

PO & CO FOR B.SC ZOOLOGY (HONOURS)
DEPARTMENT OF ZOOLOGY
DARJEELING GOVERNMENT COLLEGE
W.e.f 2018-2019

Programme Outcomes

Program Name: B.Sc. in Zoology & General Degree Programme Course

After the completion of B.Sc. Honours and General Degree Programme, the students will be able to achieve the following outcomes:

PO1: Subject Knowledge: Students learn the principles of animal sciences and develop their understanding of the intricate relationships between different living things.

PO2: Critical thinking and Cognitive skills: The Programme fosters in students a variety of skills that are useful for the advancement of society and the country as a whole as well as for their future academic endeavors, including creativity, scientific aptitude, logical thinking, critical analysis, and problem-solving abilities.

PO3: Instrumentation and Experiments: Acquire the skills in handling scientific instruments, planning and performing in laboratory experiments

PO4: Environment conservation and sustainability: Knowledge of the processes involved in environmental conservation, their significance, pollution prevention, biodiversity preservation, need for conservation of endangered species and need for sustainable development.

PO6: Research and Analysis: Demonstrate analytical skill and proficiency in a range of tools and techniques used in research in science and interdisciplinary programmes.

PO5: Entrepreneurship: Become knowledgeable about small-scale businesses such as aquaculture, fish farming, beekeeping, animal husbandry, and poultry farms.

PO6: Effective Communication: Effectively use the basic IT , writing and verbal skills for effective presentation and communication of ideas

PO7: Employability and higher Education: Students also have the option to enroll for higher education and B. Ed course and in different technical and job-oriented courses

PO8: Ethics : Grows to love and understand animals. Develop moral, ethical, and social principles in your personal and professional life to become a highly cultured and civilised personality.

PO11: Nation Building: Introspect and evolve into dynamic and creative individuals capable of socially productive, constructive actions that positively impact our Nation and the World at large

Programme Specific Outcomes: PSO

After the completion of B.Sc. Honours Degree Programme, the student will be able to:

PSO1: Students will get extensive information about animal diversity, including the idea of scientific taxonomy and systematics thereby identify, classify and differentiate diverse chordates and non-chordates based on their morphological, anatomical and systemic organization. Understand evolutionary links among animals, by connecting the theoretical concept with practical terms, practical learning.

PSO2: By studying the fundamental ideas and procedures of ecology, environment, and conservation biology, theoretically and through fieldwork and/or excursions to national parks and sanctuaries, students will gain a comprehensive understanding of these subjects. This will further aid in their understanding of animal behavior patterns and their patterns of adaption in the natural world.

PSO3: Students will be able to comprehend the fundamentals of immunological system functioning, molecular mechanisms underlying gene function, and cell and developmental biology.

PSO4: They can better comprehend appropriate functioning and the integration of various physiological systems if they have a basic understanding of the various metabolic responses. This will assist them in learning more about immunology, developmental biology, and the physiological adaption of organisms.

PSO5: Acquire practical skills in cell & molecular biology, biochemistry, genetics, enzymology These methodologies will provide an extra edge to our students, who wish to undertake higher studies. Their ability to operate in diagnostic and research centers will be facilitated by their proficiency in basic medical diagnostics, histology,

PSO6: Acquire awareness towards environmental conservation, sustainability, human values, and professional ethics and understand the difference between acting, responding, reacting to various social issues which will help in becoming responsible citizens of the country.

Semester	Course Outcomes CO: B.Sc. Zoology Honours	
SEMESTER-I	CC1- (NON-CHORDATES I)	
	CO 1. (Basics of Animal Classification)	<ul style="list-style-type: none"> Describe general taxonomic rules on Animal Classification.
	CO 2. (Protista & Metazoa)	<ul style="list-style-type: none"> Classify Phylum Protozoa to Echinodermata with taxonomic keys. Knowledge about pseudopodial, flagellar and ciliary locomotion. Develops idea about life cycle and pathogenicity of <u>Plasmodium</u> sp. and <u>Entamoeba</u> sp. Students gain knowledge about basic concepts of evolution of symmetry and segmentation in Metazoa
	CO 3. (Porifera)	<ul style="list-style-type: none"> Classify Phylum Porifera with examples. Detailed knowledge of cell types spicules and asconoid, syconoid and leuconoid canal system in sponges
	CO 4. (Cnidaria)	<ul style="list-style-type: none"> Classify Phylum Cnidaria with examples. Comprehensive knowledge about Metagenesis, polymorphism. Knowledge about Coral reefs, function and conservation.
	CO 5. (Ctenophora)	<ul style="list-style-type: none"> Describe general characteristics of Ctenophora.
	CO 6. (Platyhelminthes)	<ul style="list-style-type: none"> Classify Phylum Platyhelminthes with taxonomic keys. Knowledge about life cycle of <u>Fasciola</u> sp. and <u>Taenia</u> sp.
	CO 7. (Nematoda)	<ul style="list-style-type: none"> Classify Phylum Nematoda with taxonomic keys. Knowledge about life cycle of <u>Ascaris</u> sp. and <u>Wuchereria</u> sp. Comprehensive knowledge about parasitic adaptations in helminthes.
	CC1 – LAB (NON-CHORDATES I)	
	CO	<ul style="list-style-type: none"> Students will be able to identify with reasons and classify organisms belonging to Phylum Protozoa, Porifera Cnidaria, Platyhelminthes and Nematoda. Students will be trained stain and prepare whole mounts of unicellular organisms. They will be able to use the light microscope for viewing of unicellular organisms under different magnifications.
	CC2 - (ECOLOGY) THEORY	
	CO 1. (Introduction to Ecology)	<ul style="list-style-type: none"> Students will gain knowledge about different contributors in the field of ecology. Students will be introduced to the concept of Biosphere and some physical factors such as light and temperature.
	CO 2. (Population)	<ul style="list-style-type: none"> Understand the various features and aspects of population ecology..
	CO 3. (Community)	<ul style="list-style-type: none"> Understand the various features and aspects of community ecology such as species diversity, abundance dominance,

