DEPARTMENT OF ZOOLOGY
P. R. THAKUR GOVERNMENT COLLEGE
Ganti, Thakurnagar, North 24 Parganas – 734287

COURSE OUTCOMES (COs)

Programme: B. Sc. Zoology (Hons.) (CBCS) under West Bengal State University

Year of Introduction: 2018

Course Outcomes (COs):

Sl. No.	Semester	Name of Course	Course Code	Course Outcomes (COs)
1	Sem-I	Non-Chordates I (Theory)	ZOOACOR01T	1. Acquire knowledge of general taxonomic rules of non-chordate classification. 2. Learn the general characters and classification of different invertebrate groups (Protozoa to Nematoda) up to subclass level which make the students knowledgeable about animal world. 3. Attain the knowledge morphology, and physiological process of different invertebrate specimens through type study. 4. Learn about the life history, adaptation pathogenicity and diagnostic of different parasitic invertebrate organisms. 5. Development of clear concept about coral reef

				formation and its conservation.
		Non-Chordates I (Practical)	ZOOACOR01P	1. Able to identify and classify invertebrates by studying their external characters, prepare keys and know about their habits and habitats (Protists to Nematodes). 2. Acquire the skills of identification, mounting and staining of some non-chordate specimens. 3. Able to write project report on any topic of invertebrate phyla up to Nematoda. 4. Development of knowledge about microscopy and handling of microscopes
2	Sem-I	Ecology (Theory)	ZOOACOR02T	1. Acquire knowledge and understanding about ecology, environment and their proper functioning. 2. Able to understand the basic concepts of ecology, biogeochemical cycles, population ecology & its properties. 3. Understand the study of life history pattern, fertility rate and age structure. 4. Learn about the types and function of ecosystem, characteristics of community; ecological succession and major biomes of the world. 5. Attain knowledge about interrelationship of animal, plants, microbes and their interactions with abiotic factors. 6. Students will involve in the protection and conservation of nature and natural resources
		Ecology (Practical)	ZOOACOR02P	1. Ability to determine population density and to calculate ecological indices like Shannon-Weiner index; ability to measure the different physico-chemical and biological parameters of an aquatic ecosystem. 2. Able to study of life tables and plotting of survivorship curves. 3. Lear different techniques to study an aquatic ecosystem (phytoplankton and zooplankton, measurement of area, temperature, determination of pH, dissolve O_2 & free CO_2). 4. Able to prepare a report on a visit to National Park/Biodiversity Park/Wild life sanctuary/ Biodiversity Centre/Any Museum/Sea shore. 5. Engage in field-based activities to learn

				techniques for gathering data from the field.
3	Sem-II	Non-Chordates II (Theory)	ZOOACOR03T	1. Able to understand the evolution of coelom and metamerism. 2. Learn the classification, diversity, physiology, and life- cycle pattern of representative animals of non-chordates from Annelida to Hemi-chordates. 3. Attain the knowledge of phylum Hemichordata and their relationship with non-chordates and chordates. 4. Understand some special features like torsion of molluscs, water vascular system of Echinodermata, filter feeding of lower chordates, metamorphosis of insects and its hormonal control.
		Non-Chordates II (Practical)	ZOOACOR03P	1. Able to Identify and classify invertebrates (Annelids to Echinoderms) by studying their external characters, prepare keys and know about their habits and habitats. 2. Get a clear concept about the internal organ systems of non-chordate - nervous system, digestive system and mouth parts. 3. Able to write project report' on any related topic on invertebrate taxa. 4. Get a flavor of research by working on project besides improving their writing skills. It will further enable the students to think and interpret individually.
4	Sem-II	Cell Biology (Theory)	ZOOACOR04T	1. Able to understand the structures and function of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles. 2. Attain knowledge about cell division, cell cycle and its regulation. 3. Acquire knowledge of cancer biology and oncogenesis. 4. Understand clinical aspects, including epidemiology, tumor cell metabolism, cancer stem cells, DNA viruses, metastasis and therapeutic strategies. 5. Understand Cell signaling transduction pathways; Types of signaling molecules and receptors.

