

I Semester Zoology Core Course Content

Program Name	M.Sc	Semester	I
Course Title	SYSTEMATICS AND BIODIVERSITY (Theory)		
Course Code	HCT 101	No. of Credits	4
Contact hours	52 hours (4hrs/week)	Duration of SEA/Exam	
Formative Assessment Marks	30	Summative Assessment Marks	70

mLAC Syllabus	Hr
UNIT 1	9
<ul style="list-style-type: none"> • Biological classification: Uses of classification, kinds of classification, Hierarchy of categories (Linnaean hierarchy) and higher taxa. • Taxonomical character Procedures and key: construction of taxonomic key, feature of taxonomic key • Type of taxonomic keys: dichotomous, bracket, indented, serial key computer aided keys. Merits and demerits of taxonomic keys. • Species concepts: varieties, subspecies, sibling species and race. • International code of Zoological Nomenclature (ICZN). 	
Kingdoms of Life: General outline of kingdoms including Monera and protista; broad outline diversity of animal kingdom	
Methodologies in Systematics: Morphology based taxonomy, numerical taxonomy, cytotaxonomy and chemotaxonomy DNA fingerprinting and markers for detection/evaluation of polymorphism	
UNIT 2	13
Systematics of Invertebrates: Classification, general characters of phylum protozoa, Porifera, coelenterate, Platyhelminthes and Aschelminthes. General characteristics, classification of phylum Annelida, Arthropoda, Mollusca and Echinodermata Special topics: Bioluminescence in Invertebrates	
UNIT 3	13
Systematics of protochordate and chordate: <ul style="list-style-type: none"> • General characters and outline of classification of Protochordate and Chordate (up to orders). • Origin of chordates in the light of recent theories. • Systematic position and Phylogenetic interrelationship between Protochordates and Chordates. • Migration in fishes and birds. • Parental care in fishes and amphibians. • Adaptive radiations in birds, reptiles and mammals 	
UNIT 4	8

Biodiversity in Biosphere -Basic principles: <ul style="list-style-type: none"> • Biodiversity, Introduced Biodiversity and Native Biodiversity. Components of Biodiversity. • Classification of Habitats: Biomes, Species Diversity: o, p and y diversity. • Endemic species and patterns of distribution with special reference to India. • Biodiversity hotspots in India. Characterization, generation and maintenance. • Scope and constrains of biodiversity; genetic diversity, species diversity, eco-system diversity. 	
UNIT 5	9
Biodiversity and conservation: <ul style="list-style-type: none"> • Protected areas in India, their types and examples, resources and management. • Global diversity hotspots, effect of manmade alterations of environment on biospheres. • Biodiversity Indices, Threat to biodiversity and strategies of conservation. • Modern tools and techniques to assess biodiversity- Biodiversity Indices, • Global programmes and concept of endangered species. • Keystone species, Endemic Species, focal Species Conservation approach: <ul style="list-style-type: none"> • Landscape approach to biodiversity conservation, Corridor approach, individual species approach, habitat conservation approach. People movement/ Citizen science • National biodiversity strategy and action plan. • Ramsar heritage site 	

I Semester Zoology Core Course Content

Program Name	M.Sc	Semester	I
Course Title	SYSTEMATICS AND BIODIVERSITY (Practical)		
Course Code	HCP 101	No. of Credits	2
Contact hours	52 hours (4hrs/week)	Duration of SEA/Exam	
Formative Assessment Marks	15	Summative Assessment Marks	35

Syllabus

1. Construction of dichotomous key
2. Construction of Cladogram
3. Identification and classification of animals (at least 20 species of invertebrates and 20 species of vertebrates from different groups) found in India.
4. Identification (photographs) - Critically endangered, endangered and vulnerable Fauna of India.
5. Biodiversity indices -Problem solving: Simpson index Shannon -Wiener diversity index, , Sorenson index, Evenness index, and Marglef species richness index.
6. Field activities: Field visits- zoos, sanctuaries, national parks, forests (mini forest or reserve forest).
7. Identifying the larval forms of different insect species in their host plants.
8. Study of museum specimens and slides of chordates with emphasis on Morphological significance.

