

B.Sc. (Hons.) Zoology

PAPER NAME	COURSE LEARNING OUTCOMES
Non-Chordates I: Protists to Pseudocoelomates	<p>Upon completion of the course, students should be able to:</p> <ul style="list-style-type: none">• Learn about the importance of systematics, taxonomy and structural organization of animals.• Appreciate the diversity of non-chordates living in varied habit and habitats.• Understand evolutionary history and relationships of different non-chordates through functional and structural affinities.• Critically analyse the organization, complexity and characteristic features of non-chordates making them familiarize with the morphology and anatomy of representatives of various animal phyla.• Comprehend the economic importance of non-chordates, their interaction with the environment and role in the ecosystem.• Enhance collaborative learning and communication skills through practical sessions, team work, group discussions, assignments and projects.
Principles of Ecology	<p>Upon completion of the course, students should be able to:</p> <ul style="list-style-type: none">• Demonstrate an understanding of key concepts in ecology with emphasis on historical perspective, role of physical factors and concept of limiting factors.• Comprehend the population characteristics, dynamics, growth models and interactions.• Understand the community characteristics, ecosystem development and climax theories.• Know about the types of ecosystems, food chains, food webs, energy models, and ecological efficiencies.• Apply the basic principles of ecology in wildlife conservation and management.• Inculcate scientific quantitative skills, evaluate experimental design, read graphs, and analyse and use information available in scientific literature.
Non-Chordates II: Coelomates	<p>Upon completion of the course, students should be able to:</p> <ul style="list-style-type: none">• Learn about the importance of systematics, taxonomy and structural organization of animals.• Appreciate the diversity of non-chordates living in diverse habit and habitats.• Understand evolutionary history and relationships of different non-chordates through functional and structural affinities.• Critically think about the organization, complexity and characteristic features of nonchordates.• Getting familiarized with the morphology and anatomy of representatives of various animal phyla.• Comprehendthe economic importance of non-chordates, their interaction with the environment and role in the ecosystem.• Enhance collaborative learning and communication skills through practical sessions, team work, group discussions, assignments and projects.
Cell Biology	<p>Upon completion of the course, students should to be able to:</p> <ul style="list-style-type: none">• Understand fundamental principles of cell biology.• Explain structure and functions of cell organelles involved in diverse cellular processes.• Appreciate how cells grow, divide, survive, die and regulate these important processes.

	<ul style="list-style-type: none"> • Comprehend the process of cell signalling and its role in cellular functions. • Have an insight of how defects in functioning of cell organelles and regulation of cellular processes can develop into diseases. • Learn the advances made in the field of cell biology and their applications.
Diversity of Chordates	<p>Upon completion of the course, the students will be able to:</p> <ul style="list-style-type: none"> • Understand different classes of chordates, level of organization and evolutionary relationship between different subphyla and classes, within and outside the phylum. • Study about diversity in animals making students understand about their distinguishing features. • Appreciate similarities and differences in life functions among various groups of animals in Phylum Chordata. • Comprehend the circulatory, nervous and skeletal system of chordates. • Know about the habit and habitat of chordates in marine, freshwater and terrestrial ecosystems.
Physiology: Controlling and Coordinating Systems	<p>Upon completion of the course, students will be able to:</p> <ul style="list-style-type: none"> • Know the basic fundamentals and understand advanced concepts so as to develop a strong foundation that will help them to acquire skills and knowledge to pursue advanced degree courses. • Comprehend and analyze problem-based questions • Recognize and explain how all physiological systems work in unison to maintain homeostasis in the body and use of feedback loops to control the same • Learn an integrative approach to understand the interactions of various organ systems resulting in the complex overall functioning of the body. Synthesize ideas to make connection between knowledge of physiology and real world situations, including healthy life style decisions and homeostatic imbalances • Know the role of regulatory systems viz. endocrine and nervous systems and their amalgamation in maintaining various physiological processes.
Fundamentals of Biochemistry	<ul style="list-style-type: none"> • Upon completion of the course, students should be able to: Gain knowledge and skill in the fundamentals of biochemical sciences, interactions and interdependence of physiological and biochemical processes. • Get exposed to various processes used in industries and gain skills in techniques of chromatography and spectroscopy. • Demonstrate foundation knowledge in biochemistry; synthesis of proteins, lipids, nucleic acids, and carbohydrates; and their role in metabolic pathways along with their regulation. • Know about classical laboratory techniques, use modern instrumentation, design and conduct scientific experiments, and analyze the resulting data. • Be knowledgeable in proper procedures and regulations in handling and disposal of chemicals.
Comparative Anatomy of Vertebrates	<p>Upon completion of the course, students should be able to:</p> <ul style="list-style-type: none"> • Explain comparative account of the different vertebrate systems • Understand the pattern of vertebrate evolution, organisation and functions of various systems. • Learn the comparative account of integument, skeletal components, their functions and modifications in different vertebrates. • Understand the evolution of heart, modification in aortic arches, structure of respiratory organs used in aquatic, terrestrial and aerial vertebrates; and digestive system and its anatomical specializations with respect to different diets and feeding habits. • Learn the evolution of brain, sense organs and excretory organsto a complex,