		<p>richness.</p> <ul style="list-style-type: none"> Knowledge about Ecological succession. a
	CO 4. (Ecosystem)	<ul style="list-style-type: none"> Understand the various features and aspects of natural and human modified ecosystem ecology. They will have the knowledge about energy flow in an ecosystem. They will acquire knowledge about nutrient and biogeochemical cycle.
	CO 5. (Applied Ecology)	<ul style="list-style-type: none"> Student will be learning the various issues related to wildlife conservation. Students will gain knowledge about Wild life protection act (1972) and also learn about management and strategies for tiger conservation.
	CC2 LAB - (ECOLOGY)	
	CO	<ul style="list-style-type: none"> Students will be able to study experimentally the different physico-chemical parameters of an aquatic body. They will have the required knowledge to calculate Diversity of a community. They will be able to plot survivorship curves of biological populations. They will learn about insitu conversation, behaviour and diversity through a field visit.
SEMESTER-II	CC3 (NON-CHORDATES II) THEORY	
	CO 1. (Introduction)	<ul style="list-style-type: none"> Knowledge about evolution of coelom and metamerism.
	CO 2. (Annelida)	<ul style="list-style-type: none"> Classify Phylum Annelida with taxonomic keys upto Class level. Knowledge about excretion, metamerism and locomotion in <u>Nereis</u> sp.
	CO 3. (Arthropoda)	<ul style="list-style-type: none"> Classify Phylum Platyhelminthes with taxonomic keys upto Class level. Knowledge about vision in insecta, respiration and metamorphosis in Lepidopterans.
	CO 4. (Onycophora)	Knowledge about evolutionary significance and affinities of <u>Peripatus</u> sp.
	CO 5. (Mollusca)	<ul style="list-style-type: none"> Classify Phylum Mollusca with taxonomic keys upto Class level. Knowledge about nervous system, torsion and detorsion in Gastropoda. Comprehensive knowledge about respiration in <u>Pila</u> sp and significance of trocophore larva.
	CO 6. (Echinodermata)	<ul style="list-style-type: none"> Classify Phylum Echinodermata with taxonomic keys upto Class level. Knowledge about water-vascular system, larval forms and affinities with Chordates.
	CO 7. (Hemichordata)	<ul style="list-style-type: none"> Students will learn about the general characteristics of Hemichordata. Relationship with non-chordates and Chordates.
	CC3 LAB- (NON-CHORDATES II)	

	CO	<ul style="list-style-type: none"> Students will be able to identify with reasons and classify organisms belonging to Phylum Annelida, Arthropoda, Mollusca, Echinodermata and Sub-Phylum Hemichordata. They will have an experiential learning on the digestive system, septal nephridia pharyngeal nephridia.
	CC4 - (CELL BOLOGY) THEORY	
	CO 1. (Overview of Cells)	Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, Viruses, Viriod, Prion and Mycoplasma.
	CO 2. (Plasma Membrane)	<p>Students will gain knowledge about:</p> <ul style="list-style-type: none"> Ultrastructure and composition of plasma membrane Fluid mosaic Model active passive and facilitated transport. Cell junctions
	CO 3. (Cytoplasmic Organelles I)	<p>Students will gain knowledge about Cytoplasmic Organelles</p> <ul style="list-style-type: none"> Endoplasmic Reticulum Golgi Apparatus Lysosomes
	CO 4. (Cytoplasmic Organelles II)	<ul style="list-style-type: none"> Students will gain knowledge about Mitochondria viz. Replication, Endosymbiotic hypothesis of its origin, mitochondrial respiratory chain and chemi-osmotic hypothesis of ATP production Students will gain knowledge about the structure and function of Peroxisomes and Centrosomes.
	CO 5. (Cytoskeleton)	<ul style="list-style-type: none"> The students should be able to differentiate the molecular structure of microtubules and microfilaments and explain the structure of skeletal framework.
	CO 6. (Nucleus)	<ul style="list-style-type: none"> The students should be able to explain the ultra structure of nucleus, nuclear envelope and nucleolus in relation to the importance of the organelle as the central coordinating centre of a cell.
	CO 7. (Cell Division)	<ul style="list-style-type: none"> They will be able to describe Cancer through Concept of oncogenes and tumor suppressor genes. The students will gain knowledge to understand the different types of cell division i.e., mitosis and meiosis and its significance in vegetative and reproductive cells
	CO 8. (Cell Signalling)	<ul style="list-style-type: none"> The students will be able to explain and write on the. Cell signalling and transduction pathways
	CC4 LAB - (CELL BOLOGY Lab)	
	CO	<ul style="list-style-type: none"> This lab work enables the students : To prepare the temporary stained slide of onion root tip and draw various stages of mitosis. To know the procedure for Squash preparation from grasshopper testis and differentiate between various stages of meiosis along with the diagram. To locate the Barr body after the preparation of permanent slide to show the presence of Barr body in human female

