

PG DEPARTMENT OF ZOOLOGY

M.Sc. ZOOLOGY SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

S.C.S. (A) College, Puri



Academic Session

2017 - 2019

CBCS – M.Sc. Zoology Syllabus

Website: www.scscollege.nic.in

Semester – I

Hard Core Course

Course No.	Course Title	Lecturer	Credits	Marks
Zoo – 101	Non Chordates, Biosystematics and Taxonomy	40	4	100
Zoo – 102	Cell Biology and Genetics	40	4	100
Zoo – 103	Physiology, History and Histochemistry	40	4	100
Zoo – 104	Techniques and Instrumentation Statistics and Bioinformatics	40	4	100
Zoo – 105	Practical related to theory papers	60	6	100

Total Credits – 22, Marks - 500

Semester – II

Hard Core Course

Course No.	Course Title	Lecturer	Credits	Marks
Zoo – 201	Biophysics, Biochemistry and Molecular Biology	40	4	100
Zoo – 202	Microbiology and Immunology	40	4	100
Zoo – 203	Endocrinology and Reproductive Physiology	40	4	100
Zoo – 204	Environmental Biology and Wildlife	40	4	100
Zoo – 205	Practical related to theory papers	60	6	100
	Seminar Presentation	-	1	-

Total Credits – 23, Marks - 500

Semester – III

Hard Core Course

Course No.	Course Title	Lecturer	Credits	Marks
Zoo – 301	Chordates, Evolution and Paleo-Zoology	40	4	100
Zoo – 302	Economic Zoology and Aquaculture	40	4	100
Zoo – 303	Developmental Biology	40	4	100
Zoo – 304	Animal Behaviour and Adaptive Physiology	40	4	100
Zoo – 305	Practical related to theory papers	60	6	100
	Seminar Presentation	-	1	-

Total Credits – 23, Marks - 500

CORE ELECTIVE COURSE (if more than one of these courses are offered in a year, a student is required to choose only one i.e. 'a' or 'b' or 'c' or 'd')

Semester – IV

Applied Zoology and Biotechnology

Course No.	Course Title	Lecturer	Credits	Marks
Zoo – 401a	Molecular Biology, Genetic Engineering and Biotechnology	40	4	100
Zoo – 402a	Microbial Biotechnology and Microbial Ecology	40	4	100
Zoo – 403a	Animal Development and Neurobiology	40	4	100
Zoo – 404a	Conservation Biology and Environmental Biotechnology	40	4	100
Zoo – 405a	Practical related to theory	60	6	100

CORE PAPERS

Zoo -101: NON-CHORDATES, BIOSYSTEMATICS AND TAXONOMY

Non-Chordates:

UNIT – I

Protozoan diseases in man, Reproduction in sponges, Polymorphism in Coelenterates, Helminth parasites and human diseases/Soil nematodes and plant nematodes. Metamerism and Segmentation in Annelids.

UNIT – II

Crustacean parasites, Vision in insects. Biology of locusts, Biology of termites. Horseshoe crabs and their importance, Shell in molluscs, Larval forms in echinoderms and Role of echinoderms in origin of chordates.

Biosystematics and Taxonomy:

UNIT – III

Definition and basic concepts of Biosystematics and Taxonomy, Historical resume of systematics, Importance and applications of biosystematics in biology, Materials basis of biosystematics : different attributes. Trends in biosystematics - concepts of different conventional and newer aspects like Chemotaxonomy, Cyto-taxonomy and Molecular taxonomy,

UNIT – IV

Dimensions of speciation and taxonomic characters, Species concepts - species category, different species concepts, sub-species and other intraspecific categories and Theories of biological classification, Hierarchy of categories.

UNIT – V

Procedure keys in taxonomy, Taxonomic procedures - Taxonomic collections, Preservation, Curation, Process of identification. International Code of Zoological Nomenclature (ICZN) - its operative principles, Interpretation and application of important rules, Zoological nomenclature, Formation of scientific names of various taxa, Evaluation of biodiversity indices - Shannon-Winner Index, Dominance index, Similarity and dissimilarity index and Association Index.

