Program Specific Outcomes (PSO) of M.Sc. Zoology

PSO1: Developing deeper understanding of key concepts of biology at biochemical, molecular and cellular level, physiology and reproduction at organismal level, and ecological impact on animal behavior.

PSO2: Elucidation of animal-animal, animal-plant, animal-microbe interactions and their consequences to animals, humans and the environment.

PSO3: Strengthening of genetics and cytogenetics principle in light of advancements in understanding human genome and genomes of other model organisms.

PSO4: Description of expression of genome revealing multiple levels of regulation and strategies to manipulate the same in the benefit of the mankind.

PSO5: Learning handling DNA sequence data and its analysis which equip students to get employed in R&D in the industry involved in DNA sequencing services, diagnostics, and microbiome analysis.

PSO5: Understanding relationships of variations in phenotypic expression of genomes and their genome-wide interaction with other organisms.

PSO6: Development of an understanding of zoological science for its application in medical entomology, apiculture, aquaculture, agriculture and modern medicine.

PSO7: Development of theoretical and practical knowledge in handling the animals and using them as model organism

PSO8: Maintenance of high standards of learning in animal sciences

Course Outcomes

PART I: Semester – 1

Course ZOOL 101 – Genetics and Cytogenetics

CO1: Understanding of Mendel's principle, its extension and chromosomal basis.

CO2: Determination of gene action from genotype to phenotype including penetrance and expressivity, gene interaction, epistasis, pleiotropy; nature of the geneand its functions.

CO3: Evolution of the concept of the gene and fine structure of gene using rII locus.

CO4: Capability to perform gene mapping using 3- point test cross in *Drosophila*, gene mapping in humans by linkage analysis in pedigrees.

CO5: Imparting knowledge regarding gene mutation, types of gene mutations, methods for detection ofinduced mutations, P- element insertional mutagenesis in *Drosophila*, DNA damage andrepair.

CO6: Developing concept of regulation of gene activity in prokaryotes and eukaryotes at transcriptional and posttranscriptional level.

CO7: Describing structural and functional organization of a typical eukaryotic gene, transcription factors, enhancers and silencers, and non-coding genes.

CO8: Depicting the mechanism of sex determination and dosage compensation in human and other model organisms.

CO9: Developing skills in human genetics with capability for karyotyping and nomenclature of metaphase chromosome bands.

CO10: Understanding the chromosome anomalies and associated diseases.

CO11: Capability to perform basic geneticanalysis of complex traits - complex pattern of inheritance, quantitative traits, thresholdtraits.

CO12: Description of human genome and mapping.

CO13: Identify link between genetics and cancer with emphasis on oncogenes, chromosome rearrangement and cancer, tumor suppressor genes and genetic pathways to cancer.

Course ZOOL 102 – Principles of Gene Manipulation

CO1: Imparting knowledge of basic recombinant DNA techniques, preparation of restriction maps and mapping techniques.

CO2: Understanding of method and applications of nucleic acid probes, blotting techniques, DNAfingerprinting, DNA footprinting, methyl interference assay and polymerase chain reaction.

CO3: Developing skill to understand biology of cloning and expression vectors.

CO4: Description of gene cloning strategiesbytransformation of *E. coli* and other cells with rDNA;methods of selection and screening of transformed cells; construction of genomic andcDNA libraries.

CO5: Defining key strategies to express cloned genes including phage display.

CO6: Exposure to principles of DNA sequencing, automated sequencing methods; synthesis of oligonucleotides, primer design.

CO7: Micro-arrays and confocal microscopy techniques with application.

CO8: Understanding a concept of changing genes- directedevolution, protein engineering in microbes.

CO9: Introduction to gene manipulation methods in animals, transgenic technology, application of recombinant DNA technology; gene knockouts, gene silencing,mouse disease models, somatic and germ- line therapy.

Course ZOOL 103 – Comparative Animal Physiology

CO1: Description of internal transport and gas exchange

CO2: Regulation of heart-beat and blood pressure, neural and chemical regulation of respiration, Gas transfer in air and water.

CO3: Perception of circulatory and respiratory responses to extreme conditions

CO4: Discerning acid –base balance, Regulation of body pH.