	<p>highly evolved form in mammals;</p> <ul style="list-style-type: none"> • Learn to analyze and critically evaluate the structure and functions of vertebrate systems, which helps them to discern the developmental, functional and evolutionary history of vertebrate species. • Understand the importance of comparative vertebrate anatomy to discriminate human biology.
Physiology: Life Sustaining Systems	<p>Upon completion of the course, students should be able to:</p> <ul style="list-style-type: none"> • Have a clear knowledge of basic fundamentals and understanding of advanced concepts so as to develop a strong foundation that will help them to acquire skills and knowledge to pursue advanced degree courses. • Comprehend and analyse problem-based questions on physiological aspects. • Recognize and explain how all physiological systems work in unison to maintain homeostasis in the body; and use of feedback loops to control the same. • Learn an integrative approach to understand the interactions of various organ systems resulting in the complex overall functioning of the body.
Biochemistry of Metabolic Processes	<p>Upon completion of the course, students will be able to</p> <ul style="list-style-type: none"> • Gain knowledge and skill in the interactions and interdependence of physiological and biomolecules • Understand essentials of the metabolic pathways along with their regulation. • Know the principles, instrumentation and applications of bioanalytical techniques. • Get exposure to various processes used in industries. • Become aware about classical laboratory techniques, use modern instrumentation, design and conduct scientific experiments and analyze the resulting data. • Be knowledgeable in proper procedures and regulations in handling and disposal of chemicals
Molecular Biology	<p>Upon completion of the course, students will be able to:</p> <ul style="list-style-type: none"> • Describe the basic structure and chemistry of nucleic acids, DNA and RNA; • Compare and contrast DNA replication machinery and mechanisms in prokaryotes and eukaryotes. • Elucidate the molecular machinery and mechanism of information transfer processes– transcription and translation-in prokaryotes and eukaryotes; • Explain post-transcriptional modification mechanisms for the processing of eukaryotic RNAs; • Discuss general principles of transcription regulation in prokaryotes by exploring the structure and function of lactose and tryptophan metabolism operons; • Give an overview of gene expression regulation in eukaryotes; • Explain the significance of DNA repair mechanisms in controlling DNA damage; • Recognise role of RNAs (riboswitches, siRNA and miRNA) in gene expression regulation. • Demonstrate practical knowledge of raising, handling, maintenance and special features such as antibiotic resistance of a simple prokaryotic model organism, Escherichia coli. • Quantitatively estimate concentration of DNA and RNA by colorimetric methods.
Principles of Genetics	<p>Upon completion of the course, students will be able to:</p> <ul style="list-style-type: none"> • Have a deeper understanding of the varied branches of the biological sciences like microbiology, evolutionary biology, genomics and metagenomics.

	<ul style="list-style-type: none"> • Gain knowledge of the basic principles of inheritance. • Analyse pedigree leading to development of analytical skills and critical thinking enabling the students to present the conclusion of their findings in a scientific manner. • Know the mechanisms of mutations, the causative agents and the harmful impact of various chemicals and drugs being used in day to day life. • Find out the effects of indiscriminate use of various chemicals, drugs or insecticides in nature by studying their effect on various bacterial species in soil and water samples from different industrial or polluted areas.
Developmental Biology	<p>Upon completion of the course, students should be able to:</p> <ul style="list-style-type: none"> • Understand the events that lead to formation of a multicellular organism from a single fertilized egg, the zygote. • Acquire basic knowledge of the cellular processes of development and the molecular mechanisms underlying these. • Describe the general patterns and sequential developmental stages during embryogenesis; and understand how the developmental processes lead to establishment of body plan of multicellular organisms. • Discuss the general mechanisms involved in morphogenesis and to explain how different cells and tissues interact in a coordinated way to form various tissues and organs. • Understand about the evolutionary development of various animals. • Know the process of ageing leading to interventions that can improve the overall health and quality of life in aged people. • Learn the importance of latest techniques like stem cell therapy, in vitro fertilization and amniocentesis etc. to be applied for human welfare. • Develop the skill to raise and maintain culture of model system; Drosophila in the laboratory.
Evolutionary Biology	<p>Upon completion of the course, students should be able to:</p> <ul style="list-style-type: none"> • Acquire problem solving and high order analytical skills by attempting numerical problems as well as performing simulation studies of various evolutionary forces in action. • Apply knowledge gained, on populations in real time, while studying speciation, behaviour and susceptibility to diseases. • Gain knowledge about the relationship of the evolution of various species and the environment they live in. • Get motivated to work towards mitigating climate change so that well adapted species do not face extinction as a result of sudden drastic changes in environment. • Use knowledge gained from study of variations, genetic drift to ensure that conservation efforts for small threatened populations are focused in right direction. • Predict the practical implication of various evolutionary forces acting on the human population in the field of human health, agriculture and wildlife conservation. • Use various software to generate interest towards the field of bioinformatics and coding used in programming language