		<p>blood cells/cheek.</p> <ul style="list-style-type: none"> To understand Fuelgen reaction and know about the preparation of permanent slide to demonstrate DNA. To follow Trypan Blue staining technique using spleen and explain about the Cell viability
SEMESTER-III	CC5 - (CHORDATES) THEORY	
	CO 1. (Introduction to Chordates)	<ul style="list-style-type: none"> Students will be able to understand the main characteristic features of Phylum Chordata and general characteristic features upto Class level.
	CO 2. (Protochordata)	<ul style="list-style-type: none"> Students will be able to describe the general characters of Sub-Phylum Urochordata and Cephalochordata and their classification upto Class level. students will be able to write about Retrogressive metamorphosis in <i>Ascidia</i> sp. And filter feeding in <i>Branchiostoma</i> sp.
	CO 3. (Origin of Chordata)	<ul style="list-style-type: none"> Understand how the chordates originated through Dipleurula concept and Echinoderm theories of origin.
	CO 4. (Agnatha)	<ul style="list-style-type: none"> Learn about characteristic features of cyclostomes upto order level. The students will also know about the process of metamorphosis in Lamprey and the zoological importance of ammocoete larva
	CO 5. (Pisces)	<ul style="list-style-type: none"> Students will be familiarized with two major classes of fishes, the Chondrichthyes and Osteichthyes. The students will learn the process of migration and parental care in fishes and the diversity in the structure of swim bladder in fishes.
	CO 6. (Amphibia)	<ul style="list-style-type: none"> Students will learn to classify Amphibia upto living orders along with parental care, metamorphosis, neoteny and paedogenesis.
	CO 7. (Reptilia)	<ul style="list-style-type: none"> Students will be able to classify Class Reptilia up to living orders They will also gain a deeper insight into the biting mechanism of snakes and the poison apparatus
	CO 8. (Aves)	<ul style="list-style-type: none"> Develop idea about the characters and classification of Aves . Understand the mechanism of migration in birds, their exoskeletal structures and double respiration. The students will understand the aerodynamics and principles of flight
	CO 9. (Mammals)	<ul style="list-style-type: none"> The students will learn to classify Mammals up to living orders, the exoskeletal structures, adaptive radiation and echolocation in bats,
	CO 10. (Zoogeography)	<ul style="list-style-type: none"> Students will gain a comprehensive knowledge about The Continental Drift theory, and animal distribution globally with a detailed understanding of Zoogeographical Realms.
	CC5 – LAB (CHORDATES)	

	CO	<ul style="list-style-type: none"> At the end of this laboratory course students will be able to identify with reasons Protochordates to Mammalian specimens. Students will be able to mount pecten from the head of fowls along with dissection of brain and pituitary of carps.
	CC6 THEORY - (Animal Physiology: Controlling and Co-ordinating Systems)	
	CO1. (Tissues)	<ul style="list-style-type: none"> Students will learn about the structure and function of different kinds of tissues.
	CO2. (Bone & Cartilage)	<ul style="list-style-type: none"> Students will be able to write about the Structure and structural types of bones and cartilage and about the process of ossification.
	CO3. (Nervous System)	<ul style="list-style-type: none"> Students will learn the role of the nervous system in coordinating an animal's response to environment and organ system of human body. The basic structure and function of a neuron, the structure and function of a synapse and neurotransmitter chemicals. Students will be able to understand the origin and propagation of nerve impulse in myelinated and non-myelinated nerve fibre. Types of reflex with examples.
	CO4. (Muscular System)	<ul style="list-style-type: none"> Students will gather a detailed knowledge about different types of muscles and also understand the molecular and chemical basis of muscular contraction.
	CO5. (Reproductive System)	<ul style="list-style-type: none"> Students will understand the organs for reproduction and the roles of hormones in reproduction.
	CO6. (Endocrine System)	<ul style="list-style-type: none"> Detailed knowledge on hormones and histology and function of Pituitary, Thyroid, Pancreas and Adrenal.
	CC6- (LAB) Animal Physiology: Controlling and Co-ordinating Systems	
	CO	<ul style="list-style-type: none"> At the end of this course students will be able to demonstrate unconditioned reflex action such as knee jerk reflex. They will be able to prepare temporary mounts of squamous epithelium and striated muscle fibers. Students will be able to identify the permanent mammalian histological slides. Students will be able to carry out the microtomical processes of block preparation, trimming and staining to prepare permanent histological slides of mammalian tissues.
	CC7- (Genetics) THEORY	
	CO1. (Mendelian Genetics & its extension)	<ul style="list-style-type: none"> Students are expected: To demonstrate knowledge of the basic principles of Mendelian genetics.
	CO2. (Linkage, Crossingover &	<ul style="list-style-type: none"> To explain the process of linkage and crossing over and apply the principles in measuring recombination frequency.