				6. Get new avenues of joining research in areas such as cancer research, researches related to signal transduction pathways, cell viability assays, diabetes research etc.
		Cell Biology (Practical)	ZOOACOR04P	1. Learn different technique for staining of different macromolecules including DNA. 2. Develop the skill of preparation of temporary stained squash preparation of onion root tip and grasshopper testis to study various stages of mitosis and meiosis respectively. 3. Able prepare the permanent slide to show the presence of Barr body in human female blood cells/cheek cells. 4. They also study cell viability by Trypan Blue staining from onion root tip or blood cells.
5	Sem-III	Chordates (Theory)	ZOOACOR05T	1. Have a knowledge on the vast diversity of chordates gaining knowledge on their general characteristics and classification of Chordates: from protochordates to mammals. 2. Learn about some Special adaptive feature of some classes like parental care in fish and amphibian, poison apparatus of snakes, echolocation in bats etc. 3. Develop a knowledge about Exoskeleton and migration in Birds and mammals; Principles and aerodynamics of flight; Adaptive radiation in mammals; Echolocation in Micro chiropterans and Cetaceans 4. Learn about different Zoogeographical realms, Plate tectonic and Continental drift theory, distribution of birds and mammals in different realms.
		Chordates (Practical)	ZOOACOR05P	1. Able to identify and classify vertebrates specimens (protochordates to mammals) by studying their external characters. 2. Learn the key for Identification of poisonous and non-poisonous snake. 3. Develop the skill of dissection different vertebrate specimens for studying different organs and systems. 4. Able to prepare power point presentation on any two animals (different Classes) emphasize the importance of biodiversity, habit, habitat

				or behaviour.
6	Sem-III	Physiology: Controlling and Coordinating Systems (Theory)	ZOOACOR06T	1. Develop a concept of different types of tissues, bones and cartilage in our body and an elaborate knowledge on each type. 2. Have a clear understanding of different animal physiological systems like excretion, skeletal muscle contraction, nerve impulse and mammalian reproduction. 3. Gain knowledge of the different endocrine and neuro-endocrine glands and their functions; endocrine regulation of different reproductive cycle. 4. Learn about the molecular mechanism of hormone action and the signal transduction pathways for steroidal and non-steroidal hormones.
		Physiology: Controlling and Coordinating Systems (Practical)	ZOOACOR06P	1. Students learn to record simple muscle twitch with electrical stimulation (or virtual) 2. Understand the unconditioned reflex action (deep tendon reflex such as knee jerk reflex) by demonstration. 3. Preparation of temporary mounts of squamous epithelium and striated muscle fibres. 4. Able to Identify of histological section of different mammalian tissue such as cartilage, bone, pituitary, liver, kidney, intestine, lung, pancreas, testis, ovary, adrenal, thyroid 5. Develop skill for preparation of histological tissue, section cutting and their staining. 6. In depth practical skill will help to undertake research in any aspect of animal physiology in future.
7	Sem-III	Biochemistry (Theory)	ZOOACOR07T	1. Develop in depth knowledge about fundamentals of biochemical reactions and metabolism. 2. Acquire the knowledge about the structure and biological importance of carbohydrates, lipids, proteins and nucleic acids and their catabolic and anabolic pathways. 3. Able to understand the nature, mechanism, and kinetics of enzyme action. 4. Learn about Oxidative Phosphorylation:

