UNIVERSITY OF CALCUTTA

NotificationNo.CSR/13/2023

It is notified for information of all concerned that in terms of the provisions of Section 54 of the Calcutta University Act, 1979, (as amended), and, in exercise of his powers under 9(6) of the said Act, the Vice-Chancellor has, by an order dated 11.07.2023 approved the Syllabi of the under mentioned subjects for semester wise Four-year (Honours & Honours with Research) / Three-year (Multidisciplinary) programme of U.G. courses of studies, as applicable under CCF,2022 . under this University, as laid down in the accompanying pamphlet.

Name of Subject:

1.Anthropology
2.BBA
3.Bengali
4.BFAD
5.Bio Chemistry
6.Botany
7.Chemistry
8.Commerce
9.Economics
10.Education
11.English
12.Geology
13.Hindi
14.History,Islamic History & Culture
15.Home Science
16.Human Rights
17.Journalism & Mass Communication
18.Mathematics
19.Microbiology (Honours)
20.Molecular Biology
21.Philosophy
22.Physiology
23.Political Science
24.Psychology
25.Social Science
26.Sociology
27.Urdu
28.Women's Studies
29.Zoology

The above shall be effective from the academic session 2023-2024.

12/7/2023

SENATE HOUSE

KOLKATA-700 073

Prof.(Dr.) Debasis Das

Registrar

Outline Structure of NEP Curriculum for Zoology, C.U.

Subject Code	Name of Paper	Theory	Practical
PART I; SEM I			
CC 1	Cell Biology	75	25
SEC-1	Applied Entomology	100	
IDC	The University will offer Zoology related IDC as the Paper of Animal Science which will be selected by Students pursuing Major and Minor Courses other than Zoology	50	25
PART I; SEM II			
CC 2	Biochemistry	75	25
SEC-2	Aquaculture	100	
IDC	Anyone to be selected from other Subjects [Except Major and Minor Subject] as provided by the College	50	25
PART II; SEM III			
CC 3	Genetics	75	25
CC 4	Cells and Tissue Structure	75	25
SEC-3	Poultry farming and Animal Husbandry	100	
IDC	Anyone to be selected from other Subjects [Except Major and Minor Subject] as provided by the College	50	25
PART II; SEM IV			
CC 5	Non-chordate structure and function	75	25
CC 6	Parasitology	75	25
CC 7	Molecular Biology	75	25
CC 8	Ecology	75	25
PART III; SEM V			
CC 9	Chordate structure and function	75	25
CC 10	Endocrinology and Reproductive biology	75	25
CC 11	Animal Physiology	75	25
CC 12	Biodiversity and Conservation Biology [Field Visit]	75	25
PART III; SEM VI			
CC 13	Developmental Biology	75	25
CC 14	Taxonomy, Evolution and Adaptation	75	25
CC 15	Animal Behaviour	75	25
Summer Internship	Lab Maintenance, Reagents preparation, instrument handlings	75 [3 credits]	
PART IV; SEM VII			
CC 16	Biotechnology and its Application	75	25
CC 17	Neurobiology	75	25
CC 18	Toxicology	75	25
CC 19	Immunology	75	25
Dissertation/ Research Work		100 [4 Credits]	
PART IV; SEM VIII			
CC 20	Scientific Communication and Research Methodology	75	25
CC 21	Animal Models in Research	75	25
CC 22	Industrial Microbiology	75	25
Dissertation/ Research Work		200 [8 credits]	

Abbreviations:

CC: Core Course; IDC: inter-Disciplinary Course; SEC: Skill Enhancement Course

NOTE:Marks = 25 marks per credit

Candidates who will not pursue Dissertation/Research have to submit 1 Review paper along with Seminar Presentation at End of Semester-7 and 2 review paper along with Seminar Presentation at end of Semester-8