Zoo – 102: CELL BIOLOGY AND GENETICS

Cell Biology

UNIT – I

Introduction - Experimental systems in cell biology, Cell concept. Bio membranes: Molecular composition and arrangement, Functional consequences, Transport across cell membrane diffusion, active transport, uniports, symports and antiports. Membrane modifications, Zonulaoccludens, Zonulaadherens, Macula adherens, Gap junction (Nexus).

UNIT – II

Cytoskeleton: Micro-filaments and microtubules - structure and dynamics, Microtubules and Mitosis, Structure and function of cilia and flagella, Structure, Orientation and behaviour of chromosomes, Cell Cycle, Cell signalling.

UNIT – III

Cell cloning and its application (Origin, Development and Future prospect), Genetic analysis in cell biology, Testing of genetic toxicity, various experimental methods of harvesting of Cells (testes, bone marrow), Preparation of chromosomes and analysis.

Genetics

UNIT – IV

Laws of heredity, Co-and incomplete dominance, Gene linkage, Varieties of Gene expression -lethal genes, multiple alleles, pleiotropic genes, gene interactions, epistasis. structural and numerical alterations of chromosomes and meiotic consequences, Cytoplasmic inheritance : Sex-chromosome systems; Different mechanisms of sex determination in animals (Drosophila, Man, Bees and Bonellia).

UNIT – V

Human genetics - Chromosomal disorder, Some common human syndromes, Twin study, Superfoetation, Polyembryony, Free Martin, Multiple birth, Genetic counseling, Amniocentesis, Nature and function of genetic material, Chemical compounds causing genetic damage, Gene mapping and genome analysis.

Zoo – 103: PHYSIOLOGY, HISTOLOGY AND HISTOCHEMISTRY

Physiology

UNIT – I

Transport across cell membrane Composition of blood, Blood groups and mechanism of blood coagulation, The lymphatic system.

UNIT – II

Pulmonary ventilation, Respiratory surface and Gas exchange, Regulation of respiration, Transport of gases, Acid-base balance, Excretory system: Urine formation, Glomerular filtration, Tubular function, Renal Mechanism of concentrating and diluting urine.

UNIT – III

Osmoregulation-Fresh water, Marine and terrestrial invertebrates and vertebrates/ Nutrition-Macro and Micro-nutrients, Diversity in vertebrate digestive structures, Vitamins.

Histology

UNIT – IV

Basic requirement of a histological preparation Epithelial Tissue: Classification, types of epithelial tissues and their function, Connective tissue: Classification, types of connective tissue and their functions, Bone and Cartilage.

HISTOCHEMISTRY

UNIT – V

Basic requirements of a histochemical test: General principles of demonstration of carbohydrates, lipids, protein and nucleic acids, Enzyme histochemistry: it's important considerations, principles of demonstration of enzymes: dehydrogenases, esterases and phosphatases, Affinity histochemistry.

Zoo – 104: TECHNIQUES, INSTRUMENTATION, STATISTICS AND BIOINFORMATICS

Instrumentation and Techniques

UNIT – I: Instrumentation and Techniques – I

Microscopy: Principle of operation and Instrumentation of light, Fluorescent and Electron microscopy, Microtomy: Chromosome analysis, Karyotyping and Karyo- morphometrical analysis, Taxidermy.

UNIT – II: Instrumentation and Techniques – II

Centrifugation: Principle of sedimentation, Methods in preparatory ultracentrifugation (Differential and density gradient Centrifugation). Chromatography: Principle and application for molecular exclusion chromatography, Ion exchange chromatography, Affinity chromatography, Gas-liquid chromatography and HPLC. Electrophoresis: Principle and application of electrophoretic separation, Types of solid support used (Cellulose acetate, Starch, Agar, Agarose and PAGE) and its importance, Isoelectrofocussing,

UNIT – III: Instrumentation and Techniques – III

Spectrophotometry: Principle and application of ultraviolet and visible spectrophotometry and Spectrofluorimetry, X-ray diffraction crystallography, Radioisotopic techniques : Nature of radioactivity, application of radioactivity in biology (carbon dating, liquid scintillation counting, autoradiography).

Biostatistics:

UNIT – IV

Definition and scope of biostatistics, Measures of central tendency (Mean, Median, Mode), Measures of dispersion, Coefficient of variation, Equation and graphs of linear and exponential relation, Elementary idea about probability, Normal, Poisson, Binomial distribution, Tests of significance (t and chi-square tests),

Biostatistics and Bioinformatics

UNIT – V

Simple correlation and regression, Analysis of variance (single factor design and their applications). Sampling techniques (Random sampling etc.)
Bioinformatics: Definition and applications, Data base search for DNA and Protein sequences.