CO5: Developing the concept of animal adaptation by exploring the diversity of functional characteristics of various kinds of organisms which is closely related to evolutionary processes and environmental changes.

CO5: Perception of Osmoregulation, Kidney functions and diversity, Extra-renal osmoregulatory organs, Patterns of nitrogen excretion.

CO6: Concept of thermoregulation - Heat balance in animals, Adaptations to temperature extremes, torpor, Aestivation and hibernation, Counter current heat exchangers.

CO7: Understanding of adaptations to Stress- basic concept of environmental stress, acclimatization, avoidance and tolerance, stress and hormones.

CO8: Description of sensing the environment- photoreception, chemoreception, mechano-reception, echolocation, endogenous and exogenous biological rhythms, chromatophores and bioluminescence.

CO9: Understanding of feeding mechanisms and their control, effect of starvation.

CO10: Description of muscle physiology – striated and smooth muscle, adaptations of muscles for various activities, neuronal control of muscle contraction, electric organs.

Course ZOOL 104 – Metabolism: Concepts and Regulation

CO1: Understanding of the living state, metabolism as the defining characteristic of living organisms, molecular approach to understanding life forms and living processes.

CO2: Concept of biomolecule identification, separation and quantization, dynamic state of body constituents, experimental approaches to study metabolism.

CO3: Conceptualization of metabolic pathways and their linkage, metabolism of primary metabolites – monosaccharides, lipids, amino acids and nucleotides.

CO4: Description of nature of enzymes – kinetics, reaction mechanism of chymotrypsin and lysozyme, purification and physico – chemical characterization, regulation of enzyme activity.

CO5: Developing concept of metabolic basis of nutrition, metabolic basis of specialized tissue function.

CO6: Elucidation of metabolic disorders, metabolic basis of diagnostics, metabolism and adaption,

CO7: Description of regulation of metabolism at molecular, cellular and organismic levels, enzymes and receptors as drug targets.

PART I: Semester – 2

Course ZOOL 201 – Developmental Biology

CO1: Information about history and basic concepts of developmental biology.

CO2:Illustration of model systems: invertebrate and vertebrate model organisms.

CO3: Identification of developmental genes: spontaneous and induced mutation, mutant screening, developmental mutations in *Drosophila*.

CO4: Elucidation of early embryonic development of invertebrates and vertebrates.

CO5:Concept of axis specification in *Drosophila*, role of maternal genes, patterning of early embryo by zygotic genes and the homeotic selector genes.

CO6: Concepts of organogenesis in invertebrates and vertebrates: the homeotic selector genes for segmental identity, insect compound eye, kidney development– development of ureteric bud and mesenchymal tubules.

CO7: Illustration of postembryonic development: growth- cell proliferation, growth hormones; aging- genes involved in alteration in timing of senescence.

CO8: Understanding of process of regeneration in Hydra and salamander.

CO9: Explanation of embryonic stem cells and their applications.

CO9: Description of medical implications of developmental biology, genetic errors of human development, the nature of human syndromes

CO10: Study of gene expression and human disease– inborn errors of nuclear RNA processing, inborn errors of translation

CO11: An insight on teratogenesis- environmental assaults on human development, teratogenic agents like alcohol, retinoic acid etc.

Course ZOOL 202 – Systematics, Biodiversity and Evolution

CO1: An insight to the overview of evolutionary biology, concept of organic evolution during pre- and post- Darwin era evolution and molecular biology- a new synthesis.

CO2: A concept of – "from molecules to life", life originated from RNA, introns as ancient component of genes

CO3: Understanding of the universal common ancestor and tree of life, three domain concept of living kingdom

CO4: Illustration of the molecular phylogeny, construction of phylogenetic trees using molecular data, construction of phylogenetic trees by using 16S rRNA gene sequences and concept of speciation in bacteria.

CO5: Description of molecular divergence and molecular clocks and molecular drive, complication in inferring phylogenetic trees.

CO6: Description of origin and diversification of bacteria and archea; diversification of genomes, origin of genomes by horizontal gene transfer; role of plasmid, transposons, integrons and genomic islands in DNA transfer.