I Semester Zoology Core Course Content

Program Name	M.Sc	Semester	I
Course Title	Ecology, Environmental Biology and Evolution (Theory)		
Course Code	HCT 102	No. of Credits	4
Contact hours	52 hours (4hrs/week)	Duration of SEA/Exam	
Formative Assessment Marks	30	Summative Assessment Marks	70

mLAC Syllabus	Hr
Unit I	12
<p>Concept of Ecology and Ecosystem: Evolutionary ecology, environmental concepts-laws, ecological models. Nature of ecosystem, production, food webs, energy flow through ecosystem, bio-geochemical cycle, resilience of ecosystem, ecosystem management</p> <p>Limiting Factors:</p> <ul style="list-style-type: none"> • Concept of limiting factors-Liebig's law of the minimum, Shelford's law of tolerance. • Population ecology. Natality, mortality, growth rate as factors determining the population density-population interactions. • Community Ecology :Types of community-structure, community succession and homeostasis. <p>Habitat Ecology: Fresh water, marine, estuarine habitats, terrestrial habitats. Eco-tourism</p>	
Unit II	12
<p>Resource Ecology and Management:</p> <ul style="list-style-type: none"> • Concept-classification; non-renewable and renewable resources, • Conventional and non-conventional source and energy. Conservation of natural resources, use of alternate energy sources. <p>Environmental Pollution: Air, water, soil and land pollution. Impact of pollutants on general fauna, flora and ecosystem. Factors influencing environmental concentration of toxicants and toxicity. Environmental monitoring of pollutants. Major conventions and agreements for environmental protection. Ecorestoration/ rejuvenation of lakes</p>	
Unit III	9
<p>Climate change: UN initiatives on Climate change, IPCC, climate change studies in India Environmental stresses and their management, global climatic pattern, global warming, atmospheric ozone, acid and nitrogen deposition, coping with climatic variations. El-Nino and La-Nino effect</p> <p>Bioremediation: Major classes of contaminants. Uptake, biotransformation, detoxification, elimination and accumulation of toxicants. Factors influencing bioaccumulation from food and trophic transfer. Pesticides and other chemical in agriculture, industry and hygiene and their disposal. Impact of chemicals on biodiversity of microbes, animals and plants. Bioindicator and biomarkers of environmental health. Biodegradation and bioremediation of chemicals Case studies as examples</p>	
Unit IV	7
<p>Evolutionary concepts: Evolution of Eukaryotes from Prokaryotes. Lamarckism, Darwinism, merits and demerits. Modern synthetic theory of population genetics leading to NeoDarwinism.</p>	

Evolution of <i>Homo sapiens</i> ,	
Unit V	10
Evidences and Elemental forces of evolution: Paleobiological- concepts of stratigraphy and geological time scale; fossil study. Anatomical-vestigial organs; homologous and analogous organs (concept of co-evolution, parallelism and convergence in evolution). Taxonomic - Transitional forms/evolutionary intermediates; living fossils. Phylogenetic- A) Fossil based. B) Molecular .1 based-protein model (Cyt-C); C) Gene model (ne). Mutation, Selection (types of selection, selection coefficient, selection in natural population). Random genetic drift, Migration. Types of Speciation	

I Semester Zoology Core Lab Course Content

Program Name	M.Sc	Semester	II
Course Title	Ecology, Environmental Biology and Evolution (Practical)		
Course Code	HCP 102	No. of Credits	2
Contact hours	52 hours (4hrs/week)	Duration of SEA/Exam	
Formative Assessment Marks	15	Summative Assessment Marks	35

Syllabus

1. Estimation of chloride, sulphate in water samples.
2. Estimation of the B.o.D. and c.o.D. in water sample.
3. Thermal lag studies in terrestrial habitat.
4. Population ecology- Population growth in paramecium/Drosophila larva.
5. Estimation of soil biomass and soil organisms. (wet and dry methods)
6. Identification and observation of - a) Hospital waste (Solid waste) b) pollution indicator species.
7. Evidence for Evolution: Types of fossils, Connecting links/transitional forms, Living fossils, Vestigial, Analogous and Homologous organs.
8. Adaptive strategies: Coloration, Mimicry co-adaptation and co-evolution, aquatic, terrestrial, arboreal adaptations. Comparative study of Ape (use photos) and Human skull.