				Redox systems and Mitochondrial Electron Transport Chain.
		Biochemistry (Practical)	ZOOACOR07P	1. They also learn qualitative biochemical tests for amino acids, carbohydrates, proteins and nucleic acids and do measurement of enzyme activity and its kinetics. 2. Develop the skill for quantitative estimation of proteins; paper chromatographic technique and protein separation by SDS-PAGE. 3. Able to study the enzymatic activity of salivary Trypsin, Lipase and Acid and Alkaline phosphatase assay from serum/ tissue. 4. Acquired practical skills will help to undertake research in any aspect of animal physiology in future.
8	Sem-IV	Comparative Anatomy (Theory)	ZOOACOR08T	1. Know about the structure, function of integument derivatives in amphibian, birds and mammals. 2. Comparative anatomical account of different organs and organ systems in different Vertebrate Classes. 3. Learn the aspects of evolutionary changes that occurred to the animal's body structures.
		Comparative Anatomy (Practical)	ZOOACOR08P	1. Able to identify different fish scales (such as Cycloid & Ctenoid) and prepare whole mounts. 2. Develop the knowledge to identify the disarticulated skeleton of Toad, Pigeon and Guineapig. 3. Know the anatomy of Carapace and plastron of turtle from model and chart (Demonstration). 4. Able to identify mammalian skulls – both herbivorous (Guineapig) and carnivorous animal (Dog). 5. Develop the dissection skills for studying circulatory system, brain, pituitary and urinogenital system in Tilapia.
9	Sem-IV	Physiology: Life Sustaining system (Theory)	ZOOACOR09T	1. Learn the physiology of Digestion - structural and function of digestive tract, mechanism of digestion and absorption of carbohydrates, lipids, proteins and nucleic acids in humans. 2. Acquire in depth knowledge about physiology

				of respiration including transport of Oxygen and Carbon dioxide in blood. 3. Learn the physiology of circulation and function of heart, coronary circulation, structure and working of myocardial fibres, origin and conduction of cardiac impulses, cardiac cycle and cardiac output. 4. Develop knowledge of structure and functions of haemoglobin, blood clotting system, haematopoiesis, ABO blood grouping and Rh factor etc. 5. Learn about different physiological thermoregulation, osmoregulation in aquatic vertebrates and invertebrates.
		Physiology: Life Sustaining system (Practical)	ZOOACOR09P	1. Acquire theoretical knowledge about different haematological parameter and its clinical significance. 2. Develop the soft skill for determination of different haematological parameters such as determination of ABO blood group, total count of RBC and WBC, estimation of haemoglobin, preparation of haemin crystals etc. 3. Able to determine of blood pressure using a Sphygmomanometer (analog and digital). 4. The practical knowledge will help to pursue higher studies such as laboratory medical technology and get job in pathological laboratory.
10	Sem-IV	Immunology (Theory)	ZOOACOR10T	1. Learn about immune system with respect to health and diseases, historical perspective, cells and organs associated with the immune system, concept of innate and adaptive immunity. 2. Develop the wide concept of about antigen, antibody, cytokines, adjuvants, haptens, complement proteins and its activation, MAC formation, MHC. 3. Know about Immuno-techniques and Immuno-assays and their applications. 4. Know about Hypersensitivity reactions; Gell and Coombs' classification. 5. Develop knowledge about immunology of various diseases - malaria, filariasis, dengue

				and tuberculosis. 6. Learn about various types of vaccines; active & passive immunization (Artificial and natural).
		Immunology (Practical)	ZOOACOR10P	1. Able to identify lymphoid organs in human through model/photograph. 2. Histological study of spleen, thymus and lymph nodes through slides/photographs 3. Prepare stained blood film to identify various types of blood cells. 4. Able to determine the Total count (TC) and Differential count (DC) of WBC 5. Learn about ELISA by the Demonstration of a teaching kit.
11	Sem-V	Molecular Biology (Theory)	ZOOACOR11T	1. Get detailed idea about the structure DNA & RNA and its properties. 2. Develop concept about Central Dogma – Detailed mechanism of replication, transcription and translation – in both prokaryotes and eukaryotes. 3. Learn about post transcriptional modifications and Processing of Eukaryotic RNA. 4. Know about the regulation of gene expression in prokaryotes and eukaryotes; gene silencing, genetic imprinting. 5. Learn about the molecular aspects of various DNA damage and repair mechanisms. 6. Know about the Molecular Techniques - PCR, Western blot, Southern blot, Northern Blot and DNA sequencing.
		Molecular Biology (Practical)	ZOOACOR11P	1. Develop the skill for preparation of polytene and lamp brush chromosome from Dipteran larva of Chironomus/ *Drosophila* and identify them. 2. Acquire the skill for isolation and quantification of genomic DNA using spectrophotometer. 3. Learn the agarose gel electrophoresis technique for separation of DNA.
12	Sem-V	Genetics (Theory)	ZOOACOR12T	1. Able to understand the principles of Mendelian Genetics and its extension. 2. Develop concept on linkage, crossing over and

