

DUM DUM MOTIJHEEL COLLEGE

DEPARTMENT OF ZOOLOGY

B.Sc. Zoology (Hons) CBCS Syllabus

Issued by the West Bengal State University

With effect from 2018-19

Programme Specific Outcomes

- Students gain knowledge and skill in the fundamentals of animal sciences, recognizes the complex interactions among various living organisms and correlates with extinct animals.
- Apply the knowledge of internal structure of cells, tissue organizations and their functions in co-ordination and control of various metabolic functions of organisms.
- Analyze complex interactions among the various animals of different phyla, their distribution and their relationship with the environment and their natural histories.
- Understand the physiological processes of animals and relationship of organ systems including comparative studies.
- Preliminary studies on Agro based small-scale and cottage industries as Skill Enhancement courses like aquarium fish farming and vermicomposting to enhance the knowledge of self independence.
- Understands about various concepts of genetics, molecular biology and its importance in human health and welfare; and the physiological aspects of human and other vertebrates and invertebrates.
- This program covers theoretical studies and practical proficiency training which may help in their placement at several pharmaceutical/ biotechnology/ microbiology/ based laboratory and/ or preparation of M.Sc. entrance examination for universities & institutes including NET, SET, GATE etc.
- The students will get a flavor of research besides improving their writing skills and making them well versed with the current trends, and enable the students to think and interpret individually due to different aspects chosen, after successful completion of this course.

DUM DUM MOTIJHEEL COLLEGE
Course Outcome or Learning Outcome
Three year B.A. /B.Sc. degree course
Under CBCS semester system
HONOURS COURSE IN ZOOLOGY
With effect from the session: 2018 – 2019

Course Name: Core Course-1

Course Code: ZOOACOR01T & ZOOACOR01P

Topic Name: Animal Diversity- Non-Chordates I

Course Outcome: Non-Chordate: Protozoa to Nemathelminths

Both theory and practical paper based on systematic animal diversity and evolution.

1. Different groups of invertebrate animals are studied in this course including Protozoa, Porifera, Cnidaria, Ctenophora, Platyhelminthes, and Aschelminthes, General characters and classification up to classes are studied. Some special features, organs, pathogenicity, life history and significance are studied here.
2. It will help the students to aware of basic taxonomy of non-chordates (acoelomate and pseudocoelomates).
3. Students will acquire knowledge about the modern classification system of the Protozoa.
4. Student will learn to identify non-chordates from their special features.
5. Understanding the mode of infection of parasites, their evolution and adaptation.
6. Students also learn about the life cycles of the non-chordates.

Course Name: Core Course-2

Course Code: ZOOACOR02T & ZOOACOR02P

Topic Name: Ecology

Course Outcome: Ecology:

Both theory and practical paper cover basic ecology such as study of physical factor and its interaction with the environment, population, community and eco system and the application of ecological knowledge in the field of conservation of wild life and natural resources.

1. Understand the basic concepts of ecology, biogeochemical cycles autecology and synecology.
2. Understand the study of population, life history pattern, fertility rate, survivorship and age structure i.e. study of demography.
3. Understand the types and function of ecosystem, Characteristics of Community; Ecological Succession and Major Biomes of the world.
4. Students will involve in the protection and conservation of nature and natural resources.
5. Students will directly observe human-animal conflict and conservation measures through field studies (within the state).

Course Name: Core Course-3

Course Code: ZOOACOR03T & ZOOACOR03P

Topic Name: Non-Chordate II

Course Outcome: The course covering both theory and practical makes a detailed comparison of the anatomy of the different taxa of non-chordates (the coelomates phyla). The course gives an overview of the intricate life processes and adaptive radiations in non-chordates.

1. The students will be able to develop the power to understand the characters used to classify and being able to differentiate the organisms belonging to different taxa (up to class level).
2. They have hands on experience of materials demonstrating the diversity of coelomate non-chordates.
3. Understand the relative position of individual organs and associated structures through dissection or photographs of the systems of the invertebrate representatives (Cockroach and Earthworm only).
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 and study of different larval forms.
5. Get a flavor of research by doing literature review on invertebrate larvae improving their writing skills, analytical power and thorough interpretation.