ZOO – 201: BIOPHYSICS, BIOCHEMISTRY AND MOLECULAR BIOLOGY

Biophysics

UNIT – I

Concept of Biomolecules: Chemical composition and bonding, three dimensional structure, Chemical reactivity, macromolecules and their monomeric subunits, Weak interactions in aqueous system, ionization of water, weak acids, weak bases, buffers and buffering capacity, Principle of bioenergetics: Bioenergetics and thermodynamics, phosphoryl group transfers and ATP, Biological oxidation-reduction reactions.

Biochemistry

UNIT – II: Biochemistry – I

Amino acids and proteins: Types of amino acids and their properties, The peptide bond, biologically active peptides, Properties of proteins, Amino acid and sequence of proteins and its importance, three dimensional structure of proteins (secondary, tertiary and quaternary structure), protein denaturation and folding.

Carbohydrates: Classification, Glycoconjugates (Proteoglycans, Glycoproteins and Glycolipids) Lipids: Storage lipids, structural lipids in membranes, lipids as signals, cofactors and pigments Coenzymes and vitamins.

UNIT – III: Biochemistry-II

Enzymes: Nomenclature, Classification and properties, kinetics and mechanism of action (carboxypeptidase), Regulation (allosteric, phosphorylation and proteolytic cleavage), Metabolism of amino acid: Transamination, oxidative deamination and urea cycle.

UNIT – IV: Biochemistry-III

Metabolism of carbohydrates : Glycolysis, Pentose-phosphate pathway, TCA cycle, Gluconeogenesis, Glycogen metabolism, Regulation of carbohydrate metabolism, Oxidative phosphorylation, Electron transport chain and ATP synthesis, Metabolism of lipids : beta-oxidation of fatty acids, Biosynthesis of fatty acids.

Molecular biology

UNIT – V

Physicochemical properties of nucleic acids, DNA double helical structure, types, structural peculiarities, size, sequence, organization in chromatin, super coiling, sequencing methods of nucleic acids, DNA replication and repair, Types of RNA, mRNA synthesis, mRNA processing, RNA dependent synthesis of DNA, Genetic code, Protein synthesis.

Zoo – 202: MICROBIOLOGY AND IMMUNOLOGY

Microbiology

UNIT – I

Introduction: Concept of microbiology, Microbes and man, History of microbiology, Divisions of Microbiology, Microscopy, Microscopic units, Microbial culture, Pure culture, Subculture, Stains of microbes. Structural organisation: Prokaryotic microorganisms, Structural details of prokaryotic cell, Difference between prokaryotic and eukaryotic cell, Eukaryotic microbes (Protozoa). Structure of bacteria, virus (Bacteriophage) and multiplication (Lytic, cycle and Lysogenic cycle)

UNIT – II

Microbial genetics: Concept of genetic recombination of bacteria, Transformation, Transduction and Sexduction (Conjugation). Application and importance of microbiology: Bacteria! diseases of man (Microbes in air, water and soil), Airborne, Foodborne, Waterborne, Soilborne, Sexually-transmitted and contact diseases, Viral diseases of man, Industrial microbiology, Biomineralization (Microbial leaching).

Immunology

UNIT – III

Innate and adaptive Immunity: Organization and Structure of lymphoid organs, Antigens and antibodies, Atfigen-antibody reaction, Structure of immunoglobulins.

UNIT – IV

Humoral and cell mediated immunity, Regulation of immune response, Major histocompatibility complex and HLA system, Complement and its action.

UNIT – V

Immunological aspects of transplantation, Autoimmunity, Immunotolerance, Hypersensitivity concept, Vaccines, Interferons and Episomes

Zoo – 203: ENDOCRINOLOGY AND REPRODUCTIVE PHYSIOLOGY

Endocrinology

UNIT – I

Chemical messengers, Hormones and their feedback systems, Steroid mechanisms of hormone action (Fixed membrane - and mobile-receptor mechanisms), Receptor signal transductions, Techniques in endocrinology (Bioassay and Radioimmunoassay) Pineal, Thymus and gastrointestinal hormones Anatomy, Chemistry, Assay and Biological action of adenohipophysial and neurohipophysial hormones, Pituitary pathophysiology.

