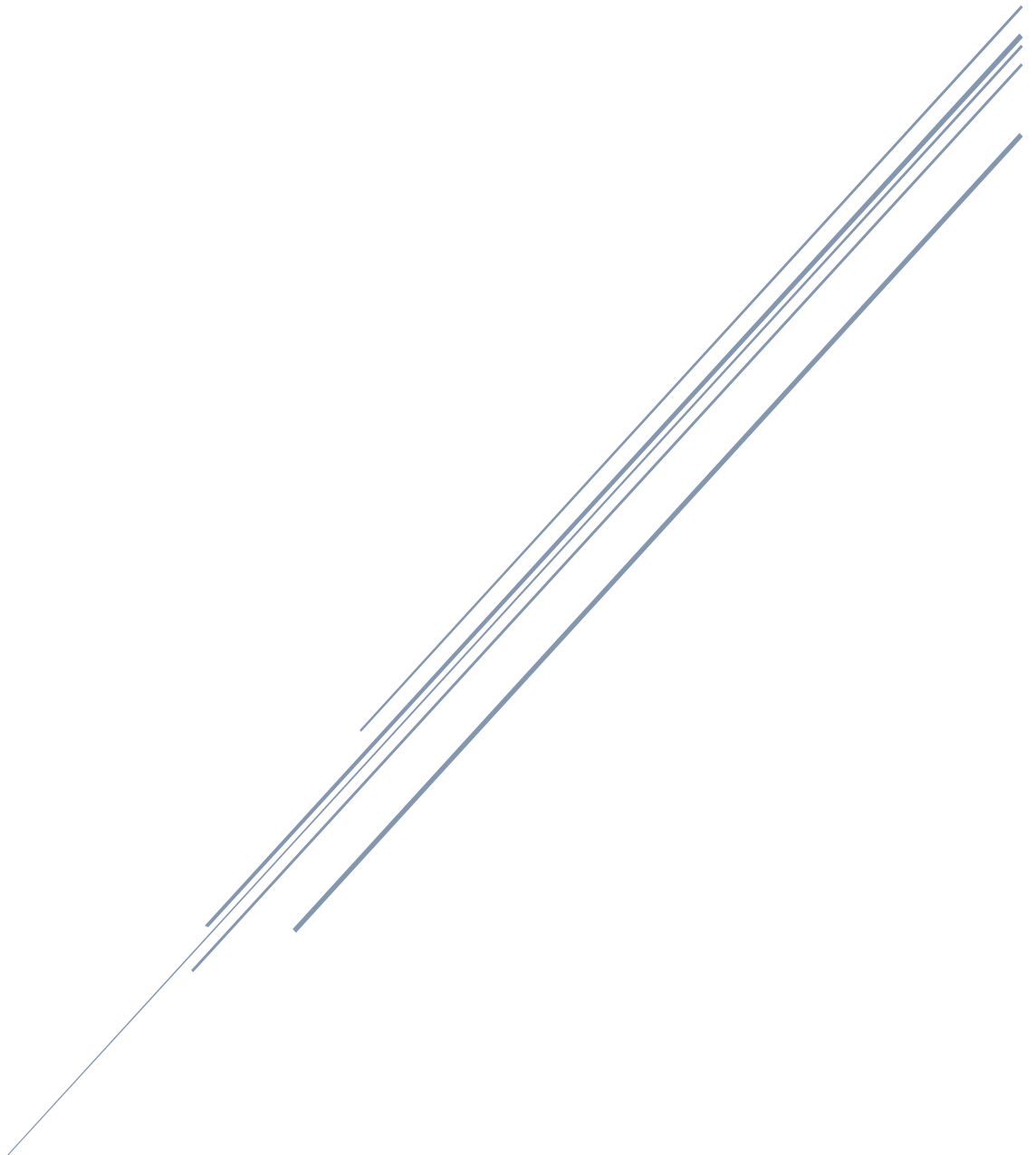


# BACHELOR OF SCIENCE (HONS) (ZOOLOGY)-ODL

PROGRAMME PROJECT REPORT (PPR)



School of Sciences

PPR of B.Sc. in Zoology approved by 39th Academic Council (vide memo no.: Reg/0322 dated 14.03.2023) for delivery of programme through Open Distance Learning mode.

***i. Programme's mission and objectives:***

Zoology is the one of the promising branch of science of everyday life-allowing us to explain animals and their anatomy, physiology, biochemistry etc. Consequently, the industry relating with the zoology is concern with a wide range of employment options open to learners in different fields of the society.

The specific objective of HZO is to provide systematic knowledge in the subject which will serve as the basis of further higher education in this area. Fundamentally, with the provision of obtaining the degree to everyone interested to learn in this area, but unable to attain the conventional system of education; the course is structured in such a manner so that it can generate interest among learners with basic understanding of the subject. This course with theoretical and practical topics and evaluation system will serve as a screening process for the students to gain interest, sufficient understanding and skill on the subjects which will influence them to proceed further in this subject and gain an educated outlook to observe and assess living world. This programme will act as the gateway to next level of higher education and for various vocational or professional courses and as basic qualification of different types of job oriented entrance examinations.

***ii. Relevance of the program with HEI's Mission and Goals:***

The mission of the Higher Education Institutions is to bring more and more learners in the higher education and thus contribute to economic as well as scientific development. In other way, involvement of more learners in higher education will help the nation to reach its goal.

Consistent with the mission of the HEI's this program is entirely consistent with the University's strategic goals as well as its mission to provide modern education to underprivileged sections of society. The program is also in accordance with the NSOU's goals to provide quality education in science establishing an equitable knowledge society within the state. Thus, NSOU brings forth this proposal after extended and thoughtful deliberations.

***iii. Nature of prospective target group of learners:***

For the programme, the students have studied Biology in Higher Secondary level from any recognized board. They are considered as the target group of learners for the programme. In West Bengal, a lot of Learners pass higher secondary (10+2) examination with science background. But due to limitation of seats in the conventional Universities/ colleges in Zoology (Honours), all of them could not get enrolled themselves in the subject of their choice (i.e., Zoology). In recent years there are ample scope of higher studies as well as research in Zoology, thus the Learners opt this subject by choice.

Besides, target group of learners are people from different age groups who wishes to pursue higher education and enhance their knowledge in the discipline to seek for a better career and lead a responsible life. The learners are from different socio-economic background and are located in different parts of the state of West Bengal and also from neighbouring other states. In compliance with the ultimate objective of distance education to reach the unreached, special care is taken to include learners from marginalised sections of the society, backward caste and tribes.

This makes for a very heterogeneous learner group.

***iv. Appropriateness of programme to be conducted in Open and Distance Learning and/or Online mode to acquire specific skills and competence:***

In science "the term theory is used to describe an organized body of principles and assumptions that account for a set of phenomena along with the rules for its application". On the other hand, practical is a simplified, physical representation of a thing or process. The representation can take many forms, such as a diagram, a flow chart, a computer program, dissection, or a physical replica. NSOU provides all the pre-conditions of the science subjects while conducting the Undergraduate programme at the University. The following attributes amply speak for this.

This programme is suitable in the ODL system to acquire skills and competence with the quality education. As the state and national level, the higher educational institutions are expected to provide quality education, education for all, strategic plans for an institution that defines targets and measures of the programmes to be achieved by the institution. Apart from physical infrastructure, administrative policy and code of behaviour, school of sciences is actively engaged in its academic development of respective subjects. The School of Sciences has been designed its curriculum by the help of the Board of Studies (BOS), several learning resource materials, and feedback system through the BOS and an expert committee. Learning material through print-media named Self-Learning Materials (SLMs) is developed with the approach of self-explanatory, self-contained, self-motivating and self-evacuating followed by the UGC guideline.