Course Name: Core Course-4
Course Code: ZOOACOR04T & ZOOACOR04P
Topic Name: Cell Biology

Course Outcome: The course provides a detailed insight into basic concepts of cellular structure and function. It also gives an account of the complex regulatory mechanisms that control cell functions and cellular abnormalities like cancer, tumor. Understand the functioning of nucleus and extra nuclear organelles like mitochondria, RER, Golgi bodies, cytoskeleton and understand the intricate cellular mechanisms involved. Thus-

1. The students acquire the detailed knowledge of different pathways related to cell cycle, cell signaling and apoptosis, PCD, Necrosis which enable them to understand the biology of cancer.
2. Understand clinical aspects, including epidemiology, tumor cell metabolism, cancer stem cells, DNA viruses, metastasis and therapeutic strategies.
3. Get new avenues of joining research in areas such as cancer research, researches related to signal transduction pathways, cell viability assays, diabetes research etc.
4. Understand the basic knowledge of histochemistry by staining mucopolysaccharides and nucleic acids.
5. Identifying sex cytologically by observing Barr body.

Course Name: Core Course-5
Course Code: ZOOACOR05T & ZOOACOR05P
Topic Name: Chordates

Course Outcome: The course (both theory and practical) deals with the amazing diversity of living forms of Chordata from simple to complex one. It also deals with the differences and similarities between organisms on the basis of their morphology and anatomy which led to their grouping into taxa and clades.

After successfully completing this course, the students will be able to:

1. Develop understanding on the diversity of life with regard to chordates.
2. Group animals on the basis of their morphological characteristics/ structures from Lower Chordates to Agnatha, Fishes, Amphibia, Reptilia, Birds and Mammals as per the evolutionary chronology.
3. Understand how morphological changes due to change in environment helps drive evolution over a long period of time.
4. The practical lab works will also give them a flavor of research to find the process involved in studying biodiversity and taxonomy besides improving their writing skills. It will further enable the students to think and interpret individually due to different animal species chosen.

Course Name: Core Course-6
Course Code: ZOOACOR06T & ZOOACOR06P
Topic Name: Physiology: Controlling and Coordinating System

Course Outcome: The course offers insight into the physiology of chordates, mammals while giving an account of their anatomy. The course deals with various physiological functions in mammals. It also gives an account of the metabolic/ biochemical pathways and the probable impact of environment on them. The major objective of this course is to provide students with a sound coverage of human reproductive biology within the framework of Human Biology. It also envisages the detailed structure and function of the male and female reproductive tracts, gametogenesis, fertilization, early embryogenesis, fetal development and preparation for birth, and maternal adaptations to pregnancy. The students will also be taught about the types of synapse, neurotransmitters and their receptors besides other related aspects. The course envisages information on endocrine system with emphasis on the structure of hypothalamus and anterior pituitary. The associated hormones and the related disorders will be explained.

After successfully completing this course, the students will be able to:

1. Understand how cells, tissues, and organisms function at different levels.
2. Understand the physiology at cellular and system levels.
3. Understand the organization of nervous system and process of nerve conduction.
4. Understand the process of muscle contraction.
5. Explain and contrast the processes of spermatogenesis, oogenesis.
6. Demonstrate an understanding of the hormonal control of reproduction in males and females.
7. Understand the structure of brain and improved methods to study it.
8. Develop treatments for neurodegenerative diseases (such as Alzheimer's and Parkinson's diseases) and mental illnesses.
9. Understand the structure of different lobes of the brain and their corresponding functions.
10. Understand intricacies of nerve impulse conduction.
11. Understand neurohormones and neurosecretions.
13. Learn about hypothalamo - hypophysial axis.
14. Understand about different endocrine glands and their disorders.
15. Understand the mechanism of hormone action.
16. Develop an understanding of the related disciplines, such as cell biology, neurophysiology, pharmacology, biochemistry, endocrinology etc.
17. Get a flavor of research besides improving their writing skills and making them well versed with the current trends. It will further enable the students to think and interpret individually due to different aspects chosen.

Course Name: Core Course-7
Course Code: ZOOACOR07T & ZOOACOR07P
Topic Name: Biochemistry

Course Outcome: The course provides an introduction to the structure of biomolecules with emphasis on the techniques used for structure determination and analysis. The course covers basic aspects of sample preparation for analysis and aims to enlighten the students how structural information can be utilized for better understanding of biological processes. The course aims to provide an advanced understanding of the core principles and topics of Biochemistry and their experimental basis, and to enable students to acquire a specialized knowledge and understanding of selected aspects by means of a stem/branch lecture series and a research project.