UNIT – II

Hypothalamic control of adenohipophysial function, Neuroendocrine system and neurosecretion Clinical aspects of the hypothalamo-hipophysial system Thyroid gland: Anatomy, biosynthesis and function of thyroid hormones, Antithyroid agents and control of thyroid secretion, Parathyroid gland: Anatomy, Regulation of secretion and function of parathyroid hormone.

UNIT – III

Endocrine pancreas: Anatomy, regulation of secretion, Chemistry and functions of insulin and glucagon. Adrenal gland (cortex and medulla) Anatomy, biosynthesis, function of cortical and medullary hormones and regulation of their secretion, General idea about hormones influencing carbohydrate metabolism, hormones of some invertebrates.

Reproductive Physiology

UNIT – IV

Structure of male reproductive system, Testicular events and biosynthesis of testosterone. Structure of sperm, Biochemistry of semen, Capacitation of spermatozoa, Structure of female reproductive system, Folliculogenesis, Ovulation, Luteinization, Estrous cycle, Menstrual cycle, Menopause, Major endocrine disorder-related to reproduction, Endocrinology of implantation, Parturition, Role of hormones during pregnancy Endocrinology of lactation.

UNIT – V

Steroids and their biosynthesis, Steroid hormones and brain differentiation, Transport of steroid hormones in blood, Metabolism and excretion of steroid hormones, Sterility, its causes and control, Artificial insemination, in vitro fertilization and embryo transfer. Fertility control, Contraception: Natural and chemical methods, Oral contraception, Contraceptives of future.

Zoo – 204: ENVIRONMENTAL BIOLOGY AND WILDLIFE

Environmental Biology

UNIT – I

Ecosystem: Component parts, energy sources and energy flow in ecosystems, Food chains and Food webs, Trophic levels, Ecological Pyramids, Ecological niche, Ecological factor (Temperature and light), Carbon and Nitrogen cycle, Resource Biology: Classification of resources, Non-renewable resources, Mineral resources, Renewable resources.

UNIT – II

Ecological succession, Microbes in decomposition and recycling process, Aquatic biology, Physiochemical and biological properties of water, Primary productivity, Waste utilization, Harmful effect of insecticides and pesticides. Biogas, Biomass, Sola energy, Coal, Wind mills, Habitat and Niche.

UNIT – III

Environment pollution: Air pollution, Water pollution, Soil Pollution, Noise pollution, pollution, Solid waste pollution, Ozone layer depletion, Hazardous wastes and Toxic chemicals Acid rains, Green house effect, Global warming.

Wildlife

UNIT – IV

Biography of India with reference of distribution of animals, Rare and endangered species of India, Wildlife in Odisha.

(a) Mammals: Blackbuck, Bison, Swamp deer, Wild buffalo, Elephant, Lion Indian rhinoceros, Tiger, Wild ass, Dugong.

(b) Birds: Horn bills, Pea fowl, White winged duck, Pink headed duck, Jerdoncursor.

(c) Reptiles: *Gavialis gangeticus*, *Crocodylus porosus*, *Crocodylus palustris*, Monitor lizards Olive ridley sea turtle, Indian python.

Threatened species of mammals of India, General methods of wildlife census, Wildlife Sanctuaries, National Parks, Biosphere Reserves and Zoos.

Wildlife Conservation

UNIT – V

Crocodile conservation in India, Sea turtle conservation in India, Project tiger in India, Elephant conservation in India, Wildlife (Protection) Act of Government of India (1972), Forest Conservation Act (1980).

Zoo – 301: CHORDATES, EVOLUTION AND PALEOZOLOGY

Chordates

UNIT – I

Affinities of *Balanoglossus*, Reproduction and colony formation in Urochordates, *Amphioxus* and its special status, Cyclostomes and their affinities, Migration in fishes, Parental care, Luminous organs in fishes, Air breathing fishes, Origin and evolution of Amphibia, Origin of Reptilia, Classification of reptiles basing on skull pattern.

UNIT – II

Origin, Migration of birds, Plumage and colouration, Nesting habit in birds, Origin and early history of mammals, Systematic position of prototherians, Adaptive radiation in 'marsupials', Adaptive radiation in mammals, Evolution of primates (excluding man), Dentition in mammals.