I Semester Zoology Core Course Content

Program Name	M.Sc	Semester	I
Course Title	Biochemistry and Biophysics (Theory)		
Course Code	HCT 103	No. of Credits	4
Contact hours	52 hours (4hrs/week)	Duration of SEA/Exam	
Formative Assessment Marks	30	Summative Assessment Marks	70

mLAC Syllabus	Hr
Unit I	7
Molecules and their characteristic features: Review of basic concepts of solution chemistry - acid, base, ionic strength, principles of thermodynamics: chemical potential, free energy, entropy, enthalpy, heat capacity; dimensions of atoms, bonds: covalent and non-covalent bonds and molecules. Dihedral angles, steric conflict, classes of organic compounds and functional groups.	
Unit II	10
Carbohydrates and Lipids: Sugars and polysaccharides: chemistry, classification and function; glycoproteins: structure and function. Fatty acids- Saturated, unsaturated and eicosanoids; phosphor and spingolipids-structure, classification, lipoprotein, liposomes and prostaglandins. Nucleic acids: Nucleotides, single and double- stranded DNA structures, types of DNA, RNA world.	
Unit III	10
Amino acids, peptides and polypeptides: Chemical reactions and physical properties, Three dimensional structures of proteins, the Ramachandran plot, α -helix, β - sheet. Structure of collagen, conformational map, tertiary structure, quaternary structure. Enzymology: Classification, specific activity, coenzymes. Kinetics of enzyme reactions, regulation of enzymatic activity. Isoenzymes: structure and function.	
Unit IV	13
Light and Biomolecules: <ul style="list-style-type: none"> • Properties of light and laser light, Polarisation of light, linear and circular dichroism (cD), cD spectra of protein and nucleic acids. Spectrometry and X-ray diffraction: Principles of spectroscopy, ionization, protein mass determination, MALDI-MS, ESI-MS. Methods of glowing crystals, theory of x-ray diffraction, Bragg's law, x-ray scattering in reciprocal space, low-angle x-ray scattering, fibre diffraction of helices. 	
Unit V	8
Fluorescence and Infrared spectroscopy (IR): <ul style="list-style-type: none"> • Phenomenon of fluorescence, fluorescence decay, fluorescence anisotropy, fluorophores, linear polarization of fluorescence, Fluorescence microscopy and Fluorescence resonance energy transfer (FRET) and its biological applications. • Electron Spin Resonance (ESR) and Nuclear Magnetic Resonance (NMR) spectroscopy: Magnetic phenomena, spin labels, Theory of nuclear resonance, chemical shift and shielding, spin-spin interaction, coupling constant and coupling behaviour, two-dimensional NMR in protein structural studies. NMR in bio-medical research 	

I Semester Zoology Lab Course Content

Program Name	M.Sc	Semester	I
Course Title	Biochemistry and Biophysics (Practical)		
Course Code	HCP 103	No. of Credits	2
Contact hours	52 hours (2hrs/week)	Duration of SEA/Exam	
Formative Assessment Marks	15	Summative Assessment Marks	35

Syllabus

1. pH : Structure and operation of pH meter; Preparation of phosphate and citrate buffers
2. Colorimetric/Spectrophotometric estimation of biomolecules: a) Total free amino acids (ninhydrin reagent method) b) Total Protein (Lowry et al 1951 method) c) Total soluble carbohydrate (Anthrone reagent method) d) Total cholesterol (Zlatkis et al method).
3. Effect of Temperature, pH and substrate concentration on salivary amylase activity.
4. Estimation of inorganic phosphate (Fiske-Subburao method)
5. Absorption spectra of amino acids, protein and nucleic acids by Spectrophotometer
6. Verification of Beer-Lambert Law.
7. Fluorescent Microscopy; Staining with fluorescent dyes & image processing

I Semester Zoology Core Course Content

Program Name	M.Sc	Semester	I
Course Title	Cell, Molecular Biology and Genetics (Theory)		
Course Code	HCT 104	No. of Credits	4
Contact hours	52 hours (4hrs/week)	Duration of SEA/Exam	
Formative Assessment Marks	30	Summative Assessment Marks	70