- ✓ It tries to ensure quality service to the learners of the subject through development of good and appropriate standard Study Learning Material (SLMs), integration of modern methods of teaching learning process.
- ✓ Hands on practice during the Practical Sessions or Laboratory Counselling-cum-evaluation Sessions (LCES) will help the learners to acquire knowledge in the practical domain of Zoology. Learners will enhance skills in assessment of personal safety, and the safety of others, in the laboratory environment.
- ✓ Online support services, PCPs, tutorial classes are also provided.
- ✓ It also includes the usage of ICT and credibility of evaluation procedures.
- ✓ Organization of inter and intra Schools/ Institutional workshops, seminars on quality related themes and promotion of quality circles.
- ✓ Arrangement for feedback responses from learners, parents and other stakeholders on quality related institutional processes will help to maintain the quality of the programme.

#### **v. Instructional Design:**

The curriculum design and detailed syllabus for UG-CBCS Zoology Learners is as follows.

Introduction: This programme is very popular and demanding since its starting in West Bengal. It is well designed and well-structured following the UGC guidelines and the syllabus is also well framed following the major educational institutions in West Bengal and India. Each and every year a very good number of students enrolled in this programme and complete it successfully. This programme for Honours in Zoology (HZO) at undergraduate level is well designed and well-structured following the Choice Based Credit system in compliance with UGC guidelines and the syllabus is also well framed following the major educational institutions in West Bengal and India. The programme consists of fourteen (14) Core Courses (CC), four (04) Discipline Specific Elective [DSE] courses, two (02) Skill Enhancement Courses [SEC], two (02) Ability Enhancement Compulsory Courses [AECC] and four (04) Generic Elective Courses [GEC]. The fresher and existing employees can take the advantage of ODL system to enhance their skills and competency in this particular field without disturbing their work schedule.

The Department takes every care to prepare the Learning Materials in printed form popularly known as the Self-Learning Materials (SLM) with the approach of self-explanatory, self-contained, self-motivating and self-evacuating following the guidelines offered by the University Grants Commission through its notifications. The details of the Under graduate programme given below:

a. Course Structure: (Please see the detailed table below):

SEM	CODE	Course Name	Credit	Study Hours	TE Full Marks	Assig. Full Marks	Total Marks
1 <sup>st</sup>	I	CC-ZO-01 Animal Diversity, Structure and Development Lab	6	180	70	--	70

		<b>CC-ZO-02</b>	Animal Physiology, Molecular Biology and Evolution Lab	6	180	70	--	70	
		<b>AE-BG-11</b>	* Bengali	2	60	50	20	70	
		<b>AE-EG-12</b>	* English						
		<b>GE-01: # Refer Table below</b>		6	180	50	20	70	
	II	<b>CC-ZO-03</b>	Basic Concept of Taxonomy and Diversity of Non- chordates	6	180	50	20	70	
		<b>CC-ZO-04</b>	Diversity of Chordates	6	180	50	20	70	
		<b>AE-ES-21</b>	Environmental Studies	2	60	50	20	70	
		<b>GE-02: # Refer Table below</b>		6	180	50	20	70	
	2 <sup>nd</sup> Year	III	<b>CC-ZO-05</b>	Ecology and Biochemistry Lab	6	180	70	--	70
			<b>CC-ZO-06</b>	Cell Biology and Parasitology Lab	6	180	70	--	70
<b>CC-ZO-07</b>			Cell and Molecular Biology	6	180	50	20	70	
<b>SE-ZO-11</b>			Sericulture	2	60	50	10	60	
<b>GE-03: # Refer Table below</b>				6	180	50	20	70	
IV		<b>CC-ZO-08</b>	Biochemistry and Metabolic Processes	6	180	50	20	70	
		<b>CC-ZO-09</b>	Principals of Ecology	6	180	50	20	70	
		<b>CC-ZO-10</b>	Developmental Biology	6	180	50	20	70	
		<b>SE-ZO-21</b>	Aquarium Fish Keeping	2	60	50	10	60	
		<b>GE-04: # Refer Table below</b>		6	180	50	20	70	
3 <sup>rd</sup> Year	V	<b>CC-ZO-11</b>	Genetics and Developmental Biology Lab	6	180	70	--	70	
		<b>CC-ZO-12</b>	Genetics	6	180	50	20	70	
		<b>DS-ZO-11</b>	Animal Behaviour and Chronobiology	6	180	50	20	70	
		<b>DS-ZO-21</b>	Animal Behaviour and Insect Biology Lab	6	180	70	--	70	
	VI	<b>CC-ZO-13</b>	Animal Physiology: Controlling and Coordinating System	6	180	50	20	70	
		<b>CC-ZO-14</b>	Evolutionary Biology	6	180	50	20	70	
		<b>DS-ZO-31</b>	Biology of Insecta	6	180	50	20	70	
		<b>DS-ZO-41</b>	Aquatic Biology	6	180	50	20	70	

GE combination list:

Subject	SEM-I: GE-01	SEM-II: GE-02	SEM-III: GE-03	SEM-IV: GE-04
Botany	<b>GE-BT-11:</b> Biodiversity	<b>GE-BT-21:</b> Plant Ecology and Taxonomy	<b>GE-BT-31:</b> Plant Anatomy and Embryology	<b>GE-BT-41:</b> Economic Botany and Plant Biotechnology
Chemistry	<b>GE-CH-11:</b> Basic Physical Chemistry	<b>GE-CH-21:</b> Basic Inorganic Chemistry	<b>GE-CH-31:</b> Basic Organic Chemistry	<b>GE-CH-41:</b> Application Oriented Chemistry
				<b>GE-CH-42:</b> Approved MOOCs'

\* Learners have to choose any one from AE-BG-11: Bengali or AE-EG-12: English as Ability Enhancement Compulsory Course 1

# Learners have to choose any one course from each individual GE group of Semester I, II, III and IV.

Course Legend: CC – Core Courses, AECC – Ability Enhancement Compulsory Courses, GEC – Generic Elective Courses, SEC – Skill Enhancement Courses, DSEC – Discipline Specific Elective Courses

b. Detailed Syllabus: (Learners are advised to check the relevant Self Learning Materials (SLM's) for actual distribution of Modules and Units. All courses have been designed in keeping with UGC (Open and Distance Learning and Online Programmes) Regulations, 2020 regarding the minimum number of Units)

### Semester-I

#### **Core Course-1 (Practical)**

**Credit-6, Full Marks-70**

**Course Code: CC-ZO-01, (Course Title: Animal Diversity, Structure and Development Lab)**

#### **1. Study of the following specimens with proper reasons**

*Amoeba, Euglena, Plasmodium, Paramecium, Sycon, Hyalonema, and Euplectella, Obelia, Physalia, Jellyfish, Sea Anemone, Taenia, Male and female Ascaris, Aphrodite, Nereis, Earthworm, Hirudinaria, Palaemon, Scylla, Carcinoscorpius, Penaeus, Scolopendra, Millipede, Periplaneta, Apis, Chiton, Dentalium, Pila, Lamellidens, Loligo, Sepia, Octopus, Star fish, Ophiura, Echinus, Cucumaria and Antedon, Balanoglossus, Herdmania, Branchiostoma, Petromyzon, Sphyrna, Pristis, Torpedo, Scoliodon, Labeo, Exocoetus, Anguilla, Teniolosa, Ureotyphlus, Salamander, Bufo, Hyla, Turtle, Calotes, Chamaeleon, Draco, Vipera, Naja, Crocodylus, Gavialis, Any six common birds from different orders available in the concerned college laboratory, Sorex, Mega- and Micro chiroptera, Squirrel.*

**2. Study of the following permanent slides:**

T.S. and L.S. of Sycon, Study of life history stages of Mosquito/ Toad, T.S. of Male and female *Ascaris*

**3. Key for Identification of poisonous and non-poisonous snakes**

**4. Osteology:**

- a) Disarticulated skeleton of fowl and white rat
- b) Carapace and plastron of turtle
- c) Mammalian skulls: One herbivorous (rat) and one carnivorous animal (dog).