Evolution

UNIT – III

Evolutionary evidences and theories, Variation and selection as underlying mechanisms' of evolution, Types and rates of mutation in population, Mechanism of isolation, Origin of species.

UNIT – IV

Evolutionary trends (micro, macro and mega patterns of evolution), Molecular and genomic evolution, Gene flow, Gene duplication and mosaic evolution, Modes of speciation, Biological and Cultural evolution of man.

Palaeozoology

UNIT – V

Survey of life through different geological era, Structure and affinities of trilobite, Evolution of camel and elephant, Formation and types of fossils.

Zoo – 302: ECONOMIC ZOOLOGY AND AQUACULTURE

Economic Zoology

UNIT – I

Insects of commercial importance, Silkworm and sericulture, Honey bee and apiculture, Lac insect and lacculture, Insect pests of medical and veterinary importance with special reference to mosquitoes, flies, lice and ticks.

UNIT – II

Insect pests of some major crops (rice, wheat, oilseeds, pulses and vegetables) Pests of stored food products and their control, Wetland resources, Earthworm and soil fertility, Economic importance of molluscs

Aquaculture

UNIT – III

Classification of fishes upto Orders, Ecology and productivity of fish ponds: Ecology and physical conditions, Biological conditions of water, Aquatic vegetation. Plankton, Chemical conditions of soil, Weeds and their control, Acid rain.

UNIT – IV

Induced breeding, Bundh breeding, Fish seed trade, Fish Culture, Air breathing fishes, Composite fish culture, Pearl culture, Prawn farming, Sewage fed fisheries, Effects of pollutants on fish and fish food organisms.

UNIT – V

Fish in relation to public health, Fish pathology, Parasitic infection and non-parasitic infection, Various types of nets. Traps, Crafts used in India, Electrofishing, Light fishing, Fish finding (Echosounder and sonar) Post-harvesting technology: Freezing, Canning Marketing and Fish farm management.

ZOO – 303: DEVELOPMENTAL BIOLOGY

UNIT – I

History of developmental biology (Contributions of Spemann, Hilde Mangold, Holtfreter, Needham, Waddington, Spratt, Briggs and King, Patric Steptoe and Robert Edwards).

UNIT – II

Gametogenesis: Spermatogenesis, Oogenesis, Fertilization: morphological aspects, Biochemical events of fertilization.

UNIT – III

Embryonic adaptations: Placentation and implantation in mammals, Biochemical aspects of placentation. Organogenesis: Embryonic induction, Movement of cells over long distance (Neural crest and primordial germ cells).

UNIT – IV

Growth: Growth at cellular and intracellular level, Growth at organismic level and Growth curves. Regeneration: Regeneration in invertebrates and vertebrates, Role of nervous system in regeneration.

UNIT – V

Metamorphosis: Biochemical aspects of metamorphosis in insects and amphibians, Nucleocytoplasmic interactions, Nuclear transplantation in vertebrate embryos, Homeotic genes and homeotic transformation in anuran tadpoles.

Zoo – 304: ANIMAL BEHAVIOUR AND ADAPTIVE PHYSIOLOGY

Animal Behaviour

UNIT – I

Ethology as a branch of biology, Classification and analysis of behaviour patterns, Methods of behavioural study, Studies in nature or wild, Studies in laboratory, Neural and hormonal control of behaviour, Mammalian nervous system and behaviour.

UNIT – II

Hormones and behaviour, Pheromones and behaviour, Biological rhythms, Circadian clock, Circannual clock, Orientation and Navigation, Migration of fish, Migration of bird.

UNIT – III

Ecological aspects of behaviour, Habitat selection, Food selection, Aggression, Homing, Territoriality, Mimicry, Host parasite relation, Social behaviour, Aggression - Schooling in fish, Flocking birds, Herding in mammals, Social organisation in insects and primates, Reproductive behaviour, Courtship, Mating systems, Mating groups, Parental care.

Adaptive Physiology

UNIT – IV

Adaptation: Mechanisms of adaptation, Physiological adaptations in different environments. Freshwater, Ecological factors (Temperature and light), Parasitic, Stress Physiology, environmental stress and strain, Stress resistance, Stress avoidance and Stress tolerance.

