,B.	Principles of Anatomy and Physiology
Voet, D and Voet, J.G	Biochemistry
Vogel, AL	Analytical chemistry
Watson,J.D	Molecular Biology of the Gene
Wilson,K. And Walker,J.	Biochemistry and Molecular Biology

Paper – 711

(Recent Trends in Zoology)

Theory – Compulsory

Marks – 80 + 20 (4 CH)

UNIT-I: BIOPHYSICS AND BIOCHEMISTRY

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Concept of energy, standard free energy, Free energy hydrolysis of ATP
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Amino group Metabolism
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Monoclonal antibodies and their applications
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Transfection, Transgenic Animals
DNA Fingerprinting
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Hormonal regulation of Reproduction (Ovulation, Implantation, Pregnancy, Parturtion, Lactation)
Mechanism of Hormonal Action and Signal Transduction
Biological rhythms and factors regulating biological rhythms
Ageing: causes and theories

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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

Componentsof a fulllength 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

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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
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Tests of significance: Student t-test, F-test, Chi-square test
Correlation and Regression
ANOVA - One-way and Two-way, Multiple-range test

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MS-Power Point
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Microsoft Excel Data Analysis Tool Pak, SPSS

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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.	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
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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
Powar, C.B.	Cell Biology(Vol-II)
R Panneerselvam	Research Methodology
Rao,Y.V.C	An Introduction to thermodynamic
Russel	i-Genetics: A molecular approach
Sharma, B.K	Instrumental method of analysis
Shelly GB, Vermaat ME, Cashman TJ	Microsoft® 2007, Introductory Concepts and Techniques.
Shourie, Abhilasha & Chapadgaonkar, Shilpa S.	Bioanalytical techniques
Shukla, A.N.	Textbook of Chronobiology
Singh, B.D. and Singh, R.P.	Biotechnology
Stryer, Lubert	Biochemistry

Tortora, G.J and Derrickson,B.	Principles of Anatomy and Physiology
Voet, D and Voet, J.G	Biochemistry
Vogel, AL	Analytical chemistry
Watson,J.D	Molecular Biology of the Gene
Wilson,K. And Walker,J.	Biochemistry and Molecular Biology