mLAC Syllabus	Hr
Unit I	13
<p>Molecular organization of cell:</p> <ul style="list-style-type: none"> Cell membrane structure; lipid bilayers- fluid mosaic model; Membrane proteins of small molecular transport and membrane potentials; Cell organelles: Structure and biogenesis of endoplasmic reticulum, Golgi, mitochondria and nucleus; Vesicular transport-from ER through Golgi, trans Golgi network to lysosomes; Endo-exocytosis. Cytoskeleton, Cell interaction and communication: Structure of cytoskeletal filaments and their regulation; Molecular motor proteins; Cell junctions, cell-cell adhesion and extracellular matrix; Cell communication- principles, signalling through G-protein coupled receptors, enzyme linked receptors 	
Unit II	13
<p>Cell cycle, cell division and cancer:</p> <p>Components of cell cycle control system; Intracellular events to control cell-cycle; Extracellular control of cell growth and division; Molecular mechanism of cell division (Mitosis and cytokinesis). Cancer- Types of cancer; Cancer genes- oncogenes, proto-oncogenes and tumor suppressor genes; Molecular basis of cancer-cell behaviour and Cancer therapy: Early detection and prevention, Molecular diagnosis; treatment; Cancer cell lines.; Apoptosis - Definition; Signaling in apoptosis and Regulated proteolysis</p>	
Unit III	13
<p>Mendelism and deviation and Concept of gene:</p> <ul style="list-style-type: none"> Mendelian laws, Incomplete dominance, multiple allele, gene action, gene interaction, penetrance, expressivity, epistasis, pleiotropy, Fine structure and function of gene, Split gene, Jumping gene, Overlapping gene and multiple genes;, allelic variations, Chromosomal theories of inheritance. Meiotic non disjunction, Sex linked inheritance. <p>Mutations and mutagenesis:</p> <ul style="list-style-type: none"> Types of Mutations- Spontaneous mutation, induced mutation, conditional mutation, lethal mutations; Gene mutation - base substitution mutation, Missense, Nonsense and Silent mutations; Mutagenesis - Chemical, Physical and Biological mutagenesis, Detection of mutations. Molecular basis of mutation and its applications 	
Unit IV	8
<p>Eukaryotic chromosome and Sex Determination:</p> <p>Ultrastructure of eukaryotic chromosomes; Types of chromosomal banding; Evolution of Sex chromosomes; Chromosomal and molecular basis of sex determination in <i>C. elegans</i>,</p>	

Drosophila and Human. Dosage compensation- Genic balance, Gene dose.	
Unit V	5
Population Genetics: Genotype and allelic frequency, Hardy-Weinberg equilibrium, Nonrandom mating; Consequences of homozygosity; Factors affecting gene frequencies, Inbreeding; Heterosis; Mutation-effect on allele frequencies; migration and Genetic drift	

I Semester Zoology Lab Course Content

Program Name	M.Sc	Semester	I
Course Title	Cell, Molecular Biology and Genetics (Practical)		
Course Code	HCP 104	No. of Credits	2
Contact hours	52 hours (4hrs/week)	Duration of SEA/Exam	
Formative Assessment Marks	15	Summative Assessment Marks	35

Syllabus

1. Vital staining of mitochondria from yeast cell
2. Study of meiotic stages in grass hopper testis, chromosomal anomalies in human (karyotyping)
3. Preparation of Drosophila Karyotype (at least two species)
4. Study of Polytene chromosomes of Drosophila melanogaster.
5. Counting of cells using haemocytometer (WBC+RBC)
6. Preparation of semi-permanent slides.
7. Genetic problems (in detail)

I Semester Zoology Core Course Content

Program Name	M.Sc	Semester	I
Course Title	Biostatistics and Bioinformatics (Theory)		
Course Code	SCT 105	No. of Credits	2
Contact hours	39 hours (3hrs/week)	Duration of SEA/Exam	
Formative Assessment Marks	30	Summative Assessment Marks	70

mLAC Syllabus	Hr
Unit I	7
<p>Statistics in biology: Importance of statistics in biology, samples and populations, variables in biology, accuracy and precision, collection and condensation of data, types of biological data and graphical representation of the data (histogram/ogive curve /frequency curve).</p> <p>Descriptive Statistics: Measures of central tendency; mean, mode and median, standard deviation, Concept of variation, measure of variation such as variance, coefficient of variation.</p>	
Unit II	8
<p>Introduction to probability distribution: Elements of probability, relative frequency approach, Binomial and Poisson distribution. Normal distribution: frequency distribution of continuous variables, properties of normal distribution, application of normal distribution, applying a normal distribution to observed data.</p> <p>Regression and correlation analysis, curve fitting: Simple linear regression equation and testing significance of regression, Curve fitting: Method of least squares, Correlation coefficient and properties, hypothesis about correlation coefficient.</p>	
Unit III	5
<p>Hypothesis testing: Tests of simple hypothesis using normal and t-distribution. Types of errors. Test of significance: parametric and non-parametric tests, T-tests, Chi-square test for goodness of fit, one-way ANOVA. Mann-Whitney test, Kruskal-Wallis test</p>	
Unit IV	11
<p>Introduction to Bioinformatics: Branches of Bioinformatics, applications of Bioinformatics, Biological databases: Classification, Biological data retrieval systems. Sequence comparison and Database Search: Global alignment, Pair wise alignment, local alignment, multiple sequence alignment, scoring a multiple alignment, multiple sequence alignment methods. Progressive alignment, iterative methods, pattern searching in DNA and protein sequences, PAM matrices, BLAST, FAST and FASTA. Identification of peptide finger print by nano LC-MSiMS database searching by using MASCOT and OMSSA. Introduction to microarray technology. II</p>	
Unit V	8
<p>Molecular phylogenetics: Application of phylogenetic trees, basic terminology-taxa, taxonomy, root, leaf, node, branch, clad, dendrogram, rooted tree, unrooted tree and scaled tree. Molecular Clocks: Basic steps of phylogenetic tree construction, Data based methods-UPGMA, NJ algorithm Character based methods-Maximum parsimony method, maximum likelihood method, validating phylogenetic methods-bootstrapping and jack-knifing, study of Phylip, NJ plot, Clustal X softwares</p>	