CO7: Study of origin and diversification of eukaryotes, early fossilized cells, evolution of eukaryotic cell from prokaryotes- a case of symbiosis, evolution of eukaryotic genomes; gene duplication and divergence.

CO8: Conceptualization of mode of speciation, evolution, systematics, biological classification, origination, extinction, and causes of differential rates of diversification.

CO9: Illustration of current status and future of biodiversity, human evolution.

CO10: Understanding genomics and humanness, current issues in human evolution.

Course ZOOL 203 – Immunology

CO1: An overview of the immune system, principles of innate and adaptive immunity. Evolution of innate andadaptive immune system.

CO2: Understanding of antigen recognition by immune cells,role of TLRs.

CO3: Conceptualization of generation of diversity in immunoglobulins and T- cell receptor gene rearrangement.

CO4: Illustration of antigen processing and presentation to T lymphocytes by antigen presenting cells and understanding the role of MHC complex.

CO5: An overview of development and survival of lymphocytes, humoral immune response, production of effector T- cells and effector mechanisms.

CO6: Description of effector mechanisms, NK and NKT cell functions.

CO7: Conceptualization of regulation of immune response, mucosal immunity, immunological memory, cytokines and chemokines. T- cell mediated regulation of immune response, Immunological tolerance and anergy.

CO8: Importance of immunity in health and disease: introduction to infectious disease, innate immunity to infection, adaptive immunity to infection, evasion of the immune response by pathogens.

CO9: Description of consequence of immunodeficiency leading to diseases such as inherited acquired immunodeficiency diseases.

CO10: Illustration of allergy and hypersensitivity diseases, autoimmunity, transplant rejection and responses to alloantigens.

CO11: An understanding of manipulation of immune responses for the benefit of mankind, vaccines.

Course ZOOL 204 – Molecular Cell Biology

CO1: Description of transport acrossthe plasma membrane, mechanism of diffusion, movement of water, Donnan equilibrium,ion movements and cell function, acidification of cell organelles and stomach.

CO2: Understanding transepithelial transport, maintenance of cellular pH, cell excitation, bulk transport, receptor mediated endocytosis, protein sorting and targeting to organelles, molecular mechanism of the secretory pathway, secretion of neurotransmitters.

CO3: Description of cellular shape, motility and energetics- cytoskeletal elements in cell shape and motility, structure and dynamics, role in cell locomotion and mitosis.

CO4: A study of intercellular communication, extracellular matrix, cell- cell and cell-matrix adhesion, gap junctions, cellular energetics, oxidation of glucose and fatty acids, the proton motive force, F0F1 ATP synthase, mechanism and regulation of ATP synthesis.

CO5: Description of life cycle of a cell - cell cycle and its regulation,checkpoints in the mammalian cell cycle.

CO6: An overview of tumor suppressors and role of helicases, regulation of cell proliferation and differentiation by hormones, neuropeptides and growth factors

CO7: Detailed view of cell differentiation, cell death and autophagy, turnover of cellular components.

CO8: Understanding the requirements for cell culture; aseptic technique; primary culture; cell lines; organotypic cultures, cytotoxicity assays.

CO9: Description of cell regulatory mechanisms- regulatory and control mechanisms in a mammalian cell at the biochemical level, key concepts about cellular signaling mechanisms

CO10: Overview of proliferative, survival and death pathways, desensitization of receptors, signaling and toxins

CO10: Detailed understanding of signaling pathways in malignant transformation of cells, cell transformation,role of oncogenes.

CO11: Description of siRNA and miRNA basics, regulation of transcription and translation of proteins by miRNA.

PART II: Semester – 3

Two papers ZOOL 301 and ZOOL 302 are compulsory. Two optional papers are to be selected by each student. One paper from ZOOL 303, ZOOL 304 or ZOOL 305 and the other paper from ZOOL 306, ZOOL 307 or ZOOL 308.

Course ZOOL 301 – Principles of Ecology

CO1: An overview of evolutionary ecology and environmental concepts

CO2: Understanding the characteristics of population and population dynamics.

CO3: A study of life history pattern, fertility rate and age structure.

CO4: Illustration of competition and coexistence, intra-specific and inter-specific interactions, scramble and contest competition model, mutualism and commensalism, prey-predator interactions.