				chromosomal mapping. 3. Know about chromosomal aberrations and its effects; Genetic and molecular basis of Mutations, effects of physical and chemical mutagens. 4. Learn genetic and molecular mechanism of sex-determination in *Drosophila* and Humans. 5. Learn extra-chromosomal and maternal Inheritance. 6. Study bacterial and Phage genetics - Conjugation, Transformation, Transduction; Complementation test in Bacteriophage. 7. Learn about Transposable Genetic Elements in bacteria, maize, *Drosophila* and Humans.
		Genetics (Practical)	ZOOACOR12P	1. Able to solve statistical problem related Chi-square analyses and T test. 2. Solving genetic problems of linkage maps on *Drosophila*. 3. Able to identify various chromosomal aberrations in *Drosophila* and Humans from photograph. 4. Acquire in depth knowledge about pedigree analysis of some human inherited traits and its application.
13	Sem-VI	Developmental Biology (Theory)	ZOOACOR13T	1. Learn about gametogenesis, fertilization and early embryonic developments, embryonic induction and Organizer concept. 2. Know about extra-embryonic membranes in birds, implantation of embryo in humans and Placentation. 3. Attain wide concept of molecular Induction in Vertebrate Brain and Eye development; Modes of regeneration, epimorphosis, morphallaxis and compensatory regeneration. 4. Develop knowledge of In vitro fertilization (IVF), Stem cell, Applications of stem cell therapy in bone marrow transplantation, Amniocentesis and Teratogenesis.
		Developmental Biology (Practical)	ZOOACOR13P	1. Students learn to identify the different developmental stages of chick embryo. 2. Students learn to identify the developmental stages and life cycle of *Drosophila*. 3. Students are able to identify the different

				sections of placenta. 4. Able to prepare a project report on *Drosophila* which will improve the writing skill.
14	Sem-VI	Evolutionary Biology (Theory)	ZOOACOR14T	1. Learn about the origin of life, Lamarckism, Darwinism and Neo-Darwinism 2. Learn about Geological time scale, Molecular Clock, evolution of horse and humans. 3. Develop a clear concept of Natural selection, Synthetic theory, Hardy-Weinberg equilibrium, Genetic drift, founder effect and population bottleneck. 4. Develop knowledge of Speciation, Adaptive radiation; have a concept of back ground and mass extinctions, K-T extinction. 5. Attain knowledge of construction and interpretation of Phylogenetic tree using parsimony, convergent and divergent evolution; learn the basics of bioinformatics.
		Evolutionary Biology (Practical)	ZOOACOR14P	1. Able to study of fossils from models/pictures 2. Study homology and analogy from suitable specimens 3. Able solve problems on Hardy-Weinberg Law by Chi-square analysis. 4. Able to prepare graphical representation and interpretation of data of height /weight of a sample of 100 humans in relation to the age and sex.
15	Sem-V	Animal Behaviour and Chronobiology (Theory)	ZOOADSE01T	1. Students learn about the Origin and history of Ethology; Methods and recording of a behaviour 2. Students learn in details about Patterns of Behaviour found in animals 3. They learn about Social Behaviour of animals like termites and honey bees, Altruism, and Wide aspects of Sexual behaviour in animals. 4. Students learn about Chronobiology, Circadian Rhythm, Role of Melatonin, Photoperiods and their role in animal reproduction.
		Animal Behaviour and Chronobiology (Practical)	ZOOADSE01P	1. Able to study of nests and nesting habits of the birds and social insects. 2. Learn to study of the behavioural responses of wood lice to dry and humid conditions.