Animal Biotechnology	<p>Upon completion of the course, students should be able to:</p> <ul style="list-style-type: none"> • Use or demonstrate the basic techniques of biotechnology like DNA isolation, PCR, transformation, restriction digestion etc. • Make a strategy to manipulate genetic structure of an organism for the improvement in any trait or its well-being based on the techniques learned during this course. • Understand better the ethical and social issues regarding GMOs. • Use the knowledge for designing a project for research and execute it.
Computational Biology	<p>Course Learning Outcome: After completion of the course the students will be able to:</p> <ul style="list-style-type: none"> • Explain the basic concepts of Bioinformatics and Biostatistics and its various applications in different fields of biological sciences • Describe theoretically sources of biological data, and list various biological databases – nucleic acids, protein sequence, metabolic pathways and small molecule • Identify various file formats of sequence data and tools for submission of data in databases as well as retrieval of gene and protein data from databases • Annotate gene sequence and protein structure prediction • Perform and explain the underlying mechanisms of pair-wise and multiple sequence alignments and determine phylogenetic relationships • Describe various computational tools and methodologies and their application in structural bioinformatics, functional genomics and in silico drug discovery • Measure variability (standard deviation, standard error, co-efficient of variance) and hypothesis testing (Z-test, t-Test, chi-square test)
Immunology	<p>After completion of the course the students will be able to:</p> <ul style="list-style-type: none"> • Describe the basic mechanisms, distinctions and functional interplay of innate and adaptive immunity • Define the cellular/molecular pathways of humoral/cell-mediated adaptive responses including the role of Major Histocompatibility Complex • Explain the cellular and molecular aspects of lymphocyte activation, homeostasis, differentiation, and memory • Understand the molecular basis of complex, humoral (Cytokines and Complement) and cellular processes involved in inflammation and immunity, in states of health and disease • Describe basic and state-of-the-art experimental methods and technologies • Integrate knowledge of each subsystem to see their contribution to the functioning of higher-level systems in health and disease including basis of vaccination, autoimmunity, immunodeficiency, hypersensitivity and tolerance

Parasitology	<p>After completion of the course the students will be able to:</p> <ul style="list-style-type: none"> ● Understand the variation amongst parasites, parasitic invasion in both plants and animals;applicable to medical and agriculture aspects. ● Help to know the stages of the life cycles of the parasites and the respective infective stages. ● Develop ecological model, knowpopulation dynamics of parasite, establishment of parasite population in host body, adaptive radiations and methods adopted by parasite to combat with the host immune system ● Develop skills and realize significance of diagnosis of parasitic attackand treatment of patient or host. ● Learn important case studies to highlight interesting researches, serendipities towards the advancement and enrichment of knowledge in the field of Parasitology.
Animal Cell Biotechnology (GE)	<p>Upon completion of the course, students will be able to:</p> <ul style="list-style-type: none"> ● Get a clear concept of the basic principles and applications of biotechnology. ● Know the basic techniques used in genetic manipulation helping them continue with higher studies in this field. ● Acquire knowledge of the basic principles, preparations and handling required for animal cell culture. ● Understand principles underlying the design of fermenter and fermentation process and its immense use in the industry. ● Design small experiments for successful implementation of the ideas and develop solutions to solve problems related to biotechnology keeping in mind safety factor for environment and society. ● Apply knowledge and skills gained in the course to develop new diagnostic kits and to innovate new technologies further in their career ● Enhance their understanding of the various aspects and applications of biotechnology as well as the importance of bio-safety and ethical issues related to it.
Animal Diversity (GE)	<p>Upon completion of the course, students will be able to:</p> <ul style="list-style-type: none"> ● Distinguish between major phyla of animals through a demonstrated understanding of their taxonomic classification and diversity. ● Describe the distinguishing characteristics of all major phyla. ● Understand the fundamental differences among animal body plans and relate them to function, taxonomic classification, and evolutionary relationships among phyla. ● Illustrate lifecycles, structure, function and reasons for importance of few representative organisms from different groups of animals. ● Identify anatomical structures from prepared tissues. ● Observe living animals in the environment and relate observations to theory from the course. ● Recognize major animal phyla and animals on the basis of their external characteristics.