II Semester Zoology Core Course Content

Program Name	M.Sc	Semester	II
Course Title	Comparative Anatomy (Theory)		
Course Code	HCT 201	No. of Credits	4
Contact hours	52 hours (4hrs/week)	Duration of SEA/Exam	
Formative Assessment Marks	30	Summative Assessment Marks	70

mLAC Syllabus	Hr
Unit I	8
<p>Locomotion and feeding habits of animals: Locomotion mechanism in invertebrates- flagellar, ciliary movements in protozoa. Hydrostatic movements in Coelenterate, Annelid and Echinodermata.</p> <p>Feeding habits: Nutrition and feeding mechanism in invertebrates, nutrition in protozoa, types and mode of feeding, feeding diversity in insects, filter feeding in lower metazoans, crustaceans, molluscs and echinoderms- functional mechanism</p>	
Unit II	10
<p>Organ system of invertebrates:</p> <ul style="list-style-type: none"> • Origin and organization of coelom: acoelomates- pseudocoelomates and eucoelomates. • Digestive systems, overview of circulatory system, respiratory systems, excretory systems, nervous and sensory system and reproductive organs of animals. 	
Unit III	12
<p>Organ system of vertebrates: Study from fishes to mammals. Respiratory organs: structure and function. Excretory systems: urinary system, Structure and function of mammalian kidney' Circulatory System: General plan of circulation. Aortic arches in various groups and evolution of heart. Nervous system: Peripheral and central nervous system- comparative account of sensory organs- eye and ear</p>	
Unit IV	10
<p>Integument and skeletal system:</p> <ul style="list-style-type: none"> • General features of integument (dermis and epidermis) from pisces to mammals. • Integumental derivatives (nails, claws, hoofs, hairs, horns, scales, feathers). <p>Skeletal system: the skull- overview of skull morphology, skull function and design types. Evolutionary significance of axial, appendicular joints</p>	
Unit V	12
<p>Reproduction and development:</p> <ul style="list-style-type: none"> • Overview of reproduction in invertebrate phyla. • Reproduction, development and phylogenetic significance of the larval forms of arthropods and echinoderms. • Comparison of male and female reproductive systems from fishes to mammals. 	

II Semester Zoology Core Course Lab Content

Program Name	M.Sc	Semester	II
Course Title	COMPARATTE ANATOMY (Practical)		
Course Code	HCP 201	No. of Credits	2
Contact hours	52 hours (2hrs/week)	Duration of SEA/Exam	
Formative Assessment Marks	15	Summative Assessment Marks	35

Syllabus

1. Computer based study of artery vein, lung, kidney, oesophagus, stomach, intestine, liver, testis and ovary of frog/fish/reptiles/mammals.
2. Mounting of Gills (tilapia fish),
3. Specimens of filter feeding species-Metazoa: Curstacea, Mollusca and Echinodermata
4. Slides of Naupilus, Zoea and Mysis larvae.
5. Types of feathers, beaks and feet of birds
6. Virtual Dissection: Reproductive system of male and female cockroach and silk worm
7. Virtual Dissection: Nervous system of silkworm larva and adult cockroach
8. Study of different types of skeletal muscle fibre types.
9. Skull of amphibia, reptiles (temporal fossae), birds (palate) and mammals