After successfully completing this course, the students will be able to:

1. Understand about the importance and scope of biochemistry.
2. Understand the structure and biological significance of carbohydrates, amino acids, proteins, lipids and nucleic acids.
3. Understand the structure and function of immunoglobulins.
4. Understand the concept of enzyme, its mechanism of action and regulation.
5. Learn the preparation of models of peptides and nucleotides.
6. Learn biochemical tests for amino acids, carbohydrates, proteins and nucleic acids.
7. Learn measurement of enzyme activity and its kinetics.
8. Develop an understanding of the related disciplines, such as cell biology, neurophysiology, pharmacology, biochemistry, endocrinology, recombinant DNA technology, genetic engineering, cloning vector biology, cell culture etc.
9. The practical and technical skills through laboratory-based work will prepare a student well for a research or technical position. Obtaining some work experience, for example a summer internship in a research laboratory or company, will help the students to boost chances of finding a job.

Course Name: Core Course-8
Course Code: ZOOACOR08T & ZOOACOR08P
Topic Name: Comparative Anatomy

Course Outcome: In this paper the students will study the comparative anatomy of different organ of the vertebrate that will give them an idea of structure of the organs, their structural development and how they become modified according to their mode of their life (Adaptation). After completion of the student the students will be able to-

1. Know about the pattern of evolution through comparative study of the systems.
2. Acquaint about the development of complexity in circulatory, nervous, excretory and reproductive system.
3. Acquire the knowledge about the trend of evolution in vertebrates.

Course Name: Core Course-9
Course Code: ZOOACOR09T & ZOOACOR09P
Topic Name: Physiology- Life Sustaining System

Course Outcome: Course outcome:

After successfully completing this course: Student will able to

1. Students gain fundamental knowledge of animal physiology
2. Know the physiological mechanism the work to keep the animal body alive and functioning.
3. Interaction and interdependence of physiological and biochemical process.
4. Any abnormalities or disease caused by metabolic error.
5. Students will gain skill to execute the roles of a biology teacher or medical lab technicians with training as they have basic fundamentals

Course Name: Core Course-10
Course Code: ZOOACOR10T & ZOOACOR10P
Topic Name: Immunology

Course Outcome: Course outcome:

1. Provides basics knowledge about immune system (Molecules, cells and tissue involved in host defence mechanism) and allows the student to create awareness as how to boost their immune system for good health.
2. Understand the Basic structure, classes and function of Antibodies, Types of immunity (Innate and Adaptive, Humoral and Cellular), Antigen-Antibody interaction, Complements and MHC.
3. Understand the types of hypersensitivity reactions and auto immune diseases.
4. Understand the immune mechanisms in disease control.
5. They will know the immune diffusion technique, ELISA , RIA , Hybridoma technology and monoclonal antibody production.
6. They will know the manipulation of immune responses for the benefit of mankind, vaccines.

Course Name: Core Course-11
Course Code: ZOOACOR11T & ZOOACOR11P
Topic Name: Molecular Biology

Course Outcome:

1. Develop an understanding of concepts, mechanisms and evolutionary significance and relevance of molecular biology in the current scenario.
2. Understanding recombinant DNA technology which holds application in biomedical & genomic science, agriculture, environment management, etc. Knowledge of Molecular Biology will help in career building in all these fields.
3. Apply their knowledge in problem solving and future course of their career development in higher education and research.
4. Provide new avenues of joining research in related areas such as therapeutic strategies or related opportunities in industry

Course Name: Core Course-12
Course Code: ZOOACOR12T & ZOOACOR12P
Topic Name: Genetics

Course Outcome:

1. Understand the mechanism how DNA encodes genetic information and the function of mRNA and tRNA2
2. Apply the principles of Mendelian inheritance.
3. Understand the cause and effect of alterations in chromosome number and structure.
4. Relate the conventional and molecular methods for gene manipulation in other biological systems.
5. Discuss and analyse the epigenetic modifications and imprinting and its role in diseases.
6. Provide new avenues of joining research in related areas such as genetic engineering of cells, cloning, genetic disorders, human fertility programme, genotoxicity.

Course Name: Core Course-13
Course Code: ZOOACOR13T & ZOOACOR13P
Topic Name: Developmental Biology

Course Outcome: After successful completion of this course students will be able to:

1. Develop critical understanding how a single-celled fertilized egg transforms into an embryo and then a fully formed adult by complex processes of cell division, cell differentiation and morphogenesis.
2. Understand the initial developmental procedures involved in frog and chick.
3. Appreciate the mechanisms that support growth and development and process of gene function.
4. Learn interesting and unique post embryonic development that happens in vertebrates.
5. Learn implication of developmental biology in medicine or its role in development of diseases.
6. Identify whole mounts of developmental stages of chick embryo growth and differentiation in different hours of incubation through permanent slides. Students will be able to recognize embryonic tissue and organ morphology and structure in clinical specimens.
7. Gain a basic knowledge on the life cycle of the model organism Drosophila and its developmental stages.
8. Acquire knowledge on the different sections of placenta and their histogenesis through micrograph or slides.
9. The students can analyze variations at different stages of embryonic development and distinguish between healthy and pathological tissues in specimens.
10. Learn the techniques of Drosophila culture and chick embryo development through short term project.