**5. Examination of gametes**

Frog/Rat - sperm and ova through permanent slides or photo- micrographs.

**6. Chick developmental stages**

Study of developmental stages - whole mount of permanent slides – 24 hrs, 48 hrs and 72 hrs embryo.

**7. Demonstration of whole mount preparation of chick embryo**

An “animal album” containing photographs, with appropriate write up about the abovementioned taxa. Different taxa/ topics may be given to different sets of students for this purpose.

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**Semester-I**

**Core Course-2 (Practical)**

**Credit-6, Full Marks-70**

**Course Code: CC-ZO-02, (Course Title: Animal Physiology, Molecular Biology and Evolution Lab)**

1. Preparation of hemin crystals
2. Study of permanent histological sections of mammalian pituitary, thyroid, pancreas, adrenal gland, testis, ovary
3. Study of permanent histological slides of duodenum, intestine, liver, lung, kidney, bone, cartilage
4. Study of human blood group by agglutination reactions.
5. Isolation of DNA from blood Fish Blood (Demonstration)
6. Quantitative estimation of DNA using colorimeter (Diphenylamine reagent) or spectrophotometer.
7. Quantitative estimation of RNA using Orcinol reaction
8. Demonstration of Preparation of permanent slide to demonstrate : DNA by Feulgen reaction; DNA and RNA by MGP; Proteins by Mercurobromophenol blue/Fast Green

- a) Study of fossil evidences from plaster cast models and pictures; b) Study of homology and analogy from suitable specimens/ pictures
9. Charts: a) Phylogeny of horse with diagrams/ cut outs of limbs and teeth of horse ancestors; b) Darwin's Finches with diagrams/ cut outs of beaks of different species
10. Visit to any National Museum and submission of report

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## Semester-II

**Core Course-3 (Theory)**

**Credit-6, Full Marks-70**

**Course Code: CC-ZO-03, (Course Title: Basic Concept of Taxonomy and Diversity of Non-chordates)**

### **Unit 1: Basics of Animal Classification**

Definitions: Classification, Systematics and Taxonomy; Hierarchy, Taxonomic types; Codes of Zoological Nomenclature; Principle of priority; Synonym and Homonym; Species Concept – Biological and evolutionary; basic idea of numerical taxonomy, Molecular taxonomy.

### **Unit 2: Protista, Parazoa and Metazoa**

General characteristics and Classification upto classes Study of *Euglena*, *Amoeba* and *Paramecium* (Structure, locomotion, reproduction & nutrition)

Life cycle and pathogenicity of *Plasmodium vivax* and *Entamoeba histolytica* Evolution of symmetry, grade of organization and segmentation of Metazoa

### **Unit 3: Porifera and Cnidaria and Ctenophora**

General characteristics and Classification upto classes, Canal system and spicules in sponges. Metagenesis in *Obelia*, Polymorphism in Cnidaria, Corals and coral reefs

### **Unit 4: Platyhelminthes**

General characteristics and Classification upto classes, Life cycle and pathogenicity of *Fasciola hepatica* and *Taeniasolium*

### **Unit 5 :Nemathelminthes**

General characteristics and Classification upto classes of phylum Nematoda Lifecycle, and pathogenicity of *Ascarislumbricoides* and *Wuchereriabancrofti* Parasitic adaptations in helminthes

### **Unit 6 :Arthropoda**

General characteristics of crustacea and arachnida, Crustacean larvae, Bionomics and affinities of *Peripatus* (Onychophora)

### **Unit 7: Echinodermata**

General characteristics and Classification. Ambulacral system.

### **Unit 8: Mollusca**

General characteristics, Classification, Torsion and detorsion mechanism, Larval stages.

**NOTE: Classification to be followed from Ruppert and Barnes Invertebrate Zoology VI edition, except for Protozoa (American Association of Protozoologist ref: Levine 1980) and Porifera (Brusca and Brusca 2002; IV edition. Invertebrate Zoology)**

## Semester-II

**Core Course-4 (Theory)**

**Credit-6, Full Marks-70**

**Course Code: CC-ZO-04, Course Title: Diversity of Chordates**

**Unit 1: Protochordata:**

General characteristics of Hemichordata, Urochordata and Cephalochordata; Study of larval forms in protochordates; Retrogressive metamorphosis in Urochordata

**Unit 2: Origin of Chordata**

Dipleurula concept and the Echinoderm theory of origin of chordates

**Unit 3: Agnatha**

General characteristics and classification of cyclostomes up to class

**Unit 4: Pisces**

General characteristics of Chondrichthyes and Osteichthyes, classification up to Order, Migration, Osmoregulation and Parental care in fishes

**Unit 5: Amphibia**

General characteristics and classification up to order; Parental care and Metamorphosis in Amphibians

**Unit 6: Reptilia**

General characteristics and classification up to order; Affinities of Sphenodon; Poison apparatus and Biting mechanism in snakes

**Unit 7: Aves**

General characteristics and classification up to order, Archaeopteryx-- a connecting link; Flight adaptations and Migration in birds

**Unit 8: Mammals**

General characters and classification up to order; Affinities of Prototheria; Adaptive radiation with reference to locomotory appendages

**Unit 9: Comparative Anatomy**

Heart, Brain and Kidney

**Semester-III**

**Core Course-5 (Practical)**

**Credit-6, Full Marks-70**

**Course Code: CC-ZO-05, Course Title: Ecology and Biochemistry Lab**

1. Preparation of nested quadrat and estimation of effective quadrat size.
2. Calculation of Sorenson's Similarity & Shannon-Weiner diversity indices for a community.
3. Study of an aquatic ecosystem: Major Phytoplankton (Up to Family) and zooplankton (Up to Genus), temperature, turbidity/ penetration of light, determination of pH, and Dissolved Oxygen content (Winkler's method) and freeCO<sub>2</sub>.
4. Estimation of Primary productivity by light & dark bottle method.
5. Report on a visit to National Park/Biodiversity Park/Wild life sanctuary/Sea Shore.
6. Qualitative tests to identify functional groups of carbohydrates in
7. given solutions (Glucose, Fructose, Sucrose, Lactose)
8. Paper chromatography of aminoacids.
9. Estimation of total protein in given solutions by Lowry's method.
10. Study of activity of salivary amylase under optimum conditions.
11. Effect of pH, temperature and inhibitors on the action of salivary amylase.