CO5: Description of nature of ecosystem, production, food webs, energy flow, biogeochemical cycles, resilience of ecosystem and ecosystem management.

CO6: Understanding the biosphere, biomes and impact of climate on biomes.

CO7: An overview of the environmental stresses and their management, global climatic pattern, global warming, atmospheric ozone, acid and nitrogen deposition, coping with climatic variations.

CO8: Description of the major classes of contaminants. Impact of pesticides and other chemicals in agriculture, industry and hygiene and their disposal.

CO9: Impact of chemicals on biodiversity of microbes, animals and plants. Bioindicator and biomarkers of environmental health. Biodegradation and bioremediation of chemicals.

CO10: Description of biodiversity assessment, conservation and management, Sustainable development, natural resource management in changing environment.

CO11:Understanding the molecular ecology, genetic analysis of single and multiple population, phylogeography, molecular approach to behavioural ecology, conservation genetics.

Course ZOOL 302 – Computational Biology, Biostatistics and Bioinformatics

CO1: Introduction to basic components of computers, Software (operating systems) and application software used in biological and statistical studies.

CO2: To get an insight into the advancement in computerized biology information, introduction to genomics and proteomics databases.

CO3: An introduction to Genbank, UCSC, ENSEMBL, EMBL, DDBJ, protein sequence databases: Swiss-prot, PDB, BLAST, PSI- BLAST (steps involved in use and interpretation of results) and HMMER, BLAST vs FASTA, file formats- FASTA, GCG and ClustalW.

CO4: An overview of databank search- data mining, data management and interpretation, multiple sequence alignment, genes, primer designing; Protein modeling, protein structure analysis, docking, ligplot interactions, phylogenetic analysis with the program PHYLIP, DISTANCES, GROWTREE etc.;

CO5: An introduction and learning of computational genomics and proteomics, designing a microarray, image analysis and normalization, annotations, protein prediction tools- protein secondary structure, molecular modeling, identification and characterization of protein mass fingerprint, world- wide biological databases.

CO6: Learning to programming languages such as "C".

Course ZOOL 303 – Biology of Parasitism

CO1: An overview to the parasitology, animal associations and host – parasite relationship.

CO2: Understanding the mode of infection of parasite, molecular biology of parasite and drug targets, mechanism of drug resistance, vaccine strategies and proteomic approaches, vaccine strategies.

CO3: A study of the immune response to parasite and self-defense mechanisms, immune evasion and biochemical adaptations of parasites.

CO4: A detailed understanding of parasites of veterinary importance and their management.

CO5: Description of parasites of insects and their significance, nematode parasites of plants and host parasite interactions.

Course ZOOL 304 – Chronobiology

CO1: Description of milestones in clock research, biological rythms, advancement in Chronobiology in 21st century.

CO2: Learning and understanding of entrainment, masking and zeitgeber cycles, organization of circadian system in multicellular animals.

CO3: Conceptualization of central and peripheral clock system, circadian pacemaker system in invertebrates and vertebrates.

CO4: To develop understanding of diversity and complexity of the clock system, molecular Biology of the circadian pacemaker system.

CO5: An overview of photoreception and photo-transduction, the physiological clock and measurement of day length,role of photic and non-photic cues in seasonality

CO6: Understanding of evolution of photoperiodism,molecular bases of seasonality.

CO7: Illustration of the relevance of biological clocks for human welfare - Clock function (dysfunction); Human health and diseases - Chronopharmacology, chronomedicine, chronotherapy.

Course ZOOL 305 – Protein Structure, Function and Evolution

CO1: Learning chemical foundation of biology- concepts of pH, pKa, buffer, acidity and basicity, reaction kinetics and mechanism, affinity, equilibrium, natural products and their physiological and pharmacological importance.

CO2: An overview of types of protein and their general properties, genetic origin of protein sequences, co- and post translational modifications of proteins, protein ligand interactions.

CO3: Understanding of enzyme catalysis and allosterism.

CO4: Developing an understanding about structure-function relationships in antibodies, proton pumps, ion channels and membrane receptors.