II Semester Zoology Core Course Content

Program Name	M.Sc	Semester	II
Course Title	ANIMAL PHYSIOLOGY (Theory)		
Course Code	HCT 202	No. of Credits	4
Contact hours	52bhours (4hrs/week)	Duration of SEA/Exam	
Formative Assessment Marks	30	Summative Assessment Marks	70

mLAC Syllabus	Hr
Unit I	10
<p>Osmoregulation: An overview of osmoregulation, osmolarity and toxicity, cell volume and ionic regulation, osmoregulation in invertebrates and vertebrates, hormonal control of osmoregulation, osmoregulatory genes. Role of renal and extra renal tissues in osmoregulation.</p> <p>Thermoregulation: Poikilotherms, homeotherms, heterotherms and their mechanism of survival. Central control of homeothermy, lethal limits, rate functions. Cold death, cold resistance, heat death; Torpor, hibernation and aestivation.</p>	
Unit II	10
<p>Digestion: Types of nutrition in lower and higher invertebrates. Nutrients-digestive enzymes digestion, absorption in vertebrates. Cellulose digestion-ruminant and non-ruminant digestion, intestinal motility, role of digestive fibre and nutritional disorders, neural and hormonal control of digestion.</p> <p>Excretion: Basic process in urine formation, nitrogenous wastes, acid-base regulation in vertebrate kidney, renal function in animals -mammalian kidney, renal portal system, hormonal regulation-ADH and aldosterone, Detoxification of nitrogen products and purine cycle.</p>	
Unit III	10
<p>Blood vascular system: Open and closed systems, vascular pumps, buffering mechanism by body fluids, blood and lymph- its composition. Blood groups and blood coagulation, hemopoiesis, blood volume, blood pressure-neural and chemical control.</p> <p>Heart:</p> <ul style="list-style-type: none"> • Structure of mammalian heart, electrical activity of the heart, cardiac pump, regulation of heart beat. • Principles of hemodynamics, the arterial system, microcirculation and lymphatics. Control of cardiac output. 	
Unit IV	12
<p>Respiration: Gas exchange and mechanism of respiration in invertebrates and vertebrates, respiratory pigments, transport of O₂ and CO₂- Bohr's and Haldane's effects, oxygen toxicity and control of respiration.</p> <p>Muscle physiology:</p> <ul style="list-style-type: none"> • Molecular structure and function of skeletal muscle, cross-bridge cycle and regulation of 	

contraction, sarcoplasmic reticulum and role of calcium in contraction, energetics of contraction, fatigue, <ul style="list-style-type: none"> • Smooth muscle contractile apparatus, cross-bridge regulation in smooth muscles. • Anatomy and regulation of cardiac muscle contraction, atrial and atrioventricular conduction. 	
Unit V	8
Nerve physiology: <ul style="list-style-type: none"> • Types of neurons and glial cells, basis and significance of membrane potentials, equilibrium potentials and their changes during stimulation, action potential generation and its propagation, Na⁺, K⁺ currents in action potential. • Types of synapses, synaptic transmission-electrical and chemical, neurotransmitters and synaptic inhibition, neurohormones and their function. • Sensory physiology: Mechanism involved in perception of mechano, chemo and photoreception, visual pigments, lateral and compound vertebrate eye. 	

II Semester Zoology Core Course Lab Content

Course Title	ANIMAL PHYSIOLOGY (Practical)	Practical Credits	2
Course Code	HCP 202	Contact Hours	4 hrs/week
Formative Assessment	15 Marks	Summative Assessment	35 Marks

Syllabus

- Determination of excretory products in aminotelic, ureotelic and uricotelic animals.
- Activity of salivary amylase
- Estimation of Hb, ESR and blood clotting time
- Determination of cell fragility
- Effect of Thyroxin on the respiratory metabolism of fish.
- Estimation of Acetylcholine esterase activity.
- Determination of ascorbic acid in blood and urine

II Semester Zoology Core Course Content

Program Name	M.Sc	Semester	II
Course Title	PARASITOLOGY (Theory)		
Course Code	HCT 203	No. of Credits	4
Contact hours	52 hours (4hrs/week)	Duration of SEA/Exam	
Formative Assessment Marks	30	Summative Assessment Marks	70