UNIT – V

Adaptation, Acclimation and Acclimatization, Homeostasis, Physiological adaptation to osmotic and ionic stress, Mechanism of cell volume regulation, Osmoregulation in aqueous environment, Physiological response to oxygen deficient stress.

CORE ELECTIVE (Special Paper)

(a) Applied Zoology and Biotechnology

Zoo – 401A: MOLECULAR BIOLOGY, GENETIC ENGINEERING AND BIOTECHNOLOGY

Molecular Biology

UNIT – I: Molecular Biology – I

Genes and genome in prokaryotes and eukaryotes, Regulation of gene expression in Prokaryotes: Operon concept, lac-operon; trp-operon, transcription attenuation, Lytic and Lysogenic cascades.

UNIT – II: Molecular Biology – II

Regulation of gene expression in eukaryotes: Types of eukaryotic promoters, DNA-binding domains and protein-protein binding domains of regulatory proteins, Signal integration and combinatorial control Transcriptional repressors, Signal transduction and control of transcription and control of transcriptional regulators, Gene silencing, siRNA.

Genetic Engineering

UNIT – III: Genetic Engineering – I

Genetic engineering: Enzymes, Vectors, Hosts, Cloning, Gene library and cDNA library.

UNIT – IV: Genetic Engineering - II

Molecular techniques in genetic engineering : Isolation of DNA and RNA from animal tissues and blood, Probes, Polymerase chain reaction, Restriction Fragment Length Polymorphism, Blotting techniques [Southern, Northern and Western), Genome sequencing (Shotgun and paired end strategies and comparative genome analysis, Study of gene expression: Transgenic and Knockout animals, Gene silencing.

Biotechnology

UNIT – V

Application of biotechnology in Medicine and Health: Diagnosis of diseases, Production of Pharmaceuticals (hormones), Recombinant vaccines and Gene therapy, Forensic science, Human genome project, Enzyme and whole cell mobilization and its industrial application.

Zoo – 402A: MICROBIAL ECOLOGY AND MICROBIAL BIOTECHNOLOGY

Microbial Ecology

UNIT – I

Distribution of microbes in soil, water, air, milk, Food, Microorganisms of the body, Microbes in metal containing habitat, Metal-microbe interactions, Microbial immobilisation and transformation of metals, Microbial application of metal removal.

UNIT – II

Microbial adaptation to contaminated environment, Microbe-petroleum (Fuels) interactions, The problems and prospects of biomining, Biofuel production with reference to microbes, Role of microbes in decomposition process and waste utilisation.

Microbial Biotechnology

UNIT – III

Bioprocess technology; Isolation and screening of industrially important microbes, Strain improvement, Production of antibiotics, Beverages, enzymes, Milk product, Vaccines, Fermentation.

UNIT – IV

Principles of bioreactor engineering, Bacterial cloning other than E. coli, downstream processing, operations, Production of microbial insecticides and Mycoherbicides.

UNIT – V

Bioconversion, Waste control, Biogas production and Bioleaching, Plant-microbe interactions and Bio fertilizers, Mushroom production technology.

Zoo – 403A: ANIMAL DEVELOPMENT AND NEUROBIOLOGY

UNIT – I

Morphogenetic determinants in egg cytoplasm and Role of maternal contribution in early embryonic development, Differential gene expression during development, Application of Developmental Biology in medicine, Regeneration therapy, Gene therapy (Somatic cell gene therapy, Germline gene therapy), in vitro fertilization (IVF).

UNIT – II

Teratogenesis, Teratogenic agents, Mechanism of teratogenesis. Ageing (The biology of (senescence), Maximum life span, Causes of ageing, Genetically programmed ageing.

UNIT – III

Stem cells, Embryonic stem cells, Adult stem cells, Transgenic stem cells. Neurobiology

UNIT – IV

General features of neurons, Cellular organisation of neurons, Dendrites and Axon, Glial cells, Schwann cells, Nerve cells as signaling units, Cytoskeleton of the neuron -Microtubule, Microfilament, Neuro filament, Synthesis of macromolecules by nerve cells, Synthesis and trafficking of neuronal proteins : Cytosolic protein. Nuclear and Mitochondrial protein, Cell membrane and. Secretory proteins, Synaptic Transmission: Structure of the synapse, Correlation of structure mid function at the synapse, Transmission across the synapse, Pre- and post-synaptic events, Electrical and chemical synapse, Excitatory and inhibitory transmission.