CO5: Description of extracellular matrix proteins and proteglycans, glycoproteins and glycobiology, super molecular assemblies involving proteins (multi- enzyme complexes), nucleic acids (chromatin) and lipids (chylomicrons).

CO6: Illustration of protein data bases, protein functions and structural domains, convergent and divergent evolution of protein structure and functions.

CO7: Learning of protein engineering, protein denaturation and folding, genetic disorders affecting functional proteins, protein pathology and prions,immobizied enzymes and enzyme technology.

Course ZOOL 306 – Structure and Function of Genes

CO1: An introduction to structure of nucleic acids, folding motifs, conformation flexibilities, denaturation, renaturation, kinetics of hybridization, super-coiling of DNA, packaging of DNA in the nucleus, structure of chromatin, chromatin territories.

CO2: Description of genetic material and its evolution- structure and function relationships.

CO3: An overview of DNA replication, recombination and repair- energetics of nucleic acid polymerization, accuracy during flow of genetic information.

CO4: Understanding of post-transcriptional gene control and nuclear transport, evolution of introns, catalytic RNA, alternative splicing and proteome diversity, regulation of Pre-mRNA Processing, micro RNA and other non-coding RNAs, degradation of RNA.

CO5: Description of transport across the nuclear envelope and stability of RNA,processes of nuclear import and export and their regulation, degradation of RNA.

CO6: An understanding about translational machinery and translational control.

Course ZOOL 307 – Animal Behavior

CO1: An overview of animal behavior, orientation to primary and secondary orientation; kinesis – orthokinesis, klinokinesis; taxis – different kinds of taxis; sun-compass orientation, dorsal- light reaction.

CO2: Devising conservation strategies for different animal species. Learning and instincts: conditioning, habituation, sensitization, reasoning.

CO3. Developing compassion towards other animals as well as other individuals, group selection, kin selection and inclusive fitness, cooperation, and alarm call.

CO4. Evaluating other individuals of the society and taking decisions.

Course ZOOL 308 – Comparative Endocrine Physiology

CO1: Developing a concept of endocrine system, its function and phylogeny.

CO2: Description of evolution and comparative aspects of endocrine physiology in vertebrates.

CO3: An overview of synthesis of corticosteroid, structural diversity of glucocorticoids among vertebrates. Importance of adrenocortical and adrenomedullary interaction.

CO4: Illustration of evolution of thyroid gland, thyroid hormone synthesis and its regulation, hormonal regulation of calcium and phosphate homeostasis.

CO5: Conceptualization of hormonal control of feeding behaviour and gastrointestinal tract functioning, Pancreatic hormones and glucose homeostasis,,vitellogenesis and the evolution of viviparity.

PART II: Semester – 4

Student selects any one of the four streams each stream consisting of three papers. Besides this, each student completes a Dissertation, which is theoretical and does not involve any laboratory component.

Stream 1 – Entomology

Course ZOOL 4101 – Insect Diversity, Society and Evolution

CO1: Identifying beneficial and harmful insects based on comparative study of morphology and their articulation.

CO2: Assisting with criminal investigation by evaluating forensically important insects, collection of data from cadaver site, interpretation of data for predicting time and cause of death.

CO3: Identifying potential disease vectors.

CO4: Identifying potential biocontrol agents.

ZOOL 4102: Insect Physiology, Toxicology& Vector Biology

CO1. Learning methods to effectively restrict insect growth.

CO2. Devise chemical methods to effectively eliminate harmful insectsby mode of action of insecticide.

CO3. Usage of methods to effectively restrict multiplication of disease causing agents within the insect vector by elucidating mode of action of insecticide, carcinogenic, mutagenic and teratogenic effects, and evaluation of toxicity.

CO4. Learning the methods to control the spread of vectors, their economic importance and control of fleas, lice, bugs, mosquitoes, flies and parasitoids.

ZOOL 4103: Pest Ecology & Agricultural Entomology

CO1. Identifying pests of agricultural crops by analyzing ecology, pest status, features responsible for evolutionary success of insect species, factors responsible for achieving the status of pest..

CO2: An overview of identification, seasonal history, biology, nature of damage and control measures of pests, of cereals, pulse crops, cotton, vegetables, oil seeds, fruit crops, sugarcane and stored grains.