PART I: SEMESTER 1
CORE COURSE-1: Cell Biology
Major/Minor/MDC: CC1-TH

Full Marks 75	3 Credits	50 Hours
Unit 1: Plasma Membrane		**7**
Structure of the Plasma Membrane: Lipid Bilayer (Phospholipids and Cholesterol), Peripheral and Integral Membrane proteins, Glycolipids and Glycoproteins (*basicconcept of Glycocalyx*), Fluid Mosaic Model with special reference to Lipid rafts, Mobility of membrane lipids (FRAP assay) and Mobility of Membrane Proteins (Frye-Edidin Experiment); Cell-cell junctions; Transport through plasma membrane.		
Unit 2: Cytoplasmic organelles I		**8**
Basic concepts on Ultrastructure of ER, Golgi and Lysosome; Overview of Protein sorting; ER Morphology, Targeting proteins to ER, The Signal hypothesis; Insertion of proteins into ER membrane, Protein folding and processing in ER, Export of proteins and lipids from ER; **Golgi Apparatus;** Morphology,Protein glycosylation within Golgi, Protein sorting and export from Golgi apparatus; **Mechanism of Vesicular Transport:** Cargo selection, coat proteins and vesicle budding, Vesicle fusion.;**Lysosome:** Polymorphism**,** Lysosomal acid hydrolases, Endocytosis and lysosome formation.		
Unit 3: Cytoplasmic organelles II		**5**
Mitochondria: Structure, Semi-autonomous nature, Mitochondrial DNA, Endosymbiotic hypothesis Mitochondrial Respiratory Chain, Chemiosmotic hypothesis and Oxidative Phosphorylation with reference to ATP Synthase and ATP synthesis **Peroxisomes:** Structure and Functions; **Centrosome and its organization**		
Unit 4: Cytoskeleton		**4**
Structure and Types: Microtubules, Actin filaments, and Intermediate filaments; Basic composition and function of ECM; Cell matrix Interactions(Integrins)		
Unit 5: Nucleus		**5**
Nuclear envelope, nuclear pore complex (transport not included), Kinetochore and centromeric DNA; Chromatin and levels of its packaging. Euchromatin & Heterochromatin, Position effect variegation. Chromatin remodeling complex.		
Unit 6: Cell Cycle		**11**
Cell Cycle: Phases of the eukaryotic cell cycle, Protein Kinases and Cell cycle regulation, MPF, Growth factors and regulation of G1-Cdks, S phase and regulation of DNA replication, DNA damage checkpoints; **Cell Death:** Caspases, Bcl-2 family, Intrinsic (Death receptors) and Extrinsic Pathway (apoptosome); **Cancer:** Basic Concept of Protooncogene [Ras] & Tumor suppressor genes [Rb and p53] Different ways of activation of a protooncogene to Oncogene.		
Unit 7: Cell Signalling		**5**
Signalling system: Modes of cell-cell signalling; Types of Signalling molecules **Signalling receptors**: Types and example with special reference to regulation of G protein, Adenyl cyclase-cAMP, Enzyme linked Receptors: RTK (ras-raf) and JAK/STAT		
Unit 8: Tools and Techniques in Cell Biology		**5**
• Animal Cell Culture: Primary cell culture and Cell line. • Subcellular fractionation and Ultracentrifugation. • Freeze fracture Replication and Freeze Etching • Principle of Light Microscope: Bright field, Phase contrast microscope, Fluorescence Microscope with reference to FRET, Principle of SEM & TEM. • Cryofixation and use of frozen specimen; Specimen Preparation for Electron Microscopy		

Cell Biology Lab; ZOOA-CC-1-P

Full Marks 25	1 Credit	20 Hours
List of Practical		
1. Cell viability study by Trypan Blue Exclusion method. 2. Standardization of Ocular and Stage Micrometer and Measurement of cell or microscopic specimen such as *Paramoecium* sp. 3. Preparation of squamous epithelial cell with staining. 4. Isolation of Bone Marrow Cells from Rat/Mouse and Giemsa Staining. 5. Note book		

PART I: SEMESTER 2
CORE COURSE-2: Biochemistry
Major/Minor/MDC; CC2-TH

Full Marks 75	**3 Credits**	**50 Hours**
Unit 1: Carbohydrates		**9**
Structure, classification and properties of Monosaccharides (aldose and ketose), Disaccharides, Polysaccharides; Isomerism of monosaccharides (D and L, optical isomers, furanose and pyranose, α and β anomers, epimers); Reducing and non – reducing sugars. Physiological importance of Monosaccharides, Disaccharides, Polysaccharides		
Unit 2: Proteins		**9**
Amino acids: Structure, Classification, General and Electro chemical properties of α-amino acids; Essential and non-essential amino acids; **Structures of Protein:** Primary, secondary, tertiary and quaternary) of protein, Classification of proteins.		
Unit 3: Lipids		**4**
Classification of lipids; Saturated and unsaturated fatty acids, essential and non – essential fatty acids. **Structure and formation of Triglyceride**.; Iodine number and saponification number of fats.		
Unit 4: Enzymes		**9**
Nomenclature, classification and properties; Cofactors and coenzymes, Effect of Temperature, pH, substrate concentration, enzyme concentration on enzyme action, Isozymes and Proenzyme, Mechanism of enzyme action (Lock and key model, Induced fit model). **Enzyme kinetics**: Derivation of Michaelis-Menten equation with its significance, Lineweaver-Burk plot and its significance. Enzyme inhibition – competitive, non- competitive, allosteric / feedback and its effect on Vmax and Km		
Unit 5: Carbohydrates Metabolism		**7**
Glycolysis, Citric acid cycle, Pentose phosphate pathway, Gluconeogenesis from lactate and glycerate, Glycogenesis and Glycogenolysis. (Pathways with name of enzymes and significance)		
Unit 6: Protein Metabolism		**4**
Transamination, Deamination and its types (Pathways with name of enzymes and significance) Fate of C-skeleton of Glucogenic and Ketogenic amino acids.		
Unit 7: Lipid Metabolism		**4**
β-oxidation of fatty acids - a. Palmitic acid {saturated (C 16:0)}, b. Linoleic acid {unsaturated (C 18:2)} Fatty acid biosynthesis		
Unit 8: Nucleic acid Metabolism		**3**
Degradation of purine; Purine Salvage pathway and significance.		
Unit 7: Free radicals and Antioxidants		**1**
Concepts of free radicals and antioxidants with examples.		