Course Name: Core Course-14
Course Code: ZOOACOR14T & ZOOACOR14P
Topic Name: Evolutionary Biology

Course Outcome: After successful completion of this course students will be able to:

1. Understand the origin and evolution of universe and earliest life.
2. Develop the historical concept of the process and theories in evolutionary biology and the role of evidences in support of evolution.
3. Develop knowledge about sources of variation and concept of population genetics and can apply them in relevant experimentation.
4. Understand species concept, extinction and molecular phylogeny and able to apply it in their lives and community analysis.
5. Examine the evolutionary changes in different taxa based on statistical analysis.
6. Learn how to study a fossil from model or photograph and analyze homology and analogy of structures from suitable specimens. They can observe and interpret about the events that took place in geologic past.
7. Think critically and logically to make relationship between evidence and explanations.
8. Verify Hardy-Weinberg equilibrium in a population by learning the chi-square calculation method and other statistical analysis from collected data.

Course Name: Discipline Specific Elective-1
Course Code: ZOOADSE01T & ZOOADSE01P
Topic Name: Animal Behaviour and Chronobiology

Course Outcome:

1. Learn a wide range of theoretical and practical techniques used to study animal behaviour.
2. Develop skills, concepts and experience to understand all aspects of animal behaviour.
3. Objectively understand and evaluate information about animal behaviour and ecology encountered in our daily lives.
4. Understand and be able to objectively evaluate the role of behaviour in the protection and conservation of animals in the wild.
5. Consider and evaluate behaviour of all animals, including humans, in the complex ecological world, including the urban environment

Course Name: Discipline Specific Elective-3
Course Code: ZOOADSE03T & ZOOADSE03P
Topic Name: Endocrinology

Course Outcome:

1. Understand neurohormones and neurosecretions.
2. Learning about hypothalamo and hypophysial axis.
3. Understand about different endocrine glands and their disorders
4. Understand the mechanism of hormone action.

Course Name: Discipline Specific Elective-5
Course Code: ZOOADSE05T & ZOOADSE05P
Topic Name: Parasitology

Course Outcome: After successful completion of this course students will be able to:

1. Understand parasitism, diversity of symbiotic associations and the biology behind host-parasite interactions.
2. Learn about epidemiological concepts of parasitic infections of global importance.
3. Gain knowledge of numerous diseases which have significant impact on human health.
4. Diagnose, identify and detect some important protozoan, helminth and arthropod parasites of human and livestock.
5. Analyze challenges in diagnosis, treatment and control of parasitic infections in humans and in veterinary context. Also learn pathological changes associated with parasite infections.
6. Identify, describe and contrast different protozoan, helminth and arthropod parasites responsible for causing various human and veterinary diseases through permanent slides or microphotographs.
7. Prepare and observe live parasitic specimens from fish gills and intestine of poultry birds. This gives them an idea of size, shape, colour pattern and unique morphological features and location of important external and internal pathogens and parasites from different phyla.
8. Learn the techniques to identify plant parasitic root knot nematodes from soil samples which will be beneficial for further advance knowledge generation.
9. Develop the skill to isolate, identify and fixation and preservation of different parasites from animal body in laboratory using microscopes

Course Name: Discipline Specific Elective-6
Course Code: ZOOADSE06T & ZOOADSE06P
Topic Name: Wildlife and Conservation

Course Outcome: After successful completion of this course students will be able to:

1. Develop an understanding of general principles of ecology and how animals interact with each other and their natural environment
2. Apply knowledge to solve problems related to wildlife conservation and management.
3. 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.
6. Develop skills for field study and biodiversity analysis.
7. Identify common local flora and fauna like mammalian, avian and herpetofauna and their normal habitat.
8. Acquainted with the basic equipment and their uses for wildlife study.
9. Develop the skill for estimation of flora and fauna diversity and relative abundance through variuos ecological tools and field techniques.