				3. Develop skills for studying geotaxis and phototaxis behaviour in animals. 4. Develop team spirit, writing skills and get flavour of field-based research work through education excursion and prepare a short report. 5. Learn how to study of circadian functions in humans (daily eating, sleep and temperature patterns).
16	Sem-V	Entomology (Insects and their Biology) (Theory)	ZOOADSE02T	1. Concept building on diversity, taxonomy, morphology and physiology of insects. 2. Learn about to insect society and their role as vectors. 3. Attain knowledge about plant insect interaction and major pest. 4. Develop the knowledge about the insect vectors and vector borne diseases.
		Entomology (Insects and their Biology) (Practical)	ZOOADSE02P	1. Develop skills for identification of the life cycle of mosquito and different body parts of insects. 2. Knowledge on how to collect, preserve and identify insects of economic interest.
17	Sem-V	Endocrinology (Theory)	ZOOADSE03T	1. Acquire the knowledge about Endocrine systems, classification, characteristics and transport of hormones, neurosecretions and neurohormones. 2. Learn about the morphological and histological structure of different endocrine gland along with their function 3. Students learn about the molecular function of different classes of hormones and their regulation 4. Learn about Bioassays of hormones using RIA and ELISA; hormonal control of ovulation in rats and humans; Multifaceted role of Vasopressin and Oxytocin; Hormonal regulation of parturition.
		Endocrinology (Practical)	ZOOADSE03P	1. Students learn to dissect and display Endocrine glands in laboratory bred rat. 2. They learn to identify with characters T.S. of all the endocrine glands. 3. Students learn the techniques of tissue fixation, embedding in paraffin, microtomy

				and slide preparation of any endocrine gland. 4. Demonstration of hormone assay through ELISA from available teaching kit.
18	Sem-VI	Fish and Fishery (Theory)	ZOOADSE04T	1. Develop clear concept of different types of fisheries and aquaculture and apply relevant scientific principles in of aquatic biology. 2. Able critically analyze, interpret, and evaluate information relevant to aquaculture and fisheries 3. Learn the multidisciplinary nature of the study of Fish and Fisheries and engage positively with people and ideas beyond their own discipline. 4. Develop the knowledge about aquaculture research and its model organism.
		Fish and Fishery (Practical)	ZOOADSE04P	1. Develop soft skills for studying morphometric and meristic characters to identify the species of fishes. 2. Able to identify different types of fishes, scale of fishes. 3. Develop *employable skills* in freshwater biological water quality analysis. 4. Improve report writing skills through the preparation of project report.
19	Sem-VI	Parasitology (Theory)	ZOOADSE05T	1. Students acquire knowledge on Parasitism, Parasite, Parasitoid, Vectors and Host-Parasite relationships. 2. Study of morphology, life cycle, prevalence, epidemiology, pathogenicity, diagnosis, prophylaxis and treatment of various parasitic protists, helminths, nematodes arthropod, vertebrate parasite. 3. The knowledge of parasitology will help to take proper prevention and control measure in their daily life.
		Parasitology (Practical)	ZOOADSE05P	1. Able to identify different life stages of various parasitic protists, helminths, Nematodes. 2. Acquire in depth knowledge for identification of plant parasitic root knot nematode, Meloidogyne from the soil sample and various parasitic arthropods. 3. Develop skills for isolation and fixation of nematode or cestode parasites from the