UNIT – V

Neurotransmitters: Synthesis, Storage, Release, Neuropeptides: Mode of action, Role of neuropeptides and coexistence of neuropeptides with other neurotransmitters, Learning and Memory, CSF and Blood brain barrier, Neurodegenerative Disorders: Parkinson's and Alzheimer's diseases, Senile dementia, Myasthenia Gravis.

ZOO – 404A: CONSERVATION BIOLOGY AND ENVIRONMENTAL BIOTECHNOLOGY

Conversation Biology:

UNIT – I

Importance: Ethical, Asthetic, Utilitarian and Ecological, Biodiversity: Types of biodiversity, Mega biodiversity countries, Keystone species, Biodiversity Hot spots in India, in situ and ex situ conservation, Germplasm conservation, Gene bank, Frozen zoos, Cryopreservation: Cryoprotectants and their physiochemical properties, Cryopreservation of gonads, Gametes and embryos.

UNIT – II

Conservation and resource management: Concept of sustainable development, Bioresource, Land use planning, Water and agriculture management, Remote sensing and its application, Legal aspects: Intellectual Property Rights (IPR), Patent, Trade mark, Copy Right, Design, Biological Diversity Act 2002, The Biological Diversity Rule 2004.

Environmental Biotechnology

UNIT – III

Bioremediation - in situ and ex-situ Gases - Biofilters, Solid waste treatment, Waste water treatment: Aerobic treatment, Aerobic reactors (fixed film digester, tricking filter digester, rotating biological contractors and dispersed growth digesters), Microorganisms involved in aerobic treatment, Anaerobic waste water treatment and Microbial digestion.

UNIT – IV

Bioaccumulation of toxicants, Degradation of xenobiotic compounds - Hydrocarbons, Heavy metals, Coal waste, Microbial leaching and Biomining, Biopesticides and Biofuels, Vermitechnology and Biogas production, Bioprospecting of marine organisms, Sea weeds as food, Phycocolloids and Source of pharmaceuticals for marine organisms, Probiotics and Single Cell protein (SCP).

UNIT – V

Hormonal manipulation in advancing maturity and reproduction, Biofermentation, Development of disease resistant stock, Artificial breeding of domestic and aquatic animals, Biotechnology in biodiversity conservation, Modelling of bioreactors.

**FREE ELECTIVE COURSE
(ZAC - I) CONSERVATION BIOLOGY AND BIODIVERSITY**

UNIT – I: CONSERVATION BIOLOGY AND BIODIVERSITY: A PROLOGUE

1. Role of Science in conservation Biology
2. Species and speciation
3. Extinct Species
4. Ethics and conservation

UNIT – II: THREATS TO BIOLOGICAL DIVERSITY

1. Biodiversity Distribution
2. Over exploitation
3. Habitat destruction
4. Alien species

UNIT – III: PROTECTED AREAS

1. Wild life sanctuaries
2. National parks
3. Biosphere reserves
4. Wildlife corridors

UNIT – IV: RESTORATION BIOLOGY

1. Ecological restoration
2. Conservation strategies (in situ and ex situ)
3. Single species conservation
4. Conservation Laws

UNIT – V: COMMUNITY BASED CONSERVATION

1. Community conservation partnership
2. Community conservation conflict
3. Conservation management, Case studies
4. Bio- adoption

(ZAC - II) GENETIC DISORDERS AND GENETIC COUNSELLING

UNIT – I

1. History and genesis of genetics
2. Genetics in relation to other sciences
3. Practical applications of genetics
4. Genetics and the animal world

UNIT – II

1. Genetics and terms associated with it
2. Mendel's experimental approach
3. Monohybrid, Dihybrid and Polyhybrid cross
4. Mendel's laws of inheritance

UNIT – III

1. Biological significance of Mendel's laws
2. Hybrid vigour (Heterosis), Gene penetrance, Expressivity and Pleiotropism
3. Blood groups
4. Polygenic inheritance, Interaction of genes

UNIT – IV

1. Sex determination, Function of X and Y chromosomes
2. Sex-linked inheritance, Sex-limited genes, Sex-influenced genes
3. Cloning, Environmental mutagen and health
4. Variation in chromosome number (Heteroploidy)