CO3: To devise cropping pattern to minimize crop loss by a detailed understanding ofagro-ecosystem, phases of population fluctuation, models of population growth, population size and regulatory mechanisms.

CO4: A detailed understanding of plant resistance to insects, transgenic plants, development of Bt plant by recombinant DNA technology, resistance management of Bt crop.

Stream 2 – Fish Biology

Course ZOOL 4201 – Evolution and Functional Anatomy of Fish

CO1: A detailed understanding of evolutionary strategies and morphological innovations, gene and genome duplication, evolutionary genetics, biogeographical distribution of major groups of fishes.

CO2: An overview of adaptations of fishes to environmental extremes- temperature, pressure, stressors.

CO3: Understanding growth and metabolism of fishes by regulation of food intake by neuropeptides and hormones, environmental factors and feed intake.

CO4: Evaluation of defense mechanism in fishes and their regulation.

CO5: Learning of fish reproduction for better yield in fish farming.

Course ZOOL 4202 – Aquatic Resources and Their Conservation

CO1: Learning classification of riverine fisheries and their hydrological conditions.

CO2: A detailed understanding of cold water fisheries, biology of important cold water fishes of India for better production of fishes in extreme condition.

CO3: Learning fishing techniques for localizing catches- remote sensing, sonar, radar; crafts and gears.

CO4: An overview of post harvest technique to prevent fish spoilage for better preservation and quality control.

CO5: Learning the management of aquatic pollution, waste managementand fisheries extension services.

Course ZOOL 4203 – Aquaculture

CO1: Learning aquaculture technology for fresh and marine fishes.

CO2: Culturing of fish food organisms like algae; Artemia; zooplankton for improving nutritive quality.

CO3: Management of water quality requirements for aquaculture.

CO4: Learning integrated farming by fish-cum-live stock farming, paddy-cum-fish farming, aquaculture engineering-aquahouse.

CO4: A detailed learning of transportation of finfish and shellfish, eggs, fry, fingerlings and adults.

CO5: Managing improvement in the Nutrition of aquatic animals by leaning feed types, manufacture and ingredients, anti- nutritional factors in fish feed ingredients.

CO6: Understanding environmental impact of aquaculture,aquacultural wastes and future developments in waste minimization, environmental consequences of hypernutrification.

CO7: Learning about fish vaccines- strategy and use in aquaculture.

Stream 3 – Genomics, Metagenomics and Epigenetics

Course ZOOL 4301 – Genomics

CO1: Detailed understanding of structure and organization of genomes along with their comparative account.

CO2: Knowledge of transposable elements, retro-transposons, SINE, LINE, Alu and other repeat elements, pseudogenes, segmental duplications.

CO3: Developing skills in how to map genomes and to integrate physical and genetic maps.

CO4: To develop technical knowhow on sequencing genomes including high-throughput sequencing, strategies of sequencing and assessment of quality of genome-sequence data.

CO5: Detailed exposure to bioinformatics tools and techniques for genomic analysis

CO6: Elucidation of comparative genomics methods

CO7: Development of skill to perform large scale mutagenesis and interference for genome wide gene targeting with different experimental approach

CO8: Making detailed understanding of the procedures and importance oftranscriptome analysis, profiling, proteomics - expression analysis, protein structure analysis, protein-protein interaction.

Course ZOOL 4302 – Metagenomics

CO1: Expansion of knowledge from genomics to metagenomics with its global impact.

CO2: Knowledge of next generation DNA sequencing technologies to study metagenomicsand potential challenges.

CO3: Creation of awareness regarding experimental approaches formetagenomics analysis

CO4: Identification of habitats and collecting metadata, gene expression system, single cell analysis.

CO5: Developing basic skills in data management and bioinformatics and developing capabilities to face challenges in metagenomics pertaining to genomics data, metagenomics data, the importance of metadata, databases for metagenomics data, software, analysis of metagenomics sequence data.

CO6: Description and detailed understanding of pioneering projects in metagenomics.

CO7: Elucidation of ecological inference from metagenomicssuch as symbiosis, competition and communication.