Course Name: Skill Enhancement Course-1
Course Code: ZOOSSEC01M
Topic Name: Aquarium Fish Keeping

Course Outcome: Knowledge on the followings

1. To learn the scientific method of setting an aquarium
2. To learn the culture breeding and marketing techniques of common indigenous ornamental fishes

Course Name: Skill Enhancement Course-2
Course Code: ZOOSSEC02M
Topic Name: Vermicompost Production

Course Outcome:

1. Understanding the role of worm farming in Modern Farming
2. Understanding the potential of vermicompost as an alternative to chemical fertilizers
3. Role of vermiculture in maintaining the health of soil and humans
4. Economic importance of vermiculture
5. Role of Vermiculture in protecting the environment and managing the waste

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Course Outcome or Learning Outcome
Three year B.A. /B.Sc. degree course
Under CBCS semester system
GENERAL COURSE IN ZOOLOGY
With effect from the session: 2018 – 2019

Course Name: Generic Elective/Department Specific Core Course-1
Course Code: ZOOHGEC01T & ZOOHGEC01P / ZOOGCOR01T & ZOOGCOR01P
Topic Name: Animal Diversity

Course Outcome: Knowledge on the followings:

1. Develop understanding on the diversity of life with regard to protists, non-chordates and chordates.
2. Group animals on the basis of their morphological characteristics / structures.
3. Develop critical understanding how animals changed from a primitive cell to a collection of simple cells to form a complex body plan.
4. Examine the diversity and evolutionary history of a taxon through the construction of a basic phylogenetic/cladistics tree.
5. Understand how morphological change due to change in environment helps drive evolution over a long period of time.
6. 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.
7. It will further enable the students to think and interpret individually due to different animal species chosen.

Course Name: Generic Elective/Department Specific Core Course-2
Course Code: ZOOHGEC02T & ZOOHGEC02P / ZOOGCOR02T & ZOOGCOR02P
Topic Name: Human Physiology & Biochemistry

Course Outcome: Knowledge on the followings

1. Understand the process of digestion and its control.
2. Develop understanding in muscle structure and contraction mechanism.
3. Learn the process of respiration and transport of gases.
4. Understand kidney structure and regulation of urine formation.
5. Understand heart structure and functioning.
6. Understand function of endocrine glands and formation of gametes.
7. Understand about the importance and scope of biochemistry.

Course Name: Generic Elective/Department Specific Core Course-3
Course Code: ZOOHGEC03T & ZOOHGEC03P / ZOOGCOR03T & ZOOGCOR03P
Topic Name: Insect Vectors and Diseases

Course Outcome: Knowledge on the followings

1. To learn understand the general features of insects and gain knowledge about their distribution and success on Planet Earth and to learn Insect's taxonomy, general morphology and physiology
2. Learn about vector and vector borne diseases.
3. Describe the mechanisms for transmission, virulence and pathogenicity in pathogenic micro-organisms.
4. Diagnose the causative agents, describe pathogenesis and treatment for important diseases like malaria, leishmaniasis, Dengue, Chikungunya, Viral encephalitis, Filariasis
5. Explain how the infectious disease can transmit to human.
6. Properly understand the prevention and control mechanism of infectious diseases
7. Develop education, communication programme and learn how to maintain proper WHO guidelines about infectious diseases.

Course Name: Generic Elective/Department Specific Core Course-4
Course Code: ZOOHGEC04T & ZOOHGEC04P / ZOOGCOR04T & ZOOGCOR04P
Topic Name: Environment and Public Health

Course Outcome: Knowledge on the followings

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.

Course Name: Department Specific Elective-1
Course Code: ZOOGDSE01T & ZOOGDSE01P
Topic Name: Applied Zoology

Course Outcome: Knowledge on the followings

1. Describe the mechanisms for transmission, virulence and pathogenicity in pathogenic micro-organisms.
2. Diagnose the causative agents, describe pathogenesis and treatment for important diseases like Tuberculosis, Typhoid, *Entamoeba histolytica*, *Plasmodium vivax* and *Trypanosoma gambiense*, *Ancylostoma duodenale* and *Wuchereria bancrofti* etc
3. Develop an understanding of the classification of fishes and integrating structure, function and physiology
4. Gain an overview of the fishery and aquaculture industry
5. Express the importance of aquaculture
6. To understand the techniques involved in aquaculture practices.
7. To understand artificial insemination in cattle.
8. Get basic knowledge in poultry keeping.

Course Code: ZOOGDSE04T & ZOOGDSE04P

Course Name: Immunology

Course Outcome:

Knowledge on the followings

1. Understand and apply relevant scientific principles in the area of Immunology.
2. Employ scientific methodologies such as experimentation and data analysis in the area of immunology.
3. Critically analyze, interpret and evaluate antigen-antibody reactions and Blood groups.
4. Appreciate the multidisciplinary nature of the study of immunology.
5. Explore some of the unique features like graft rejection, hypersensitivity etc.
6. Develop employable skills and knowledge in vaccination.