

## **B.Sc Zoology (H) Programme Outcomes**

Zoology is one of the most fundamental branch of biology to be studied at undergraduate level. It is required to learn and understand about animal diversity to appreciate the variability in relation to their morphology, anatomy and behaviour among different animals. Our students will be equipped to learn and know about different human systems, their coordination and control. This course will also provide an opportunity to learn about their own evolution along with other animals. They will be able to qualitatively and quantitatively analyse evolutionary parameters using various bioinformatics and computational tools used in modern sciences. This will provide them ample opportunities to explore different career avenues. This course will also provide a platform to learn classical genetics to understand distribution of different traits among populations, their inheritance ethnicity and can correlate with contemporary and modern techniques like genomics, metagenomics, genome editing and molecular diagnostic too Practical and theoretical skills gained in this course will be helpful in designing different public health strategies for social welfare.

**Programme specific outcome**-Zoology course also provide a knowledge of applied subjects to develop various skills to make a career and become an entrepreneur in the field of aquatic biology, sericulture, apiculture etc. After completion of this course students will be able to contribute as policy makers in wild life conservation animal preservation and environment protection.

## **B.Sc Zoology (H) Course learning Outcomes**

### **First Year Semester I**

#### **Core course: 1.Non-Chordates I-Protista to Pseudocoelomates**

- Students will learn about importance of systematic, taxonomy, structural organization of the animals and will appreciate diversity of non-Chordates.
- They will understand evolutionary history and relationships of different non-Chordates through functional and structural affinities.
- They will be able to critically analyse organization, complexity and characteristic features of non-Chordates along with their significance and interactions with the environment.
- The paper of Non-chordates will help them to enhance their collaborative learning and communication skills through discussions in the class group.

#### **Core course:2. Principles of Ecology**

- After completion of this course students will Understand the population and community characteristics, ecosystem development and climax theories.
- Knowledge about the types of ecosystems, food chains, food webs, energy models, and ecological efficiencies.
- Capability to apply the basic principles of ecology in wildlife conservation and management.
- They will understand about the paramount role and importance of Nature.
- It will impart them with the knowledge about the judicious use of existing ecological resources for sustainable development.

### **GE-1 Course-1: Animal Diversity**

- The course teaches the students about the diversity of both the vertebrate and the invertebrate members of the animal kingdom.
- This course brings into perspective the regular yet largely ignored observances about the members of the animal kingdom and help students to identify and group various animals.
- The course leads the students to understand evolutionary relations between different groups in the animal kingdom, their global distribution as well as their conservation status.
- The course enables the students to prepare for further studies like MSc in Zoology, and several government jobs entrances as well.

### First Year Semester II

#### **Course Name: 3. Cell Biology**

- Illustrate that Cell being the fundamental structural unit defines the function of all living things.
- Obtain knowledge of the structures and functions of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles.
- Understand the cellular components underlying cell division.
- Compare and contrast the events of cell cycle and its regulation.
- Explain the communications of cells with other cells and to the environment.

#### 4.Non-Chordates II : Coelomates

1. Student learn the origin of multicellular organisms from unicellular eukaryotes
2. Students learn about the concept and diversity of Non-Chordata with an emphasis and distinction in reference to coelom (e.g. in first semester, protista to pseudocoelomates)
3. Students learn about how organisms are classified based in Non-Chordata on their complexity, organization and characters
4. Students learn about Specific features for any group of organisms in non-chordates and their identification

#### GE-2- Human Physiology

Zoology department offered this course to the students of other than zoology as generic elective course.

- This course helps the students to know about the basic histology and physiology of human body. Students know how their body functions, what are the chemical changes taking place in their body during any action they do like how their brain and hand coordinate during writing.
- They know what the hormones are and how their concentration changes with puberty or some other conditions like menstruation, pregnancy, stress or happy moments.
- They also know how their heart, lungs, kidney and other glands work.
- They also become aware about various types of diseases of human body.

- Thus this course helps the students to keep their body fit by knowing about it.