mLAC Syllabus	Hr
Unit I	8
<ul style="list-style-type: none"> • Basic concept and overview of parasitology, parasites, parasitoids, host, zoonosis • Ecology and evolution of parasites. • Inter relationship between host and parasites • Responses of host to parasitic infection • Mode of transmission of parasites with examples • Host specificity and parasitic adaptations (structural, physiological and reproductive) 	
Unit II	8
<ul style="list-style-type: none"> • Physiology and cell biology of parasites • molecular mechanism of susceptibility and resistance • Immunity and immune responses (humoral and cell mediated) • Diagnosis and control of parasites (<i>general tests to identify parasites, specifically different organs and how to diagnose them</i>) 	
Unit III	12
<ul style="list-style-type: none"> • General characters of parasitic protozoans, morphology, life cycle, epidemiology and management of <i>Entamoeba histolytica</i>, <i>Giardia</i>, <i>Trichomonas naeglaria</i>, • Haemoflagellates: <i>Trypanosoma</i>, <i>Leishmania</i>.- morphology, life cycle, epidemiology and management • Apicomplexa: <i>Plasmodium</i> - morphology, life cycle, epidemiology and management, Differential diagnosis. 	
Unit IV	12
<ul style="list-style-type: none"> • General characters, classification, epidemiology and management of helminthes • Identification characters, life cycle, pathogenicity and control of <i>Fasciola hepatica</i>, <i>Taenia solium</i> (tape worm), <i>Ascaris lumbricoides</i>(round worm), <i>Ancylostoma duodenale</i> (hook worm), <i>Wuchereria bancrofti</i> (filarial worm). 	
Unit V	12
<ul style="list-style-type: none"> • Vectors- types of vectors; • Arthropod vector of medical and veterinary importance-sand flies, mosquito species, house fly, rat flea, cockroach, bed bug and their control. • Life history and importance of acarine ticks: Argas, Rhipicephalus and haemaphysalis; Mites: sarcoptes, psoroptes. • Kyasanur Forest disease (KFD)- epidemiology and managemen 	

II Semester Zoology Core Course Lab Content

Course Title	PARASITOLOGY (Practical)	Practical Credits	2
Course Code	HCP 203	Contact Hours	4 hrs/week
Formative Assessment	15 Marks	Summative Assessment	35 Marks

Practical Content:

1. Identification and economic importance of parasites and vectors: protozoans and helminths (Plasmodium, Trypanosoma, Leishmania, Roundworm-Ascaris lumbricoides (male & female), Hookworm, Filarial worm).
2. Vectors: Anopheles, culex and, Aedes species (Adults, eggs, larvae and pupae), house fly, cockroach, bed bug.
3. Ticks and mites: Argas, sarcoptes, psoroptes, Hemaphysalis spinigera

II Semester Zoology Core Course Content

Program Name	M.Sc	Semester	II
Course Title	ECONOMIC ZOOLOGY (Theory)		
Course Code	HCT 204	No. of Credits	4
Contact hours	52 hours (4hrs/week)	Duration of SEA/Exam	
Formative Assessment Marks	30	Summative Assessment Marks	70

mLAC Syllabus	Hr
Unit I	12
<p>Apiculture- Honey bee species, bee flora and nectar composition. Pollen calendar and management of bee flora. Division of labour, comb building, communication, queen rearing, seasonal management and bee keeping. Medicinal value of honey and apitherapy. Pests and diseases of honey bees and their management.</p> <p>Sericulture- Mulberry cultivation, Rearing and production of mulberry silk and non-mulberry silk (eri, tasar, muga) in India. Races and voltinism of mulberry silkworms and sericulture products and by-products. Global silk production, Indian silk industry. Pests and diseases of silkworms and their management.</p> <p>Vermiculture: Vermiculture process and components, vermicomposting. Types of earthworms. Habit categories - epigeic, endogeic and anecic; indigenous and exotic species. Methodology of vermicomposting: containers for culturing, raw materials required, preparation of bed, environmental pre-requisites, feeding, harvesting and storage of Vermicompost.</p>	
Unit II	10
<p>Fisheries:</p> <ul style="list-style-type: none"> • Marine and inland. Induced breeding, bundh breeding, fish seed trade, fish culture and fish farm management. Composite fish culture. Hybridization, post-harvesting technology, processing and preservation, diseases and their management. Fish farm management. • Shell fish culture. • Prawn Culture (fresh water and marine water) • Pearl culture. Composition, colour, size and quality of pearl. • Fish industry in India and fishery economics. 	
Unit III	12
<p>Poultry: Breeds, principles and techniques of breeding. Management of growers and overcrowding. Management of layers and broilers, broiler industry. Poultry diseases and their control measures. Poultry products- nutritional value of egg and meat. Meat products and by-products of poultry.</p> <p>Dairy breeds and management: Cattle breeds-milk breeds, draught breeds, exotic and cross breeds. Buffalo breeds. Techniques in cattle breeding and artificial insemination. Dairy products: physico-chemical properties of cow and buffalo milk. Processing, preservation and marketing of dairy milk and meat. Diseases and control measures (any four)</p>	
Unit IV	12
Pests and their management:	