<p>Food, Nutrition and Health (GE)</p>	<p>Upon the completion of the course, students will be able to:</p> <ul style="list-style-type: none"> • Have a better understanding of the association of food and nutrition in promoting healthy living. • Think more holistically about the relationship between nutrition science, social and health issues. • Move on to do post-graduation studies and can apply for jobs as food safety officers, food analysts, food inspectors, food safety commissioners or controllers for jobs in organizations like FSSAI. • Specialize in various fields of nutrition.
<p>Human Physiology (GE)</p>	<p>Upon completion of the course, students will be able to:</p> <ul style="list-style-type: none"> • Know the principles of normal biological function in human body. • Outline basic human physiology and correlate with histological structures. • Understand how animals maintain an internal homeostatic state in response to changes in their external environment.
<p>Insect Vector and Disease (GE)</p>	<p>Upon completion of the course, the students will be able to:</p> <ul style="list-style-type: none"> • Identify different insects and classify them based on their morphology and behaviour • Describe the host-pathogen relationships and the role of the host reservoir on transmission of parasite • Explain various modes of transmission of parasite by insect vectors • Recognize various possible modern tools and methodologies for laboratory diagnosis, surveillance and treatment of diseases • Define various terms related to insect transmitted diseases such as vectorial capacity, mechanical and biological transmission, host specificity etc. • Identify the risk groups and characterize them on the basis of exposure risk • Explain control methods of insect vector diseases including spreading awareness on public health programs and mitigating insect borne diseases • Employ the use of advanced management strategies in disease control with respect to parasite evolution
<p>Apiculture (SEC)</p>	<p>Upon completion of the course, students should be able to:</p> <ul style="list-style-type: none"> • Learn about the various species of honey bees in India, their social organization and importance. • Be aware about the opportunities and employment in apiculture- in public, private and government sector. • Gain thorough knowledge about the techniques involved in bee keeping and honey production. • Know about various products obtained from beekeeping sector and their importance. • Develop entrepreneurial skills necessary for self-employment in beekeeping sector. • Enhance collaborative learning and communication skills through practical sessions, team work, group discussions, assignments and projects.
<p>Aquarium Fish Keeping (SEC)</p>	<ul style="list-style-type: none"> • Upon completion of the course, students should be able to: Acquire knowledge about different kinds of fish their compatibility in aquarium. • Become aware of Aquarium as commercial, decorative and of scientific studies. • Develop personal skills on maintenance of aquarium. • Know about the basic needs to set up an aquarium, i.e., dechlorinated water, reflector, filters, scavenger, aquatic plants etc. and the ways to make it cost-effective.

<p>Medical Diagnostics (SEC)</p>	<p>After completing this course, the students should be able to:</p> <ul style="list-style-type: none"> ● Gain knowledge about various infectious, non-infectious and lifestyle diseases, tumors and their diagnosis ● Understand the use of histology and biochemistry of clinical diagnostics and learn about the molecular diagnostic tools and their relation to precision medicine. ● Develop their skills in various types of tests and staining procedure involved in hematology, clinical biochemistry and will know the basics of instrument handling. ● Learn scientific approaches/techniques used in the clinical laboratories to investigate various diseases and will be skilled to work in research laboratories. ● Gain knowledge about common imaging technologies and their utility in the clinic to diagnose a specific disease.
<p>Sericulture (SEC)</p>	<p>Upon completion of the course, students should be able to:</p> <ul style="list-style-type: none"> ● Learn about the history of sericulture and silk route. ● Recognize various species of silk moths in India, and exotic and indigenous races. ● Be aware about the opportunities and employment in sericulture industry- in public, private and government sector. ● Gain thorough knowledge about the techniques involved in silkworm rearing and silk reeling. ● Develop entrepreneurial skills necessary for self-employment in mulberry and seed production and be apprised about practicing sericulture as a profit-making enterprise. ● Enhance collaborative learning and communication skills through practical sessions, team work, group discussions, assignments and projects.