## Second Year Semester III

### 5.Diversity of Chordates

- Understand the evolutionary history and relationship between the different classes of chordates.
- Know the different characteristics along with their habits, habitats and distribution of the chordates.
- Understand the significance of the differences in physiological systems between the vertebrates.
- Distinguish the significance of the chordates from other lower organisms and comprehend their advantages.

- 6.Physiology: Controlling and Coordinating systems
- Students' knowledge of the structure, function and regulation, of endocrine systems would be broadened
- The knowledge of the processes underlying male and female reproduction and fertility would be broadened.
- Students' interest and passion for biomedical sciences would be invoked.

### 7. Fundamentals of Biochemistry

At the end of third semester, the undergraduate student will be able to

- interpret structure-functional relationships of carbohydrates, proteins and lipids .
- describe the structure and role of purines and pyrimidines in nucleic acids and their types, cot curves, Hypo-hyperchromicity of DNA.
- be familiar with enzyme , mechanism of action of enzymes; coenzymes, co-factors, Isozymes; kinetics of enzyme catalysed reactions and enzyme inhibitions and regulatory process.
- learn about basic laboratory techniques and equipments used in biochemistry.
- perform qualitative analysis to characterize properties of various biomolecules and determine the effect of pH and temperature on salivary enzyme.

### GE 3 Course: GE-Food, Nutrition and Health

- Especially important keeping in mind the covid 19 pandemic where regular attention is to be paid to diet, nutrition and health.
- This course teaches the students about regular but much ignored aspects of nutrition, and how good nutrition is a direct effector of immunity, longevity and leading a disease free life. The course is complementary to the dietary needs of all age groups and people from different walks of life.

- The course empowers the students to be future nutritionists, dieticians, along with several prospects of government and private jobs in the food and beverage industry and the obviously related health industry.
- at the culmination of this course, the students can, for themselves, practice good nutrition and provide better care for themselves and their loved ones.

## **Semester IV**

### **8.COMPARATIVE ANATOMY OF VERTEBRATES**

- Understand 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 organs to a complex, highly evolved form in mammals;
- 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.

### **9. RESEARCH METHDOLOGY**

- Describe basic concepts of research and its methodologies
- Identify appropriate research topics and set up hypothesis
- Perform literature review using library (print) and internet (online) resources
- Design experiments/surveys, collect data and represent data in tables/figures
- Analyze data with appropriate software tools, interpret results and draw conclusion
- Write scientific report/ review/ thesis and prepare seminar/ conference presentations - oral as well as poster
- Understand the methods of citation and referencing styles, check plagiarism and get insight of intellectual property right

### **GE IV- Animal Cell Biotechnology**

- To 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.

#### **10. Physiology: Life Sustaining systems**

- Students would be able to know basic fundamentals and understand advanced concepts related to systems in the body, their feedback loop controls.
- They would be able to understand the connections between knowledge of Physiology in relation to real world situations, including healthy lifestyle decisions, diseases and disorders and homeostatic imbalances.
- They would be able to know the role of self-sustaining systems like circulatory, digestive, respiratory and excretory systems and how all of these work in unison to maintain a balance in the body.

#### **11. Biochemistry of Metabolic Processes**

At the end of fourth semester, the undergraduate students will be able to

- understand the processes in metabolism and regulation of metabolic pathways.
- understand the metabolism of carbohydrates, proteins and lipids through various anabolic and catabolic pathways like glycolysis, gluconeogenesis, Krebs cycle, Glycogen metabolism, transamination, deamination, urea cycle, beta and omega oxidation of saturated fatty acids and their regulation; Ketogenesis.
- know in detail about concepts to illustrate how enzymes and redox carriers and the oxidative phosphorylation machinery occur.
- get exposure to various processes of metabolism and quantification of many biomolecules.
- plan and safely perform biochemical and physiological significant enzyme assays.