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**Semester-III**

**Core Course-6 (Practical)****Credit-6, Full Marks-70****Course Code: CC-ZO-06, Course Title: Cell Biology and Parasitology Lab**

1. Study of polytene chromosome from chironomid larvae
  2. Study of mitosis from bone marrow of goat/ Onion roottip
  3. Study of various stages of meiosis grasshopper/ testis of mouse
  4. Preparation of stained blood film to study various types of white blood cells
  5. Demonstration of ELISA.
  6. Study of life stages of *Entamoeba histolytica*, *Leishmania donovani* and *Plasmodium vivax*, *Taeniasolium*, *Ascaris lumbricoides*, *Ancylostoma duodenale*, *Wuchereria bancrofti* through permanent slides/microphotographs
  7. Study of *Pediculus humanus*, *Ctenocephalidesspp.* And *Cimex lectularius* through permanent slides/photographs
  8. Study of nematode/cestode parasites from the intestines of Poultry bird
- (Laboratory Note Book must be prepared on day-to-day basis and should be signed by the concerned teacher immediately after the laboratory work. The Laboratory Note Book should contain all the items in the syllabus and must be submitted on the day of examination.)**

**Semester-III****Core Course-7 (Theory)****Credit-6, Full Marks-70****Course Code: CC-ZO-07, Course Title: Cell and Molecular Biology****Unit 1: Plasma Membrane**

Fluid Mosaic model of plasma membrane; Transport across membranes: Active and Passive transport, Facilitated transport; Cell junctions: Tight junctions, Gap junctions, Desmosome

**Unit 2: Mitochondria and Peroxisomes**

Mitochondria: Structure, Mitochondrial Respiratory Chain, Chemi-osmotic hypothesis, Peroxisome

**Unit 3: Cytoskeleton**

Structure and Functions: Microtubules, Microfilaments, and Intermediate filaments

**Unit 4: Nucleus**

Structure of Nucleus: Nuclear envelope, nuclear pore complex, nucleolus

**Unit 5: Cell division**

Mitosis; Meiosis; Cell cycle and its regulation;

**Unit 6: Nucleic Acids**

Salient features of DNA and RNA; Watson and Crick model of DNA

**Unit 7: DNA Replication**

DNA Replication in prokaryotes and eukaryotes, DNA polymerases, primosome, RNA priming, Replication of circular and linear ds-DNA, replication of telomeres

**Unit 8: Transcription and Translation**

RNA polymerase and transcription Unit, mechanism of transcription in prokaryotes and eukaryotes, transcription factors, Split genes: concept of introns and exons, splicing mechanism, Genetic code, Degeneracy of the genetic code and Wobble Hypothesis; mechanism of protein synthesis in prokaryotes: Ribosome structure and assembly in prokaryotes, amino acyl tRNA synthetases and charging of tRNA; Proteins involved in initiation, elongation and termination of polypeptide chain.

**Unit 9: Gene Regulation**

Transcription regulation in prokaryotes: lac operon and trp operon; Transcription regulation in eukaryotes: Activators, repressors, enhancers.



**Semester-IV**

**Core Course-8 (Theory)**

**Credit-6, Full Marks-70**

**Course Code: CC-ZO-08, Course Title: Biochemistry and Metabolic Processes**

**Unit 1: Biological macromolecules**

Structure, types and biological importance: carbohydrate, protein, lipid and nucleic acids

**Unit II: Bioenergetics**

Laws of thermodynamics and its relevance to biological systems.

High-energy phosphate bonds and its role in energy capture and transfer.

**Unit III: Enzymes**

Enzymes: Nomenclature and classification; Cofactors; Specificity of enzyme action; Isozymes; Mechanism of enzyme action; Enzyme kinetics; Factors affecting rate of enzymecatalyzed reactions; Derivation of Michaelis-Menten equation, Concept of  $K_m$  and  $V_{max}$ ,

Lineweaver-Burk plot; Multi-substrate reactions; Enzyme inhibition; Allosteric enzymes and their kinetics; Regulation of enzyme action.

**Unit IV: Overview of Metabolism**

Catabolism vs Anabolism, Stages of catabolism, Compartmentalization of metabolic pathways, Shuttle systems and membrane transporters; ATP as "Energy Currency of cell"; coupled reactions; Use of reducing equivalents and cofactors; Intermediary metabolism and regulatory mechanisms

**Unit V: Carbohydrate Metabolism**

Glycolysis and its regulation; Citric acid cycle; Phosphate pentose pathway Gluconeogenesis, Glycogenolysis and Glycogenesis

**Unit VI: Lipid Metabolism**

$\beta$ -oxidation and omega -oxidation of saturated fatty acids with even and odd number of carbon atoms; Biosynthesis of palmitic acid; Ketogenesis

**Unit VII: Protein Metabolism**

Catabolism of amino acids: Transamination, Deamination, Urea cycle; Fate of C- skeleton of Glucogenic and Ketogenic amino acids

**Semester-IV**

**Core Course-9 (Theory)**

**Credit-6, Full Marks-70**

**Course Code: CC-ZO-09, Course Title: Principles of Ecology**

**Unit 1: Introduction to Ecology**

Levels of organization, Laws of limiting factors, study of physical factors

**Unit 2: Population**

Population attributes: Density, natality, mortality, life tables, fecundity tables, survivorship curves, age, ratio, sex, ratio, dispersal and dispersion Exponential and logistic growth, equation and Patterns, r and k strategies Population regulation-density-dependent and independent factors

Population interactions; Gause's Principle with laboratory and field examples, Lotka- Volterra equation for competition

**Unit 3: Community**

Community characteristics: species richness, dominance, diversity, abundance, vertical stratification, Ecotone and edge effect, Ecological succession

**Unit 4: Ecosystem**

Types of ecosystems with one example in detail, Food chain: Detritus and grazing food chains, Linear and Y-shaped food chains, Food web, Energy flow through the ecosystem, Ecological pyramids and Ecological efficiencies Nutrient and biogeochemical cycle with one example of Nitrogen cycle

**Unit 5: Wild life Conservation**

Wild life Conservation (ideas of in-situ and ex-situ conservation) Management strategies for tiger conservation; protection laws for wildlife conservation.

**Unit 6: Ecological , Faunal and Floral characteristics**

Tropical rain forest, Mangrove, Island and Desert Ecosystem

**Unit 7: Zoogeography**

Zoogeographical realms, Theories pertaining to distribution of animals

**Semester-IV**

**Core Course-10 (Theory)**

**Credit-6, Full Marks-70**

**Course Code: CC-ZO-10, Course Title: Developmental Biology**

**Unit 1: Introduction to Developmental Biology**

Historical perspective and basic concepts: Phases of development, Cell-Cell interaction, Pattern formation, Differentiation and growth, Differential gene expression, Cytoplasmic determinants and asymmetric cell division.

**Unit 2: Early Embryonic Development**

Gametogenesis, Spermatogenesis, Oogenesis; Types of eggs, Egg membranes; Fertilization :(acrosome reaction & egg activation, blocks to polyspermy); Planes and patterns of cleavage; Types of blastula; Fate map construction; Early development of frog and chick upto gastrulation; Embryonic induction and organizers.

**Unit 3: Late Embryonic Development**

Fate of Germ Layers; Extra-embryonic membranes in birds; Implantation of embryo in humans, Placenta (Structure, types and functions of placenta).

**Unit 4: Post Embryonic Development**

Metamorphosis: hormonal regulations in amphibians and insects  
Regeneration with special reference to Hydra.

**Unit 5: Implications of Developmental Biology**

Teratogenesis: Teratogenic agents and their effects on embryonic development; *in vitro* fertilization, Stem cell (ESC), Amniocentesis

**Semester-V**

**Core Course-11 (Practical)**

**Credit-6, Full Marks-70**

**Course Code: CC-ZO-11, Course Title: Genetics and Developmental Biology Lab**

1. Pedigree analysis of some human inherited traits
2. Study of Mendelian Inheritance and gene interactions (Non Mendelian Inheritance) using suitable examples. Verify the results using Chi-square test.
3. Study of Linkage, recombination, gene mapping using the data.
4. Study of human karyotype (normal and abnormal)
5. Pedigree analysis of some human inherited traits
6. Study of sections of developmental stages of frog through permanent slides:  
Cleavage stages, blastula, gastrula, neurula, tail-bud stage, tadpole (external and internal gill stages) and sections of chick embryos of 48 and 72 hrs passing through eye, brain, heart and gut region.