CO8: Illustration of metagenomicswith specific example of soil and soil health, microbial community - genomics in ocean;

CO9: Learning of application of metagenomics with technical advancement in the field, application and expected benefits from large scale metagenomics data, application in human health, agriculture, industry and environment remediation.

Course ZOOL 4303 – Epigenetics and Chromatin Biology

CO1: Detailed understanding of chromatin structure and different levels of its organization.

CO2: Description of higher order structure of chromatin, chromatin-territories; intra-nuclear spatial organization of chromatin into MARs and SARs.

CO3: Awareness of brief history of epigenetics and key concepts.

CO4: Detailed knowledge chromatin modifications and their mechanism of action, concept of 'histone-code' hypothesis inthe phenomenon of epigenetics.

CO5: Understanding of RNAi and heterochromatin assembly, role of noncoding RNAs in epigenetic regulation.

CO6: Developing skill in describing chromatin structure and epigenetics marks, dosage compensation and mechanism of chromatin remodeling.

CO7: Learning of epigenetics and genome imprinting and the reprogramming of the genome.

CO8: Elucidation of epigenetic contribution to human diseases including cancer.

Stream 4 – Molecular Endocrinology and Reproduction

Course ZOOL 4401 – Neuroendocrinology

CO1: General understanding of anatomical and structural organization of neuroendocrine organs and nervous system.

CO2: Imparting knowledge regarding neurophysiology, electrical properties of neurons and propagation of nerve impulses.

CO3: Description of Synapse, neurotransmition and neuromodulation

CO4: Detailed understanding of the hypothalamo- hypophyseal axis, hypothalamo- vascular system and role of hormones.

CO5: Knowledge of regulation of hypothalamic and pituitary hormone secretion.

CO6: Imparting knowledge on physiological and mechanistic role of neurohypophysis and regulation of neurohypophyseal hormones.

CO7: Conceptualization of feed-back inhibition and feed-forward activation of neurohypophyseal hormones.

CO8: Understanding of the link between environment and reproduction.

CO9: Illustration of neuroendocrine regulation of immune system with principles and application of related.

Course ZOOL 4402 – Molecular Endocrinology

CO1: Description of discovery of hormones as chemical signals for control and regulation of physiological processes.

CO2: Understanding the nature of hormonal action and its experimental methods of evaluation.

CO3: Elucidation of biosynthesis of protein hormones and molecular mechanisms of regulation.

CO4: Knowledge of signal discrimination, signal transduction and signal amplification in hormone regulated physiological processes.

CO5: Acquaintance with receptor antagonists and their applications.

CO6: Developing knowhow of pharmacokinetics of hormones and behavior.

CO7: Proficiency in using hormones as therapeutic agentsin regulation of fertility, and hormonal contraceptives.

CO8: To develop expertise in recombinant protein hormones-production and application in farm animals and humans.

Course ZOOL 4403 – Biology of Reproduction

CO1: Understanding of sex determination and differentiation and its mechanism.

CO2: Elucidation of stem cell renewal in testis during spermatogenesis, structural and molecular events, and respective experimental approaches

CO3: Description of regulation of testicular functions.

CO4: Epididymal maturation of spermatozoa; Capacitation, Signal transduction pathway in acrosome reaction;

CO5: Illustration of different types of male sterility includingazoospermia, oligozoospermia,asthenozoospermia, and varicocele with specific emphasis on the genetic and molecular basis

CO5: Understanding of detailed follicular development and selection evaluating the role of extra-and intra-gonadal factors in folliculogenesis.

CO6: Description of oocyte maturation its regulationand follicular atresia.

CO7:Knowledge of regulation of reproductive cycle in female: menstrual cycle in human, estrous cycle in rat, estrous behavior in cycling animals.

CO8: Development of mechanistic understanding of female reproductive disorder: amenorrhea, polycystic ovary.

CO9: Familiarity with the process of fertilization with a comparative account of different events involved.

CO10: Generating awareness on contraception leading to prevention of polyspermy: surgical, hormonal and immunocontraception.

Course ZOOL 4004 – Dissertation

CO1: This theoretical project work is aimed to inculcate ability to develop a research question.

CO2: Organize relevant available literature to back the proposed hypothesis.

CO3: Development of technical writing skill