<ul style="list-style-type: none"> • Insect pests and vectors- major pests of crops (rice, coconut, sugar cane and mango)- biology, damage and management. • Pests of stored products-rice weevil, rice moth, pulse beetle- biology, damage and management. • House hold pests: cockroach, house fly -vector status and control. • Insect vectors of human diseases (malaria, dengue, chikungunya, encephalitis). • Rodent pests and their management. • Integrated pest management 	
Unit V	8
Pet Animals: <ul style="list-style-type: none"> • Maintenance of pet animals (ornamental fish, reptiles, birds, cats and dogs), • Breeds and breeding of cats and dogs. • Pests, diseases of pet animals (bird, cats and dogs) and their management. 	

II Semester Zoology Core Course Lab Content

Program Name	M.Sc	Semester	II
Course Title	ECONOMIC ZOOLOGY (Practical)		
Course Code	HCP 204	No. of Credits	2
Contact hours	52 hours (2hrs/week)	Duration of SEA/Exam	
Formative Assessment Marks	15	Summative Assessment Marks	35

Syllabus

1. Identification and economic importance: Honeybee species, bee products (bee wax, pollen), pests of honey bees- wax moths, Varroa mites.
2. Mulberry and Non-mulberry silkworms and their cocoons (adults, larvae, bivoltine, multivoltine, defective and double cocoons, muga, tasar and eri cocoons). pests of silkworm- Uzi fly and Dermis beetle.
3. Earthworm species (indigenous and exotic) and cocoons
4. Comparative account (palatability, medicinal value, nutritional value, by-products) of any five of fresh water and seawater fishes.
5. Identification of larval and adult forms of prawns.
6. Poultry and Dairy (cow and buffalo) -breeds (two example each class).
7. Pests of crops (charts and photos): Rice: *Nilaparantata lugens* (Brown planthopper); sugarcane: *Chilo spp.* (Shoot & stem borers); coconut: *Oryctus rhinoceros* (Rhinoceros beetle), *Rhynchophorus ferrugineus* (Red palm weevil) ; mango : *Sternochetus mangiferae* (Mango Seed Weevil); cotton: *Helicoverpa armigera* (American Bollworm), *Spodoptera litura* (Tobacco caterpillar).
8. Stored products: *Sitophilus oryzae* (Rice weevil), *Callosobruchus maculatus*, *C. chinensis* (Pulse beetles), *corcyra cephalonica* (Rice moth).

II Semester Zoology Soft Core Course Content

Program Name	M.Sc	Semester	II
Course Title	Animal Behaviour (Theory)		
Course Code	SCT 205	No. of Credits	2
Contact hours	39 hours (3hrs/week)	Duration of SEA/Exam	
Formative Assessment Marks	30	Summative Assessment Marks	70

mLAC Syllabus	Hr
Unit 1	
Development of behaviour:	
<ul style="list-style-type: none"> History of behavioural studies, development of behaviour causes of behavioural changes during development, Analysis of behaviour ethogram Innate behaviour- orientation, kineses, taxes, motivation, tropism, reflex and nest building. 	6
Unit 2	
Learning and memory:	
Learning Types of learning:	
<ul style="list-style-type: none"> Non-associative learning :Sensitization, habituation, Associative learning: Imprinting, latent and insight learning, reasoning, instrumental conditioning, trial –and–error discrimination, 	7
Memory- Nature, Types- sensory memory, Short term memory, long term memory. Brain Anatomy for memory, memory storage.	
Unit 3	
Evolution and Genetics of behaviour	
Genes and behavioural evolution, evolutionary stable strategies, cultural transmission of behaviour, Hamilton's rule, kin selection and inclusive fitness, altruism, sex and sexual selection, phylogeny of behaviour, genetic control of behaviour (single and multiple gene effect).	10
Unit 4	
Animal communication	
<ul style="list-style-type: none"> Types of communication- auditory, visual, vocalization, tactile, chemical signalling, pheromones, vibration, echolocation in bats, bee dance, and infrasound communications (elephant and whales). Signals- Types and significance of signalling, 	8
Unit 5	
Social behaviour:	
<ul style="list-style-type: none"> Types of social groups, advantages of grouping, social organization insects (honey bees, ants, termites) and primates. Feeding and mating strategies in animals, cooperation and conflict in birds-mammals, evolution of eusocial behaviour. Significance of social life. 	8