				intestine of hen.
20	Sem-VI	Wildlife and Conservation (Theory)	ZOOADSE06T	1. Develop an understanding of general principles of wild life conservation and how animals interact with each other and their natural environment. 2. Attain knowledge to solve problems related to wildlife conservation and management. 3. Able to identify common local flora and fauna and how they related to terrestrial and/or aquatic plant and animal conservation and management. 4. Critically evaluate current events and public information related to man animal conflict and other wildlife conservation issues. 5. Understand conservation ethics and acts practiced in India.
		Wildlife and Conservation (Practical)	ZOOADSE06P	1. Develop skills for field study and biodiversity analysis. 2. Able to identify common local flora and fauna like mammalian, avian and herpetofauna and their normal habitat. 3. Acquainted with the basic equipment and their uses for wildlife study. 4. Develop the skill for estimation of flora and fauna diversity and relative abundance through various ecological tools and field techniques.
21	Sem-III	Aquarium Fish Keeping (Theory)	ZOOSSEC001	1. Students will apply information and practical experience in aquarium decoration 2. Students learn the potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic and Endemic species of Aquarium Fishes. 3. Develop knowledge about the biology of aquarium fishes and about various means of Live fish transport. 4. Learn about the use of live fish feed organisms, preparation and composition of formulated fish feeds, aquarium fish as larval predator. 5. Develop the skill for culture breeding and marketing techniques of common indigenous ornamental fishes

				6. Learn about general Aquarium maintenance, budget for setting up an Aquarium Fish Farm as a Cottage Industry.
22	Sem-IV	Vermicompost Production (Theory)	ZOOSSEC002	1. Understanding the role of worm farming in modern farming 2. Understanding the potential of vermicompost as an alternative to chemical fertilizers 3. Learn about role of vermicultre in maintaining the health of soil and its economic importance. 4. Role of Vermiculture in protecting the environment and managing the waste

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Course Outcomes (Cos):

Sl. No.	Semester	Name of Course	Course Code	Course Outcomes (COs)
1	Sem-I	Animal Diversity (Theory)	ZOOHGEC01T	1. Develop understanding on the diversity of life with regard to protists, non-chordates and chordates. 2. Knowledge on the general characteristics, classification, life- cycle pattern of representative animals of non-chordates and Chordates.
		Animal Diversity (Practical)	ZOOHGEC01P	1. Able to classify animals based on their morphological characteristics / structures. 2. Able to identify poisonous and non-poisonous snake. 3. The project assignment will also give them a flavour of research to find the process involved in studying biodiversity and taxonomy besides improving their writing skills.
2	Sem-II	Physiology and Biochemistry (Theory)	ZOOHGEC02T	1. Acquire knowledge about the process of digestion, muscle contraction, respiration and transport of gases, urine formation, function of endocrine glands and formation of gametes.

				2. Develop the basic concept of different biomolecules and different anabolic and catabolic process.
		Physiology and Biochemistry (Practical)	ZOOHGEC02P	1. Develop the skill for different haematological test, identification of histological sections. 2. Able to perform different quantitative and qualitative test for different biomolecules.
3	Sem-III	Insect, Vectors and Diseases (Theory)	ZOOHGEC03T	1. Able to understand the general features of insect vector and their taxonomy, general morphology and physiology. 2. Develop knowledge about vector, vector borne diseases and their mode of transmission, virulence, pathogenicity and diagnose. 3. Able to understand the prevention and control mechanism of infectious diseases as per WHO guidelines.
		Insect, Vectors and Diseases (Practical)	ZOOHGEC03P	1. Able to identify and classify different vector insects with reasons and the diseases transmitted by it. 2. Develop the skill for identification of different types of mouth parts through theoretical and hands on training. 3. Through the project assignment they will develop the skill of report writing.
4	Sem-IV	Environment and Public Health (Theory)	ZOOHGEC04T	1. Understand different causes of environmental pollution and their remedies 2. Learn about the depletion and contamination of natural resources. 3. To learn waste management technologies and its applications. 4. Develop awareness about the causative agents and control measures of many commonly occurring diseases.
		Environment and Public Health (Practical)	ZOOHGEC04P	1. Develop the skill for measuring water parameter analysis from different ecological setting.