7. Study of the developmental stages and life cycle of *Drosophila* from stockculture
  8. Study of different sections of placenta (photomicrograph/slides)
  9. Project report on *Drosophila* culture/chick embryo development
- (Laboratory Note Book must be prepared on day-to-day basis and should be signed by the concerned teacher immediately after the laboratory work. The Laboratory Note Book should contain all the items in the syllabus and must be submitted on the day of examination.)**

### Semester-V

**Core Course-12 (Theory)**

**Credit-6, Full Marks-70**

**Course Code: CC-ZO-12, Course Title: Genetics**

**Unit 1: Mendelian Genetics and its Extension**

Principles of inheritance, Incomplete dominance and co-dominance, Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Sex-linked, sex influenced and sex-limited characters inheritance

**Unit 2: Linkage, Crossing Over and Chromosomal Mapping**

Linkage and crossing over, Cytological basis of crossing over, Molecular mechanisms of crossing over including models of recombination, Recombination frequency as a measure of linkage intensity, Two factor and three factor crosses, Interference and coincidence, Somatic cell hybridization

**Unit 3: Mutations**

Types of gene mutations (Classification), Types of chromosomal aberrations (Classification, figures and with one suitable example of each), Molecular basis of mutations in relation to UV light and chemical mutagens; Detection of mutations: CLB method, attached X method

**Unit 4: Sex Determination**

Chromosomal mechanisms of sex determination in *Drosophila* and Man

**Unit 5: Polygenic Inheritance**

Polygenic inheritance with suitable examples; simple numericals based on it

**Unit 6: Recombination in Bacteria and Viruses**

Conjugation, Transformation, Transduction, Complementation test in Bacteriophage

### Semester-VI

**Core Course-13 (Theory)**

**Credit-6, Full Marks-70**

**Course Code: CC-ZO-13, Course Title: Animal Physiology: Controlling and Coordinating System**

**Unit 1: Physiology of Digestion**

Structural organization and functions of gastrointestinal tract and associated glands; Mechanical and chemical digestion of food; Absorptions of carbohydrates, lipids, proteins

**Unit 2: Physiology of Respiration**

Histology of trachea and lung; Mechanism of respiration, Pulmonary ventilation; Respiratory volumes and capacities; Transport of oxygen and carbon dioxide in blood;

**Unit 3: Renal Physiology**

Structure of kidney and its functional unit; Mechanism of urine formation; Regulation of water balance; Regulation of acid-base balance

**Unit 4: Nervous System**

Structure of neuron, resting membrane potential, Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibers.

**Unit 5: Muscle**

Histology of different types of muscle; Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle twitch.

**Unit 6: Reproductive System**

Histology of testis and ovary; Physiology of male and female reproduction; Puberty.

**Unit 7: Endocrine System**

Histology of endocrine glands - pituitary, thyroid, parathyroid, pancreas, adrenal; hormones secreted by them and their mechanism of action; Classification of hormones; Regulation of their secretion; Mode of hormone action.

**Semester-VI**

**Core Course-14 (Theory)**

**Credit-6, Full Marks-70**

**Course Code: CC-ZO-14, Course Title: Evolutionary Biology**

**Unit 1:**

Life's Beginnings: Chemogeny, RNA world, Biogeny, Evolution of eukaryotes

**Unit 2:**

Historical review of evolutionary concept: Lamarckism, Darwinism, Synthetic theory

**Unit 3:**

Evidences of Evolution: Fossil record (types of fossils), transitional forms, geological time scale, evolution of horse.

**Unit 4:**

Sources of variations: Heritable variations and their role in evolution

**Unit 5:**

Population genetics: Hardy-Weinberg Law (statement and derivation of equation, application of law to human Population); Evolutionary forces upsetting H-W equilibrium; Natural selection, Genetic Drift (mechanism, founder's effect, bottleneck phenomenon); Role of Migration and Mutation in changing allele frequencies

**Unit 6:**

Product of evolution: Micro evolutionary changes (inter-population variations, clines, races), Species concept, Isolating mechanisms, modes of speciation—allopatric, sympatric, Adaptive radiation/ macroevolution (exemplified by Galapagos finches).

**Unit 7:**

Origin and evolution of man, Unique hominid characteristics contrasted with primate characteristics, primate phylogeny from Australopithecus leading to Homo sapiens

**Discipline Specific Elective Courses**

**Semester-V**

**Discipline Specific Elective Course-1 (Theory)**

**Credit-6, Full Marks-70**

**Course Code: DS-ZO-11, Course Title: Animal Behaviour and Chronobiology**

**Unit 1: Introduction to Animal Behaviour**

Origin and history of Ethology; Brief profiles of Karl von Frish, Ivan Pavlov, Konrad Lorenz, Niko Tinbergen, Proximate and ultimate causes of behaviour

**Unit 2: Patterns of Behaviour**

Stereotyped Behaviours (Orientation, Reflexes); Individual Behavioural patterns; Instinct vs. Learned behaviour; Associative learning, classical and operant conditioning, Habituation, Imprinting.

**Unit 3: Social Behaviour**

Social Behaviour: Concept of Society; Communication and the senses; Altruism; Insects' society with Honey bee as example; Foraging in honey bee and advantages of the waggle dance.

**Unit 4: Biological Rhythm**

Types and characteristics of biological rhythms: Short- and Long- term rhythms; Circadian rhythms; Tidal rhythms and Lunar rhythms; Circannual rhythms;

### **Unit 5: Biological Clocks**

Relevance of biological clocks; Adaptive significance of biological clocks

### **Semester-V**

#### **Discipline Specific Elective Course-2 (Practical)**

**Credit-6, Full Marks-70**

#### **Course Code: DS-ZO-21, Course Title: Animal Behaviour and Insect Biology Lab**

1. To study nests and nesting habits of social insects (Termites and Ants).
2. To study geotaxis behaviour in earthworm.
3. Visit to Forest/ Wild life Sanctuary/Biodiversity Park/Zoological Park to study behavioural activities of animals and prepare a short report.
4. Study of different kinds of mouth parts of insects
5. Study of insect wings and their venation.
6. Methodology of collection, preservation and identification of insects
7. Study of any three insect pests and their damages
8. Study of any three beneficial insects and their products
9. Field study of insects and submission of a project report on the insect diversity

### **Semester-VI**

#### **Discipline Specific Elective Course-3 (Theory)**

**Credit-6, Full Marks-70**

#### **Course Code: DS-ZO-31, Course Title: Biology of Insects**

##### **Unit 1: Introduction**

General Features of Insects

Distribution and Success of Insects on the Earth

##### **Unit 2: Insect Taxonomy**

Basis of insect classification; Classification of insects up to orders

##### **Unit 3: General Morphology of Insects**

External Features; Head – Eyes, Types of antennae, Mouth parts w.r.t. feeding habits, Types of Legs adapted to diverse habitat

##### **Unit 4: Physiology of Insects**

Structure and Physiology of Insect respiratory & endocrine systems Sensory receptors Growth and metamorphosis

##### **Unit 5: Insect Society**

Group of social insects and their social life ; Social organization and social behaviour (with reference to any one example)

##### **Unit 6: Insect Plant Interaction**

Theory of co-evolution, role of allelo-chemicals in host plant mediation

##### **Unit 7: Insects as Vectors**

Insects as mechanical and Biological vectors, Brief discussion on houseflies and mosquitoes as important insect vectors

### **Semester-VI**

#### **Discipline Specific Elective Course 4 (Theory)**

**Credit-6, Full Marks-70**

#### **Course Code: DS-ZO-41, Course Title: Aquatic Biology**

##### **Unit 1: Aquatic Biomes**

Brief introduction of the aquatic biomes: Freshwater ecosystem (lakes, wetlands, streams and rivers), estuaries, intertidal zones, oceanic pelagic zone, marine benthic zone and coral reefs.