	Chromosomal mapping)	
	CO3. (Mutations)	<ul style="list-style-type: none"> • Students are expected: • To demonstrate knowledge of the basic principles of Mendelian genetics. • To explain the process of linkage and crossing over and apply the principles in measuring recombination frequency. • To classify different types of gene mutations and chromosomal aberrations. To explain the role of chemical mutagens. • To differentiate the different mechanisms of sex determination. • To explain the process of extra- chromosomal inheritance and antibiotic resistance in <i>Chlamydomonas</i>. • To explain in detail the processes of recombination in bacteria and viruses, and to differentiate between conjugation, transformation and transduction.
	CO4. (Sex Determination)	<ul style="list-style-type: none"> • To differentiate the different mechanisms of sex determination.
	CO5. (Extra-chromosomal Inheritance)	<ul style="list-style-type: none"> • To explain the process of extra- chromosomal inheritance and antibiotic resistance in <i>Chlamydomonas</i>.
	CO6. (Recombination in Bacteria & Viruses)	<ul style="list-style-type: none"> • To explain in detail the processes of recombination in bacteria and viruses, and to differentiate between conjugation, transformation and transduction.
	CC7 LAB - (Genetics)	
	CO	<ul style="list-style-type: none"> • At the end of this Laboratory course, students will be able to analyze chi-square data. • Prepare Conjugation linkage maps. • Be able to identify from photographs chromosomal aberration occurring in <i>Drosophila</i> and man. • Be adept in analyzing pedigree charts to understand common human-inherited trait
SEMESTER IV	SEC P1- Apiculture (Group A) THEORY	
	CO1. (Biology of Bees)	<ul style="list-style-type: none"> • Students will learn about the Biology, Classification and Social organization of Honey Bees. • They will be able to name the different classes of honeybees and have a preliminary knowledge regarding Apiculture.
	CO2. (Rearing of Bees)	<ul style="list-style-type: none"> • Students will have a comprehensive knowlege about selection of honey bee, different rearing equipments, different kinds of

		beehives and methods of honey extraction.
CO3. (Diseases and enemies)		<ul style="list-style-type: none"> Students will be able to understand and treat/control/prevent different diseases of honey bees based on the symptoms.
CO4. (Bee Economy)		<ul style="list-style-type: none"> Students will gain knowledge on different products of apiculture industry such as honey, beeswax propolis etc.
CO5. (Entrepreneurship in Apiculture)		<ul style="list-style-type: none"> Modern methods of beekeeping will be taught in detail and the students will also be given an insight into the beekeeping industry.
CC8 (Comparative anatomy of vertebrates) THEORY		
CO1. (Integumentary system)		<ul style="list-style-type: none"> Students will learn about integumentary system in mammals and birds and will be able to write about their derivatives in the two classes.
CO2. (Skeletal System)		<ul style="list-style-type: none"> Students will get an overview of axial and appendicular skeleton; Jaw suspension; Visceral arch
CO3. (Digestive System)		<ul style="list-style-type: none"> Students will learn about comparative anatomy of stomach in birds and mammals and dentition in mammal
CO4. (Respiratory system)		<ul style="list-style-type: none"> Students will be able to describe the respiratory organs in fish, amphibian, birds and mammals
CO5. (Circulatory system)		<ul style="list-style-type: none"> Students will get a comprehensive idea about the general plan of circulation and knowledge about comparative account of heart and aortic arches
CO6. (Urinogenital system)		<ul style="list-style-type: none"> Students will be introduced to the urinogenital system, succession of kidney and evolution of urinogenital ducts
CO7. (Nervous system)		<ul style="list-style-type: none"> Students will be able to describe the brains in different vertebrate groups and cranial nerves in mammals
CO8. (Sense organs)		<ul style="list-style-type: none"> Students will learn about sense organs in animals and the different classification of receptors
CC 8 - (LAB) Comparative anatomy of vertebrates		
CO		<ul style="list-style-type: none"> This lab work enables the students to distinguish between different kinds of skulls, scales in fishes, and skeleton of different groups of vertebrates. It also provides the students with practical dissection skills.
CC9 (Animal Physiology: Life Sustaining Systems)THEORY		
CO1. (Physiology of Digestion)		<ul style="list-style-type: none"> Students will learn about structural organisation and functions of Gastrointestinal tract and Associated glands. They will develop an understanding about mechanical and chemical digestion and absorption of Carbohydrates, Lipids, and Proteins.
CO2.		<ul style="list-style-type: none"> Students will learn about mechanism of Respiration in

