PG DEPARTMENT OF ZOOLOGY
M.Sc. ZOOLOGY SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

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

Academic Session
2015-18

CBCS – M.Sc. Zoology Syllabus

Website: www.scscollege.nic.in
Semester – I

Hard Core Course

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Course Title</th>
<th>Lecturer</th>
<th>Credits</th>
<th>Marks</th>
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</thead>
<tbody>
<tr>
<td>Zoo – 101</td>
<td>Non Chordates, Biosystematics and Taxonomy</td>
<td>40</td>
<td>4</td>
<td>100</td>
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<tr>
<td>Zoo – 102</td>
<td>Cell Biology and Genetics</td>
<td>40</td>
<td>4</td>
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<tr>
<td>Zoo – 103</td>
<td>Physiology, History and Histochemistry</td>
<td>40</td>
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<tr>
<td>Zoo – 104</td>
<td>Techniques and Instrumentation Statistics and Bioinformatics</td>
<td>40</td>
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<tr>
<td>Zoo – 105</td>
<td>Practical related to theory papers</td>
<td>60</td>
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Total Credits – 22, Marks - 500

Semester – II

Hard Core Course

<table>
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<tbody>
<tr>
<td>Zoo – 201</td>
<td>Biophysics, Biochemistry and Molecular Biology</td>
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<tr>
<td>Zoo – 202</td>
<td>Microbiology and Immunology</td>
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<tr>
<td>Zoo – 203</td>
<td>Endocrinology and Reproductive Physiology</td>
<td>40</td>
<td>4</td>
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<tr>
<td>Zoo – 204</td>
<td>Environmental Biology and Wildlife</td>
<td>40</td>
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<tr>
<td>Zoo – 205</td>
<td>Practical related to theory papers</td>
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Total Credits – 23, Marks - 500

Semester – III

Hard Core Course

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<tr>
<td>Zoo – 301</td>
<td>Chordates, Evolution and Paleo-Zoology</td>
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<tr>
<td>Zoo – 302</td>
<td>Economic Zoology and Aquaculture</td>
<td>40</td>
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<td>Zoo – 303</td>
<td>Developmental Biology</td>
<td>40</td>
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<tr>
<td>Zoo – 304</td>
<td>Animal Behaviour and Adaptive Physiology</td>
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<td>Zoo – 305</td>
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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

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<thead>
<tr>
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<tbody>
<tr>
<td>Zoo – 401a</td>
<td>Molecular Biology, Genetic Engineering and Biotechnology</td>
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<tr>
<td>Zoo – 402a</td>
<td>Microbial Biotechnology and Microbial Ecology</td>
<td>40</td>
<td>4</td>
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<tr>
<td>Zoo – 403a</td>
<td>Animal Development and Neurobiology</td>
<td>40</td>
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<tr>
<td>Zoo – 404a</td>
<td>Conservation Biology and Environmental Biotechnology</td>
<td>40</td>
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<tr>
<td>Zoo – 405a</td>
<td>Practical related to theory</td>
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CORE PAPERS

Zoo -101: NON-CHORDATES, BIOSYSTEMATICS AND TAXONOMY

Non-Chordates:

UNIT – I

UNIT – II

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

Zoo – 102: CELL BIOLOGY AND GENETICS

Cell Biology

UNIT – I

UNIT – II
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.

Histology

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**

**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**

**Biostatics:**

**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 submits, 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 bend, 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: Prokarytic 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

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 (Bio assay and Radioimmunoassay) Pineal, Thymus and gastrointestinal hormones Anatomy, Chemistry, Assay and Biological action of adenohypophysial and neurohypophysial hormones, Pituitary pathophysiology.

UNIT – II
Hypothalamic control of adenohypophysial function, Neuroendocrine system and neurosecretion Clinical aspects of the hypothalamo-hypophysial 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

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 Tors 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, Crocodilusporosus, Crocodiluspalustris, 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 PALEOZOOLOGY

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

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 specification, 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, Silkmoth 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

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

UNIT – III

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, Nucleo-cytoplasmic 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 Lysogemic 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 combinational 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 (Shortgun 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

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, N euro 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
ZOO – 404A: CONSERVATION BIOLOGY AND ENVIRONMENTAL BIOTECHNOLOGY

Conversation Biology:

UNIT – I

UNIT – II

Environmental Biotechnology

UNIT – III

UNIT – IV
Bioaccumulation of toxicants, Degradation of xenobiotic compounds - Hydrocarbons, Heavy metals, Coal waste, Microbial leaching and Biominning, 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. Wildlife 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 leukocytes 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 identity 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 faeciatius/ channa sp.