##### **Unit 2: Freshwater Biology**

Lakes: Origin and classification, Lake as an Ecosystem, Physico-chemical Characteristics: Light, Temperature, Thermal stratification, Dissolved Solids, Carbonate, Bicarbonates, Phosphates and Nitrates, Turbidity; dissolved gases (Oxygen, Carbon dioxide). Nutrient Cycles in Lakes-Nitrogen:-Sulphur and Phosphorous. Streams: Different stages of stream development, Physico-chemical environment, Adaptations of hill-stream fishes.

**Unit 3: Marine Biology**

Salinity and density of Sea water, Continental shelf, Adaptations of deep sea organisms.

**Unit 4: Management of Aquatic Resources**

Causes of pollution: Agricultural, Industrial, Sewage, Thermal and Oil spills, Eutrophication, Management and conservation (legislations), Sewage treatment Water quality assessment-BOD and COD.

**Skill Enhancement Courses**

**Semester-III**

**Skill Enhancement Course 1 (Theory)**

**Credit-2, Full Marks-60**

**Course Code: SE-ZO-11, Course Title: Sericulture**

**Unit 1: Introduction**

Sericulture: Definition, history and present status; Silk route Types of silkworms, Distribution and Races, Exotic and indigenous races Mulberry and non-mulberry Sericulture

**Unit 2: Biology of Silkworm**

Life cycle of *Bombyx mori*. Structure of silk gland and secretion of silk

**Unit 3: Rearing of Silkworms**

Selection of mulberry variety and establishment of mulberry garden Rearing house and rearing appliances Disinfectants: Formalin, bleaching powder, RKO Silkworm rearing technology: Early age and Late age rearing Types of mountages Spinning, harvesting and storage of cocoons

**Unit 4: Pests and Diseases**

Pests of silkworm: Uzi fly, Dermestid beetles and vertebrates. Pathogenesis of silkworm diseases: Protozoan, viral, fungal and bacterial Control and prevention of pests and diseases.

**Unit 5: Entrepreneurship in Sericulture**

Prospects of Sericulture in India: Sericulture industry in different states, employment, potential in mulberry and non-mulberry sericulture.

**Semester-IV**

**Skill Enhancement Course 2 (Theory)**

**Credit-2, Full Marks-60**

**Course Code: SE-ZO-21, Course Title: Pharmaceutical Chemistry**

**Unit1: Introduction to Aquarium Fish Keeping**

The potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic and Endemic species of Aquarium Fishes

**Unit 2: Biology of Aquarium Fishes.**

Common characters and sexual dimorphism of Fresh water and Marine Aquarium fishes such as Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish

**Unit 3: Food and feeding of Aquarium fishes**

Use of live fish feed organisms. Preparation and composition of formulated fish feeds

**Unit 4: Fish Transportation**

Live fish transport - Fish handling, packing and forwarding techniques.

**Unit 5: Maintenance of Aquarium**

General Aquarium maintenance – budget for setting up an Aquarium Fish Farm as a Cottage Industry

**Generic Elective Courses (For learners of Honours programmes other than Zoology)**

**Semester-I**

**Generic Elective Course-1 (Theory)**

**Credit-6, Full Marks-70**

**Course Code: GE-ZO-11, Course Title: Animal Diversity**

**Unit 1.** Protista General characters of Protozoa; Life cycle of Plasmodium

**Unit 2.** Porifera General characters and canal system in Porifera

**Unit 3.** Radiata General characters of Cnidarians and polymorphism

**Unit 4.** Aceolomates General characters of Helminthes; Life cycle of *Taeniasolium*

**Unit 5.** Pseudo coelomates General characters of Nemethehelminthes; Parasitic adaptations

**Unit 6.** Coelomate Protostomes General characters of Annelida; Metamerism.

**Unit 7.** Arthropoda General characters. Social life in insects.

**Unit 8.** Mollusca General characters of mollusca; Pearl Formation

**Unit 9.** Coelomate, Deuterostomes, General characters of Echinodermata, Water Vascular system in Starfish.

**Unit 10.** Protochordata Salient features

**Unit 11.** Pisces Osmoregulation, Migration of Fishes

**Unit 12.** Amphibia General characters, Adaptations for terrestrial life, Parental care in Amphibia.

**Unit 13.** Amniotes; Origin of reptiles. Terrestrial adaptations in reptiles.

**Unit 14.** Aves: The origin of birds; Flight adaptations

**Unit 15.** Mammalia- Early evolution of mammals; Primates; Dentition in mammals.

**Semester-II**

**Generic Elective Course-2 (Theory)**

**Credit-6, Full Marks-70**

**Course Code: GE-ZO-21, Course Title: Aquatic Biology**

**Unit 1:**

Aquatic Biomes Brief introduction of the aquatic biomes: Freshwater ecosystem (lakes, wetlands, streams and rivers), estuaries, intertidal zones, oceanic pelagic zone, marine benthic zone and coral reefs.

**Unit 2:**

Freshwater Biology Lakes: Origin and classification, Lake as an Ecosystem, Lake morphometry, Physico-chemical Characteristics: Light, Temperature, Thermal stratification, Dissolved Solids, Carbonate, Bicarbonates, Phosphates and Nitrates, Turbidity; dissolved gases (Oxygen, Carbon dioxide). Nutrient Cycles in Lakes- Nitrogen, Sulphur and Phosphorous. Streams: Different stages of stream development, Physico-chemical environment, Adaptation of hill-stream fishes.

**Unit 3:**

Marine Biology Salinity and density of Sea water, Continental shelf, Adaptations of deep sea organisms, Coral reefs, Sea weeds.

**Unit 4:**

Management of Aquatic Resources Causes of pollution: Agricultural, Industrial, Sewage, Thermal and Oil spills, Eutrophication, Management and conservation (legislations), Sewage treatment Water quality assessment- BOD and COD

**Semester-III**

**Generic Elective Course-3 (Theory)**

**Credit-6, Full Marks-70**

**Course Code: GE-ZO-31, Course Title: Insect Vector and Disease**

**Unit I:**

Introduction to Insects General Features of Insects, Morphological features, Head – Eyes, Types of antennae, Mouth parts with respect to feeding habits

**Unit II:**

Concept of Vectors Brief introduction of Carrier and Vectors (mechanical and biological vector), Reservoirs, Host-vector relationship, Vectorial capacity, Adaptations as vectors, Host Specificity

**Unit III:**

Insects as Vectors Classification of insects up to orders, detailed features of orders with insects as vectors – Diptera, Siphonaptera, Siphunculata, Hemiptera

**Unit IV:**

Dipteran as Disease Vectors Dipterans as important insect vectors – Mosquitoes, Sand fly, Houseflies; Study of mosquito-borne diseases – Malaria, Dengue, Chikungunya, Viral encephalitis, Filariasis; Control of mosquitoes Study of sand fly-borne diseases – Visceral Leishmaniasis, Cutaneous Leishmaniasis, Phlebotomus fever; Control of Sand fly Study of house fly as important mechanical vector, Myiasis, Control of house fly

**Unit V:**

Siphonaptera as Disease Vectors Fleas as important insect vectors; Host- specificity, Study of Flea-borne diseases – Plague, Typhus fever; Control of fleas

**Unit VI:**

Siphunculata as Disease Vectors Human louse (Head, Body and Pubic louse) as important insect vectors; Study of louse-borne diseases –Typhus fever, Relapsing fever, Trench fever, Vagabond's disease, Phthiriasis; Control of human louse

**Unit VII:**

Hemiptera as Disease Vectors 6 Bugs as insect vectors; Blood-sucking bugs; Chagas disease, Bed bugs as mechanical vectors, Control and prevention measures.