UNIT – V

1. Disorders due to somatic chromosomes (Syndromes)
2. Disorders due to sex chromosomes (Syndromes)
3. Pedigree analysis.
4. Human twins, Genetic counselling, Heredity and environment

(ZAC - 3) HUMAN PHYSIOLOGY

UNIT – I: CIRCULATION

1. Heart as a pump
2. Cardiac output and Blood pressure
3. Blood groups
4. Blood coagulation (clotting)

UNIT – II: RESPIRATION

1. Structure of human lung
2. Work of breathing
3. Oxygen transport and delivery
4. Carbon dioxide expiration

UNIT – III: DIGESTION

1. Macro and micro nutrients
2. Vitamins
3. Secretory functions of the digestive system
4. Gastrointestinal disorders

UNIT – IV: EXCRETION

1. Body fluid compartments
2. Urine formation and micturition
3. Mechanism of concentrating and diluting urine
4. Artificial kidney

UNIT – V: ENDOCRINE GLANDS

1. Pituitary - The master gland
2. Thyroid - The metabolic regulator
3. Pancreas - The diabetes on settler
4. Pineal - The third eye

PRACTICAL SEMESTER – I

Dissection

Nervous system of *Palaemon malcolmsoni*

Museum Specimen

Museum Specimen of invertebrate phyla

Cytogenetic

1. Human Karyotyping
2. Types of chromosomes
3. Study of barr body in drumstick method/ in Buccal Mucosal cell
4. Study of leucocytes in human blood
5. Temporary and permanent preparation of chromosomal slide
6. Study of different stages of cell division

Physiology

1. Calculation of Hb. Concentration
2. Total RBC count
3. Total WBC count
4. Haemin crystal formation

Instrumentation

1. Centrifugation (Working principle)
2. Spectrophotometer
3. Calorimeter
4. Electrophoresis
5. Paper chromatography
6. Beer-Lambert's law (validation)
7. Absorption Maxima

PRACTICAL SEMESTER – II

Biochemistry Experiments:

1. Preparation of standard curve of protein and estimation of protein by biuret reagent/ Colorimetric estimation of Protein of supplied tissue.
2. Preparation of standard curve and estimation of DNA by diphenyl amino reagent.
3. To study the effect of time on the activity of enzyme urase on substrate urea.

Microbiology:

1. Culture of *Paramecium* in laboratory condition.
2. Study of conjugation in *Paramecium*.
3. To standardize the ocular micrometer with stage micrometer.
4. To prepare and study the histological tissue through microtomy.

Immunology:

To determine the blood group of the given sample.

Environmental experimental:

1. Estimation of D.O in the given sample

2. To estimate the % of organic matter present in the given sample of soil.
 3. Endocrinological slides
 4. Wild life specimen
- To identify the plaster of paries cost of the given pug marks.

PRACTICAL SEMESTER – III

Comparative Osteology:

Bones of reptiles and frog (limb, vertebrae)

Developmental Biology:

1. Study of various developmental stages of chick embryo.
2. Study of different developmental stages of any frog.
3. Chick embryo mounting.

Economic Zoology:

Identification of insect pest of rice, wheat, pulses and brinjal.

Ecological:

1. Determination of chloride content of various types of water samples.
2. To determine the hardness of given water samples.

PRACTICAL SEMESTER – IV

EXPERIMENT:

1. Determination of Gastro Somatic Index (GSI), Hepato Somatic Index (HSI), and Gonado Somatic Index (GSI) of given fish.
2. Staining of bone and cartilage by Alcian Red and Alizamin Red.
3. Estimation of chloride (mg/g) of given soil sample.
4. Extraction of DNA from tail of tadpole of *polypedatus malulatus*.
5. Gel-electrophoresis (PAGE)/ Sample run.

SLIDE:

1. Amphibia (Duodenum, Intestine, Pharynx, lungs, liver, kidney) Bird (lungs, kidney, liver)
2. Mammal (Lungs, kidney, liver, spleen, skin, ciliated epithelium, cuboidal cell, columnar epithelium, artery, vein, Hyaline cartilage)

Bones of mammals and Bird

Dissection of Brain of oxygaster faeciatus/ channa sp.