(Physiology of Respiration)	vertebrates with comprehensive knowledge about transport of Oxygen and Carbon dioxide in blood and types of respiratory pigments.
CO3. Physiology of Circulation	Students will gain knowledge about: <ul style="list-style-type: none"> • Components of Blood and their functions; Structure and functions of haemoglobin • Haemostasis; Blood clotting system, Fibrinolytic system • Haemopoiesis; Basic steps and its regulation • Blood groups; ABO and Rh factor
CO4. Physiology of Heart	Students will be able to understand the following aspects on the physiology of heart: <ul style="list-style-type: none"> • Structure of mammalian heart with special reference to human, Coronary Circulation, Structure and • working of conducting myocardial fibres, Origin and conduction of cardiac impulses • Cardiac Cycle and cardiac output • Blood pressure and its regulation
CO5. Thermoregulation & Osmoregulation	<ul style="list-style-type: none"> • Students will gain knowledge about osmoregulatory organs and mechanism of osmoregulation in vertebrates. • They will learn about the classification and mechanisms of thermoregulation in vertebrates.
CO6. Renal Physiology	<ul style="list-style-type: none"> • Students will develop knowledge about structure of Kidney and nephron. They will understand in detail the mechanism of urine formation •
CC9 LAB Animal Physiology: Life Sustaining Systems	
CO	<ul style="list-style-type: none"> • The lab work provides hands-on pathology training to the students. It provides them with the basic skill-set and can be further opted as a career choice
CC10 - Fundamentals of Biochemistry THEORY	
CO1. Carbohydrates	<ul style="list-style-type: none"> • Students will gain comprehensive knowledge about Monosaccharides, Disaccharides, Polysaccharides • They will study Carbohydrate metabolism through Glycolysis, Citric acid cycle, Pentose phosphate pathway, Gluconeogenesis
CO2. Lipids	<ul style="list-style-type: none"> • Students will be able to understand the structure and Significance of physiologically important saturated and unsaturated fatty acids, Triacylglycerols, Phospholipids, Sphingolipid, Glycolipids, Steroids, Eicosanoids and terpenoids. • They will learn about Lipid metabolism in detail.
CO3. Proteins	<ul style="list-style-type: none"> • Students will learn about Structure, Classification, General and Electro chemical properties of α-amino acids; • They will be able to understand the different levels of organization of Proteins (primary, secondary, tertiary, quaternary). • Students will be about to understand and write about Protein metabolism.
CO4.	<ul style="list-style-type: none"> • Effort will be made to make the students understand the

	Nucleic Acids	<p>structure of Purines and pyrimidines, Nucleosides, Nucleotides, Nucleic acids</p> <ul style="list-style-type: none"> They will be able to understand the different types of DNA and RNA.
	CO5. Enzymes	<ul style="list-style-type: none"> Students will be able to understand the nomenclature and classification of enzymes. They will be able to understand the mechanism of enzyme action, and different types of enzyme inhibitions. Students will be introduced to the concept of Enzyme kinetics;.
	CO6. Oxidative Phosphorylation	<ul style="list-style-type: none"> The concept of mitochondrial respiratory chain and ATP synthesis will be clear to the students.
	CC10 LAB Fundamentals of Biochemistry	
	CO	<ul style="list-style-type: none"> The lab work provides basic practical training to the students. They perform experiments that help them understand the concept of basic techniques that may come handy if they pursue research or for further education
	SEC Paper 2 (Group A)– Sericulture	
	CO1. Introduction	<ul style="list-style-type: none"> Students will be introduced to Sericulture. They will learn about types of silkworms on the basis of their geographic origin and food preference.
	CO2. Biology of Silkworm	<ul style="list-style-type: none"> Students will learn about the Life cycle of Bombyx mori and will be able to describe the structure of silk gland and secretion of silk .
	CO3. Rearing of Silkworms	<p>Students will get an overall idea about selection of mulberry, rearing house and rearing appliances.</p> <p>Disinfectants, Spinning, harvesting and storage of cocoons</p>
	CO4. Pests and Diseases	<ul style="list-style-type: none"> Students will learn about different pests of silkworm They will learn about the Pathogenesis of Protozoan, viral, fungal and bacterial silkworm diseases and their Control and Prevention.
SEMESTER V	CO5. Entrepreneurship in Sericulture	<ul style="list-style-type: none"> Students will get an overall idea about Sericulture industry in different states, employment, potential in mulberry and non-mulberry sericulture.
	SEC Project	
	CC 11 - Molecular Biology THEORY	
	CO 1: Nucleic Acids	<ul style="list-style-type: none"> Salient features of DNA and RNA Watson and Crick Model of DNA, Clover leaf model of tRNA
	CO 2: DNA Replication	<ul style="list-style-type: none"> Mechanism of DNA Replication in Prokaryotes, Semi-conservative, bidirectional and discontinuous ReplicationRNA priming, Inhibitors of replication