**Semester-IV**

**Generic Elective Course-4 (Theory)**

**Credit-6, Full Marks-70**

**Course Code: GE-ZO-41, Course Title: Food, Nutrition and Health**

**Unit 1:**

Basic concept of food and nutrition Food Components and food-nutrients Concept of a balanced diet, nutrient needs and dietary pattern for various groups--- adults, pregnant and nursing mothers, infants, school children, adolescents and elderly

**Unit 2:**

Nutritional Biochemistry: Carbohydrates, Lipids, Proteins--- Definition, Classification, their dietary source and role Vitamins--- Fat-soluble and Water- soluble vitamins- their dietary source and importance Minerals--- Iron, calcium, phosphorus, iodine, selenium and zinc: their biological functions

**Unit 3:**

Health Introduction to health--- Definition and concept of health Major nutritional Deficiency diseases- Protein Energy Malnutrition (kwashiorkor and marasmus), Vitamin A deficiency disorders, Iron deficiency disorders, Iodine deficiency disorders- their causes, symptoms, treatment, prevention, and government programmes, if any. Life style related diseases



hypertension, diabetes mellitus, and obesity- their causes and prevention through dietary and lifestyle modifications Social health problems--- smoking, alcoholism, drug dependence and Acquired Immuno Deficiency Syndrome (AIDS) --- their causes, treatment and prevention Common ailments- cold, cough, and fevers, their causes and treatment

**Unit 4:**

Food hygiene: Potable water- sources and methods of purification at domestic level Food and Water borne infections: Bacterial infection: Cholera, typhoid fever, dysentery; Viral infection: Hepatitis, Poliomyelitis, Protozoan infection: *Amoebiasis*, *Giardiasis*; Parasitic infection: *Taeniasis* and *Ascariasis* their transmission, causative agent, sources of infection, symptoms and prevention Brief account of food spoilage: Causes of food spoilage and their preventive measures.

c. Duration of the programme:

The minimum duration of the Programme is 3 (three) years from the date of registration. The registration is valid for a period of maximum 6 (six) years.

d. Faculty & Support Staff requirement:

Sl. No.	Faculty	Name of the Faculty	Work at (HQ/RC)	Number
1	Associate Professor	Dr. Bibhas Guha	HQ - 1	1
2	Associate Professor	Dr. Anirban Ghosh	RC - 1	1
3	Associate Professor	Dr. Sanjay Mandal	RC - 1	1
4	Associate Professor	Dr. Sudipta Das	RC - 1	1
5	Assistant Professor	Mr. Ashif Ahamed	RC - 1	1

e. Support Staff:

Sl. No.	Office Staff (Designation)	Work at (HQ/RC)	Number
1	Junior Assistant	RC - 1	1
2	Junior Assistant Cum Typist	HQ - 1	1

f. Instructional Delivery Mechanisms:

Mode of Delivery/ Types	Delivery Mechanisms	Provided (Yes/No)	Detailed Information (Please Mention the Activity Hour)
Face to Face Mode	PCP	Yes	Provided at LSC. For 6 Credits Theory Courses 9 counselling sessions of 2 hours each (Total 18 hrs); for 2 Credits Ability/Skill Courses 3 counselling sessions of 2 hours each (Total 6 hrs)
	Tutorials/ Special Classes/ Remedial Classes/ PCP	Yes	Provided online by NSOU faculty @ 6 hrs for each 6 Credits Course; Offline remedial classes once every semester at RC's (6 hrs for each 6 Credits Course)
	Seminar/ Research Colloquium	Yes	Learners participates in the seminar/workshops conducted by the University as per prior notice
	Laboratory based Practical	Yes	96 hour Practical session per Core Courses and Discipline Specific Courses
Self-Learning	SLMs	Yes	All Courses are designed within the range of Units specified by relevant regulations. 20 hours of self- study time is envisaged for each SLM
	Reference Books	Yes	All Units have suggested reading lists. Additionally, faculty at LSC (during PCP) & NSOU

Mode of Delivery/ Types	Delivery Mechanisms	Provided (Yes/No)	Detailed Information (Please Mention the Activity Hour)
			faculty (at online sessions) guide learners regarding Reference Books
ICT/ Digital Wellness of students	Online (Web driven/Mobile App )	Yes	Learners have access to institutional Learning Management System (LMS)
	Offline DVD/SD Card/USB Drive	Yes	
	Telecommunications	Yes	Supports are given as per need. Communication Support is provided to the learners through University technical team as per requirement
Blended	Smart Classrooms	Yes	Arrangements are available both at RC's and at LSC's
	Flipped Learning	No	Will come into effect in a phased manner from the upcoming session with the development of NSOU MOOC

#### **vi. Procedure for admissions, curriculum transaction and evaluation:**

University frames its policy related to admission entry criteria, method of admission, conduction of admission through the Admission Committee (statutory body) following the guideline of the UGC (Open and Distance Learning and Online Programmes) Regulations, 2020 and Department of Higher Education, Govt. of West Bengal. Admissions are conducted entirely through Online mode centrally by the University.

#### **Information Circulation Policy:**

All information related to the programme like admission policy, eligibility, fee structure, course curriculum, medium of instruction, method of instruction, evaluation method, SLMs etc. are transacted through prospectus, brochure, official notification etc.

#### **Learner Support Services:**

Learner support services are provided by the University at three level of functioning of the Open University architecture i.e. Learner Support Centre (LSC), Regional Centre and Head Quarter.

Following the UGC (Open and Distance Learning and Online Programmes) Regulations, 2020 LSCs are provide various learner support services in order to facilitate the acquisition of teaching-learning experience for its enrolled learners throughout at various phases of learners' study life cycle. LSC also main contact points for access by the learners, responsive and facilitating information centres, arranging contact sessions and other operations like processing of assignments etc.

University has constituted Learner's Facilitation Centre (LFC) at each Regional Centres to provide various support services. Beside that University has also provided learners support services through web based platform/ telephone/ email/ instant messaging services.

#### **Transaction of Curriculum and Academic Planner:**

The whole curriculum of the programme is well structured and well designed with the updated syllabus structure. The curriculum transaction involves the face to face PCP sessions through chalk and talk method, use of Power Point presentations, web-based lessons, animated videos, etc. The PCP sessions would be such that the learner should participate actively in the discussion. Apart from this ICT enables online supports are provided for better understanding of the subject.

For practical courses exclusive study materials containing the requirements, procedure for the experiments are issued to the learners. In the laboratory, instruction would be given for the experiments followed by demonstration and finally the learners have to do the experiments individually.