## **12. Molecular Biology**

On completion of this course, the students will:

- Be able to describe the basic structure of nucleic acids at the molecular level and with a deeper understanding of the structure of DNA students will be able to explain how RNA differs from DNA.
- Learn how the DNA is packaged inside the nucleus in association with the histone proteins and organized in a genome.
- Explain the underpinnings of the mechanism of DNA replication and repair and will be able to compare and contrast eukaryotic and prokaryotic enzymes involved in DNA replication and repair.
- Have a deeper understanding of DNA repair mechanisms, including mismatch repair, base excision, and nucleotide excision repair mechanisms and the repair of double stranded DNA.
- Explain the interrelationship of DNA, RNA and protein synthesis and how these interactions are regulated.
- Demonstrate the profound understanding of the process of transcription, including the three major steps of initiation, elongation, and termination and how this process is both similar and different in prokaryotic and eukaryotic organisms.
- Understand the characteristics of genetic code, how to interpret the codon table and explain the relationship between codons on mRNA and the amino acids in a polypeptide.
- Be able to explain how genetic information in the DNA is selectively expressed as functional proteins.
- Be able to explain how mRNAs, rRNAs and tRNAs are synthesized and processed.
- Know the components of prokaryotic and eukaryotic ribosomes and how they are organized into subunits and whole ribosomes.
- Demonstrate the deeper understanding of the mechanisms of post-transcriptional processing and the role of this process in control of gene expression.
- Understand the general mechanism of RNA splicing, and be familiar with structure and function of spliceosomes.
- Define and explain the role of ribozymes. What three properties allow some RNA molecules to function as ribozymes?

## **13. Principles of Genetics**

- A thorough and in-depth understanding of the chemical basis of heredity
- The skills required to plan, carry out, and evaluate the outcomes of genetic experiments in animal model systems.
- Develop the necessary communication skills in the discipline required for Oral presentations of research results, and poster presentations at conferences etc.

## **14. Developmental Biology**

Course outcome for Developmental biology:

1. This course will help the students to understand the development of multicellular organisms from a single cell zygote.
2. Students will be able to appreciate the mechanisms that support growth and development.
3. They will learn interesting and unique post embryonic development that happens in other animals

4. It will help them to understand the concept of aging and the relevance of this knowledge in several medical applications.

### **15.Paper: Evolutionary Biology**

Upon completion of the course, students should be able to:

- 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

### **16. Immunology Discipline Specific Elective - (DSE)**

A student should be able to demonstrate the following:

- 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, 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

### **17. Basics of Neuroscience**

On completion of this course, the students should be able to:

- Explain the fundamental concepts in the general organization and operation of the nervous system.
- Demonstrate a basic understanding of the cellular composition of the nervous system and the process of communication between these cells.
- Explain the cellular and molecular basis for excitability, conductivity, synaptic function and plasticity of the nervous system.
- Understand the role of various neurotransmitters and neuromodulators, their structure, classification and signalling pathways.
- Understand the neurobiology of sleep and wakefulness, sexual orientation and other complex behaviour such as how does a brain learn to use language, how neurobiological underpinnings of language shape human communication and how specific neural circuits contribute to learning and consolidation of memory.
- Examine the neural basis of vision perception, process of transduction of visual information and understand how sensory systems transform environmental stimuli into electrical signals.

Examine the physiological, and neurochemical bases of psychiatric disturbances such as schizophrenia, depression, addiction, Parkinson's disease and Alzheimer's Disease and the mechanism of action of therapeutic drugs used in their treatment.

### **18. ANIMAL BEHAVIOUR & CHRONOBIOLOGY**

- Understand types of animal behaviour and their importance to the organisms.
- Enhance their observation, analysis, interpretation and documentation skills by taking short projects pertaining to Animal behaviour and chronobiology.
- Relate animal behaviour with other subjects such as Animal biodiversity, Evolutionary biology, Ecology, Conservation biology and Genetic basis of the behaviour.
- Understand various process of chronobiology in their daily life such as jet lag.
- Learn about the biological rhythm and their application in pharmacology and modern medicine.
- Realize, appreciate and develop passion to biodiversity; and will respect the nature and environment.

### **19 Animal Biotechnology Discipline Specific Elective - (DSE)**

- The student will be able to use or demonstrate the basic techniques of biotechnology like DNA isolation, PCR, transformation, restriction digestion etc.



- Will be able to 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.
- Will understand better the ethical and social issues raised regarding GMOs. .
- Can use the knowledge for designing a project for research and execute it.

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