		<ul style="list-style-type: none"> •
	CO 3: Transcription	<ul style="list-style-type: none"> • Mechanism of Transcription in prokaryotes Inhibitors of transcription •
	CO 4: Translation	<ul style="list-style-type: none"> • Mechanism of protein synthesis in prokaryotes, Ribosome structure and assembly in prokaryotes, • fidelity of protein synthesis, aminoacyl tRNA synthetases and charging of tRNA; Proteins involved in • initiation, elongation and termination of polypeptide chain; Genetic code, Degeneracy of the genetic • code and Wobble Hypothesis; Inhibitors of protein synthesis
	CO 5: Gene Regulation	<ul style="list-style-type: none"> • Regulation of Transcription in prokaryotes: lac operon and trp operon; •
	CO 6: DNA Repair Mechanisms	<ul style="list-style-type: none"> • Types of DNA repair mechanisms, RecBCD model in prokaryotes, nucleotide and base excision • repair, SOS repair •
	CO 7: Molecular Techniques	<ul style="list-style-type: none"> • Basic Principles of PCR, Western and Southern blot, Northern Blot, Sanger DNA sequencing •
CC 11 - LAB (Molecular Biology)		
	CO	<ul style="list-style-type: none"> • The students will learn about the giant chromosome like polytene and lamp brush chromosome. • They will now be able to isolate genomic DNA. • They will understand how to separate DNA fragments on the basis of their molecular weight
CC 12 – Immunology THEORY		
	CO 1: Overview of Immune System	<ul style="list-style-type: none"> • Basic concepts of health and diseases, Historical perspective of Immunology, Cells and organs of the • Immune system •
	CO 2: Innate and Adaptive Immunity	<ul style="list-style-type: none"> • Anatomical barriers, Inflammation, Cell and molecules involved in innate immunity, Adaptive immunity • (Cell mediated and humoral). Structure of B and T cell Receptor and its signalling, T cell development & selection
	CO 3: Antigens	<ul style="list-style-type: none"> • Antigenicity and immunogenicity, Immunogens, Adjuvants and haptens, Factors influencing • immunogenicity, B and T-Cell epitopes •
	CO 4: Immunoglobulins	<ul style="list-style-type: none"> • Structure and functions of different classes of immunoglobulins, Antigen- antibody interactions, • Immunoassays (ELISA and RIA), Hybridoma technology, Monoclonal antibody production •

	CO 5: Major Histocompatibility Complex	<ul style="list-style-type: none"> • Structure and functions of MHC molecules.
	CO 6: Cytokines	<ul style="list-style-type: none"> • Types, properties and functions of cytokines. •
	CO 7: Complement System	<ul style="list-style-type: none"> • Components and pathways of complement activation (Classical & alternative). •
	CO 8: Hypersensitivity	<ul style="list-style-type: none"> • Gell and Coombs' classification and brief description of various types of hypersensitivities. •
	CO 9: Immunology of disease	<ul style="list-style-type: none"> • Malaria •
	CO 10: Vaccines	<ul style="list-style-type: none"> • Various types of vaccines. Active & passive immunization (Artificial and natural). •
	CC 12- LAB (Immunology)	
	CO	<ul style="list-style-type: none"> • Upon successful completion of the course, learners will demonstrate proficiency in locating various lymphoid organs throughout the human body. Specifically, they will be adept at identifying the spleen, thymus, and lymphoid nodes. Additionally, learners will exhibit competence in distinguishing between different types of leukocytes and comprehending the sequential procedures inherent in Enzyme-Linked Immunosorbent Assay (ELISA).
	DSE Paper 1 (Group B) –Endocrinology THEORY	
	CO 1: Introduction to Endocrinology	<ul style="list-style-type: none"> • General idea of Endocrine systems, Classification, Characteristic and Transport of Hormones, • Neurosecretions and Neurohormones •
	CO 2: Epiphysis, Hypothalamo-hypophyseal Axis	<ul style="list-style-type: none"> • Structure of pineal gland, Secretions and their functions in biological rhythms and reproduction. • Structure and functions of hypothalamus and Hypothalamic nuclei, Regulation of neuroendocrine glands, Feedback mechanisms • Structure of pituitary gland, Hormones and their functions, Hypothalamo-hypophyseal portal system, • Disorders of pituitary gland. •
	CO 3: Peripheral Endocrine Glands	<ul style="list-style-type: none"> • Structure, Hormones, Functions and Regulation of Thyroid gland, Parathyroid, Adrenal, Pancreas, • Ovary and Testis • Hormones in Calcium and glucose homeostasis, Disorders of endocrine glands •
	CO 4: Regulation of Hormone Action	<ul style="list-style-type: none"> • Mechanism of action of steroidal, non-steroidal hormones with receptors • Bioassays of hormones using RIA & ELISA