Curriculum transaction is through Online and or Offline modes as detailed above and all academic activities are conducted following the programme is following the below mentioned activity planner during the academic session:

Name of the Activity	Tentative months schedule (specify months) during Year			
	From (Month)	To (Month)	From (Month)	To (Month)
Admission	Jun	Jul	NA	NA
Distribution of SLM	Jul	Aug	NA	NA
Contact Programmes (counselling, Practical, etc.)	Aug	Oct	Jan	Mar
Assignment Submission	Oct	Nov	Mar	Apr
Evaluation of Assignment	Nov	Nov	Apr	Apr
Examination	Nov	Dec	May	Jun
Declaration of Result	Dec	Dec	Jun	Jun
Renewal/ Re-registration	NA	NA	Jun	Jul

#### **Evaluation:**

Evaluation is on a 2-tier basis, divided into Assignment submission (online mode) and Term End Examinations (Offline mode). The weightage is as follows:

Assignment – 20 marks

Term End Examination – 50 marks

Total marks for each course – 70

**Assignment / Internal Assessment/ Continuous Assessment / Formative Assessment:** Assignment submission is the first interaction between the learner and the teacher. It has a very important role to play in the teaching-learning process in distance education. So, submission of Assignment is mandatory for all learners. The assignment responses reflect what the learners have understood and learnt. The assignment answer scripts are returned to the learners so that the assignment answers serve the purpose of providing feedback to the learners and inform them their strengths and weaknesses. Learners will be required to submit assignment for each course and the marks obtained on evaluation of those assignment courses will be entered into his/her individual record of performance. This will constitute 30% (maximum) of the Full marks in the course as per University Grants Commission (Open and Distance Learning Programmes and Online Programmes) regulations, 2020. All the Marks secured by the learners will be progressively entered into the result card. Every learner is required to submit the assignment courses before each Term-End Examination. In practical course of Science stream, there is no assignment.

**Term-End Examinations:** Minimum 70% of the total credit points of the course (except practical course where it is 100%) would be reserved for Term-End Examination as per University Grants Commission (Open and Distance Learning Programmes and Online Programmes) Regulations, 2020. Minimum qualifying marks in each course is 30% (Term End Examination Marks + Assignment Marks).

**Practical Examination / Laboratory Counselling-cum-Evaluation Sessions (LCES) for Lab based subjects:** Practical Sessions or Laboratory Counselling-cum-Evaluation Session (LCES), for Core and Discipline Specific Elective courses of Science stream, are arranged by the University for the learners who have enrolled for the particular programme. Centre for practical work (LCES) will be allotted by the University. For UG, a length of 12 days' practical session is held during Puja vacation at different study centres. First 11 days during the total session, the learners gain hands on experiences with the help of counsellors. Marks have been allotted on each day's work and awarded on the basis of the

actual performance of the Learners. The sum of normalized marks awarded by Counsellors in continuous assessment contribute 70% to the final marks. On 12th day of the programme a Practical Examination which is unguided have been conducted and evaluated jointly by an external and internal examiner and 30% marks from this examination is reflected to the final marks. Examination is held in the examination centres in presence of both the internal and external examiners appointed by the Controller of Examination of the University. Attendance in the Lab Counselling Evaluation Session (LCES) is mandatory.

#### **Waive of Programme Fee:**

University waive of full course fee for transgender learners.

#### **vii. Requirement of the laboratory support and Library Resources:**

To educate the students in more scientific way, a rhythmic practical class programme has been introduced. NSOU provides the necessary laboratory facilities to the students in their respective study centres. For BDP level, a period of 12 days (eight hours per day) has been allotted for the students during the Puja vacation. The College and University teachers have been appointed to take classes which show a good sharing of resource persons among the conventional and distance institutions. The students of different study centres have been clubbed into a nearby study centres for practical classes. Due to the increased number of enrolments, the number of study centres for practical classes have been enhanced accordingly.

Library facility is one of important services in any higher educational institution. In addition to the Self Learning Materials (SLMs) and other learning resources the University provides library facility to all of its registered learners. The Library Department, Netaji Subhas Open University is located at Kalyani Campus.

Further, to cater to the needs of huge number of registered students, the University needs unlimited libraries to provide educational support to everyone. To cope with the situation, the University has initiated the process of setting up a strategic partnership with the existing network of Public Libraries that are available in the State of West Bengal to offer educational support to our learners all over the State. This initiative taken by NSOU is the first of its kind in the country.

#### **viii. Cost estimate of the programme and the provisions:**

Total course fee is Rs. 15,600/- (Excluding Examination and Studentship Renewal Fees). An approximate distribution of expenditure is given below to get prior view:

Assigned Head	Sub Head	% of Expenditure
Development	SLM Preparation and Development Cost	7
	SLM Printing	44
Maintenance & Programme Delivery	Maintenances Grant	15
	Counselling/ PCP/ Lab Counselling	15
	Delivery Charges	4
	Other Overhead Expenses	8
ICT Support	Admission Processing	1
	ICT Support Services	5
	Computer Training	1

#### **ix. Quality assurance mechanism and expected programme outcomes:**

Centre for Internal Quality Assurance (CIQA) as per UGC (Open and Distance Learning and online programme) Regulations, 2020 to ensure the delivery of high quality programmes to its learners and CIQA has the following functions:

- ✓ Facilitating the creation of a learner-centric environment conducive for quality education and faculty maturation to adopt the required knowledge and technology for participatory teaching and learning process.
- ✓ Arrangement for feedback responses from stakeholders, such as Learners, alumni, employers, and community members, is gathered through surveys, focus groups, and other methods to ensure that the program is meeting the needs of the community and to identify areas for improvement.
- ✓ Dissemination of information on the various quality parameters of the University.
- ✓ Development of quality culture in the University, and encourage creativity and innovation among the faculty and staff.
- ✓ Organization of inter and intra Schools/ Institutional workshops, seminars on quality related themes and promotion of quality circles.
- ✓ Documentation of the various programmes / activities of the School leading to quality improvement
- ✓ Acting as a nodal agency of the institution for quality-related activities, including adoption and dissemination of good practices.

Moreover, CIQA records activities undertaken on quality assurance along with the preparation of the PPRs and Annual Reports. The program aims to make learners knowledgeable, proficient and competent enough to secure good job opportunities as well as take up further research work.

**Board of Studies (BOS):** Board of Studies ensure quality of the Curriculum of Bachelor's Degree Programme in Zoology as per University norms. BOS plays a vital role as the following

- ✓ Curriculum review and development of quality Self Learning Materials (SLMs) in print under Choice Based Credit System (CBCS) system. The curriculum is reviewed regularly to ensure that it is up-to-date and relevant to the needs of learners.
- ✓ Learner's assessment and evaluation process through a variety of methods, including exams, assignments. This helps to ensure that Learners are meeting the learning outcomes of the Programme.

***Expected Programme outcomes:***

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After successful completion of this Undergraduate Degree Programme, Learners may increase their knowledge in the field of zoology as well as in the practical laboratory skills and it will help them to increase competencies to seek jobs as well as progress in their further academic career. The following are the expected programme outcomes-

- ✓ The learners will have a firm foundation in the fundamentals and application of recent trends in Zoology.
- ✓ Learners will be able to execute hand to hand dissections and/or video on dissection.
- ✓ They will be able to design and carry out scientific experiments as well as accurately record and analyse the results of such experiments.
- ✓ Achieve the skills required to succeed in graduate school, professional school, Petrochemical industries, Food processing industries, Fertilizer industries etc.
- ✓ Learners will be able to explain why zoology is an integral activity for addressing social, economic, and environmental problems.