	<ul style="list-style-type: none"> • Estrous cycle in rat and menstrual cycle in human • Multifaceted role of Vasopressin & Oxytocin. Hormonal regulation of parturition. •
DSE Paper 1 (Group B) – LAB Endocrinology	
CO	<ul style="list-style-type: none"> • Students are expected to dissect and display Endocrine glands and prepare slide of any one endocrine gland, and identify the permanent slides of all the endocrine glands. • estimate the plasma level of any hormone using ELISA.
DSE Paper 2 ((Group B) – Wild Life Conservation and Management (THEORY)	
CO 1- Introduction to Wild Life	<ul style="list-style-type: none"> • Students will learn the importance of conserving wildlife and its values to human kind. • The reasons of the decline of wildlife. • Strategies for the conservation of wildlife.
CO 2 - Evaluation and management of wild life	<ul style="list-style-type: none"> • Analysis and management of wildlife habitats. • Evaluation of wildlife by the use of remote sensing and GIS applications.
CO 3- Management of habitats	<ul style="list-style-type: none"> • Management of the habitats and conserving the genetic diversity therein. • Ways and methods of habitat restoration.
CO 4 - Population estimation	<ul style="list-style-type: none"> • The various indices and methods of population estimation.
CO 5 - Aims and Objectives of Wildlife Conservation	<ul style="list-style-type: none"> • The various modes of wild life conservation in insitu and exsitu .
CO 6 - Management planning of Wildlife in Protected areas	<ul style="list-style-type: none"> • How to estimate the carrying capacity of the wild habitat. • Role of ecotourism in safeguarding the wildlife.
CO 7 - Man and Wildlife	<ul style="list-style-type: none"> • Causes and consequences of human-wildlife conflicts • The ways of mitigation of these issues.
CO 8 - Protected Areas	<ul style="list-style-type: none"> • Differences in WLS, NP and Biosphere reserves. • Various WLS, NP and Biosphere reserves of country. • Project tiger its aim and objectives.
DSE Paper 2 (Group B) – LAB (Wild Life Conservation and Management)	
	<ul style="list-style-type: none"> • Identification of mammalian fauna/ avian fauna, herpeto-fauna of any protected area of North Bengal • Demonstration of basic equipment needed in wildlife studies. • Identification of animals through pug marks, hoof marks, scats, pellet groups, nest, antlers, etc. • CQ, ten tree method, Circular, Square & rectangular plots, Parker's 2 Step and other methods for ground cover assessment, Tree canopy cover assessment, Shrub cover assessment • Trail / transect monitoring for abundance and diversity estimation of mammals and bird (direct and indirect evidences)

SEMESTER-VI CC 13 - Developmental Biology (THEORY)		
	CO 1- Basic Concept	<ul style="list-style-type: none"> Basic concepts of different aspects of developmental biology
	CO 2 - Early Embryonic Development	<ul style="list-style-type: none"> Will learn the different phases of early embryonic development especially that of frog and chick
	CO 3- Late Embryonic Development	<ul style="list-style-type: none"> Students will understand the roles of extra-embryonic membranes, implantation and placenta
	CO 4 - Post Embryonic Development	<ul style="list-style-type: none"> Will understand the process of development of organs and regeneration
	CO 5- Implications of Development Biology	<ul style="list-style-type: none"> Will understand what is teratogenesis and different techniques related to developmental biology.
	CC13 LAB Developmental Biology	
	CO	<ul style="list-style-type: none"> Hands on training on whole mount of embryonic stages Hand on training on Drosophila culture
	CC14 [Evolutionary Biology & Biostatistics] THEORY	
	CO 1: Origin of life	<ul style="list-style-type: none"> Understand the various theories associated with origin of life.
	CO 2: Historical review of Evolutionary Concept	<ul style="list-style-type: none"> Will understand the geological time scale with the evolution of horse as one of its examples. Will be able to interpret phylogenetic trees. Understand the concept of molecular clock and modern theory of molecular evolution
	CO 3: Geological time scale, Evolution of horse, Phylogenetic tree, Molecular evolution	<ul style="list-style-type: none"> Will understand the roles and various types and sources of variations. Understand why variations is important in the evolution.
	CO 4: Sources of variation	<ul style="list-style-type: none"> The various sources of variations. The role of heritable variations in evolution.
	CO 5: Population genetics	<ul style="list-style-type: none"> Basic idea on population genetics. Knowledge on Hardy-Weinberg Law; its derivation and application Understand the role of evolutionary forces upsetting the equilibrium. Concept of Natural selection and its types. General idea on genetic drift mechanism and role of Migration and Mutation in changing allele frequencies
	CO 6: Speciation	<ul style="list-style-type: none"> Basic idea on Isolating mechanisms. Knowledge on species concept and modes of speciation. Understanding adaptive radiation/macroevolution with special reference to Galapagos finches
	CO 7: Extinction	<ul style="list-style-type: none"> Idea of different types of extinctions. Concept of K-T extinction
	CO 8:Biostatistics	<ul style="list-style-type: none"> Understanding biostatistics through theory and mathematical deductions. Ability solve different biostatistical problems
	CC14 LAB (Evolutionary Biology & Biostatistics)	
	CO	<ul style="list-style-type: none"> Study of vertebrate fossils using models/ pictures. Study of homology and analogy with suitable

		specimen/model/pictures <ul style="list-style-type: none"> Hands-on training on Graphical representation and interpretation of data Application of Hardy Weinberg Law in a real population Biostatistical analysis related to correlation and regression in a human population
	DSE Paper 3 (Group B)- Parasitology (THEORY)	
	CO 1: Introduction to Parasitology	<ul style="list-style-type: none"> Basic idea of Parasitism, Parasite, Parasitoid carriers and Vectors. Concept of host parasite relationship
	CO 2: Parasitic Protists	<ul style="list-style-type: none"> Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of different parasitic Protists.
	CO 3: Parasitic Platyhelminthes	<ul style="list-style-type: none"> Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of different parasitic Platyhelminthes
	CO 4: Parasitic Nematodes	<ul style="list-style-type: none"> Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of different parasitic Nematodes
	CO 5: Parasitic Arthropods	<ul style="list-style-type: none"> Knowledge on biology, importance and control of different parasitic Arthropods.
	CO 6: Parasitic Vertebrates	<ul style="list-style-type: none"> Concise idea on parasite vertebrates.
	DSE Paper 3 (Group B)- LAB Parasitology	
	CO	<ul style="list-style-type: none"> Learn about parasitology and about the various types of parasites and hosts, their characteristics and medical importance. Learn about the relationship between a parasite and the host and their effects. Students will have an idea about the geographic distribution, life cycle, pathogenicity control and treatment of Protozoan, helminths, nematodes, parasitic arthropod and vertebrates. Will learn about the direct and indirect impact of the parasites on human society.
	DSE 4 (Group B)- - Fish and Fisheries (THEORY)	
	CO 1- Introduction and classification	<ul style="list-style-type: none"> General description of fish Feeding habit, habitat and manner of reproduction Classification of fish (up to Subclasses)
	CO 2 - Morphology and Physiology	<ul style="list-style-type: none"> Different types of fins, locomotion, scales in fishes. Types of swim bladders and their roles in fish biology Osmoregulation and their importance in fish biology.
	CO 3- fisheries	<ul style="list-style-type: none"> Types of fisheries. Depletion of fish as a food resource. Laws and regulation related to fishing.
	CO 4 -Aquaculture	<ul style="list-style-type: none"> Ways to sustainable aquaculture. Types of aquaculture. Taking care of aquarium fish , their diseases. Fishery industry.
	CO 5- Fish in research	<ul style="list-style-type: none"> Roles of fish as a model in lab research.

	DSE 4 LAB (Fish and Fisheries)	
	CO	<ul style="list-style-type: none"> These practical lab works will enable the students to identify different types of fishes, the scales, breathing organs. They will be able to implement the basic techniques required for the aquaculture
SEMESTER III	GE 2 PAPER 1 Animal Diversity (THEORY)	
	Unit 1- Protista	<ul style="list-style-type: none"> Basic knowledge on protozoa and life cycle of <i>Plasmodium</i>.
	Unit 2 - Porifera	<ul style="list-style-type: none"> Study of phylum characteristics and its biological system.
	Unit 3- Radiata	<ul style="list-style-type: none"> Study of phylum characteristics and its biological system.
	Unit 4 - Aceolomate	<ul style="list-style-type: none"> Study of phylum characteristics.
	Unit 5- Pseudocoelomates	<ul style="list-style-type: none"> Study of phylum characteristics.
	Unit 6 - Annelids	<ul style="list-style-type: none"> Study of phylum characteristics and body segmentation.
	Unit 7 - Arthropods	<ul style="list-style-type: none"> Study of phylum characteristics and its biological system.
	Unit 8 - Mollusca	<ul style="list-style-type: none"> Study of phylum characteristics and its biological system.
	Unit 9-Echinodermata	<ul style="list-style-type: none"> Study of phylum characteristics and its biological system.
	Unit 10 - Protochordates	<ul style="list-style-type: none"> Study of phylum characteristics.
	Unit 11-Pisces	<ul style="list-style-type: none"> Study of phylum characteristics and its migration patterns.
	Unit 12-Amphibians	<ul style="list-style-type: none"> Study of phylum characteristics and parental role.
	Units 13-Reptiles	<ul style="list-style-type: none"> Study of phylum characteristics and its biological system. Distinguishing venomous and non-venomous snakes.
	Units 14-Aves	<ul style="list-style-type: none"> Study of phylum characteristics and the flight adaptations.
	Unit 15-Mammals	<ul style="list-style-type: none"> Study of phylum characteristics and its integumentary glands.
	GE 3 – LAB (Animal Diversity)	
		<ul style="list-style-type: none"> Students develop proficiency in identifying specimens and documenting their characteristics based on their systematic position. They gain the ability to accurately draw, label, and identify specimens both in slide form and under a microscope. Additionally, students learn proper mounting techniques and perform dissections effectively. Through these practical skills, students enhance their understanding of organismal diversity and anatomy, preparing them for further studies and research in biology.
SEMESTER IV	GE 2 . PAPER 2 , Human Physiology(THEORY)	
	Unit 1- Digestion and Absorption of food	<ul style="list-style-type: none"> Idea on digestion , absorbtion of Carbohydrates, proteins and lipids.
	Unit 2 - Functioning Of Excitable Tissue(Nerve and Muscle)	<ul style="list-style-type: none"> Idea on the structure and function and physiology of excitable neurons and muscle.

	Unit 3- Respiratory Physiology	<ul style="list-style-type: none"> • The basic concept on the mechanism of respiration.
	Unit 4 - Renal Physiology	<ul style="list-style-type: none"> • Study on the structure and function of kidneys.
	Unit 5- Cardiovascular Physiology	<ul style="list-style-type: none"> • Study on the structure and physiology of heart. • Concepts of ECG
	Unit 6 - Endocrine and Reproductive Physiology	<ul style="list-style-type: none"> • Understanding the structure and function of the endocrine glands and their associated physiological functions.
	GE 4 - LAB (Human Physiology)	
		Students will prepare temporary slides of Neurons or Blood Films, comprehend the ABO blood group system to determine their blood group and type, estimate Haemoglobin levels, and identify various mammalian histological sections