Biochemistry Lab; CC-2-P

Full Marks 25	**1 Credit**	**20 Hours**
List of Practical		
Group A **10 Hours**	**15 Marks**	
Qualitative tests for carbohydrates, proteins and lipids 1. For carbohydrate (Glucose, Fructose, Maltose, Sucrose, Starch) – Molisch test, Barfoed test, Benedict test, Fehling test, Seliwanoff test, Hydrolysis test for sucrose, Iodine test 2. For Protein (Albumin, Gelatine, Peptone) –Biuret test, Million's test, Xanthoproteic test, Ninhydrin test 3. For lipid – Grease spot test		
Group B **10 Hours**	**10 Marks**	
Colorimetric estimation of the following a) Protein by Lowry's method b) To study activity of amylase		

PART I: SEMESTER 1
SEC-1: Applied Entomology
Major; SEC-1-TH

Full Marks 75	**3 Credits**	**50 Hours**
Unit 1 Basics of Entomology		**12**
Insect diversity and adaptation: Morphological adaptation of insects: Head and antenna; Mouthparts of honey bee and cockroach; Thorax and thoracic appendages- legs and wings [General concept]. **Physiological adaptation in cockroach:** Digestive system: Alimentary canal and digestive glands, digestion; Respiratory organs and mechanism of gaseous exchange; Sense organs compound eyes, chemoreceptors. **General Characteristics of Class Insecta and living orders with examples:**Orthoptera, Dictyoptera, Hemiptera, Coleoptera, Lepidoptera, Diptera, Hymenoptera, Anoplura, Siphonaptera(Imms, A.D., 1938); **Ticks and Mites:** General features; difference between ticks and mites; Soft ticks and Hard ticks.		
Unit 2 Medical Entomology		**14**
Concept of Vectors: Mechanical and biological vectors, modes of transmission; Biological vector and disease cycle. **Biology of *Anopheles, Culex* and *Aedes:***Study of mosquito borne diseases- Malaria, Dengue, and Filariasis; control of mosquitoes. **Biology of *Musca domestica*:**Disease relationship; control of house fly. Biology and systematicsof Bed bug *Cimex lectularius*; disease relationship; Control of Bed Bug. Ticks as Causative agents and Vectors: Rickettsiosis, Tick-borne encephalitis. Forensic Entomology: General perceptions and status of Forensic entomology; Insects and other arthropods of forensic importance; Pattern of insect succession on carcass; Postmortem Interval (PMI) and its estimation process; Applications and limitations of Forensic Entomology		
Unit 3 Agricultural Entomology		**14**
Concept of insect pest; Economic Injury Level (EIL), Economic Threshold Level (ETL), Dynamics of EIL; Pests of major crops (Life cycle, Nature of damage and control measures): Pests of Paddy, *Scirpophagaincertulus*; Pests of Jute, *Anomissabulifera;* Pests of brinjal, *Leucinodesorbonalis*; Stored grain pest: *Sitophilusoryzae*; Invasive insect pests of India and their consequences. Insect Pest control: Chemical, Mechanical, Cultural and Biological control measures; Integrated Pest Management (IPM) Study of appliances used in pest control: Dusters; Sprayers- categories of sprayers, agricultural Aircrafts; Granule applicator; soil injectors.		
Unit 4 Sericulture		**5**
Types of Silk Moths with special reference to their scientific name, geographical distribution, and host plants. Life cycle of *Bombyx mori*; Structure of Silk Gland; Voltinism,Rearing of mulberry silkworm; Reeling and extraction of silk; Mulberry cocoon management; Mulberry plant types and cultivation; Common diseases and pests of mulberry silkworm and their control measures;Prospects of Sericulture in West Bengal; employment potential in sericulture.		
Unit 5 Apiculture		**5**
Various domesticated species of Honeybee; Social organization and life cycle of Honeybee; Modern method of Beekeeping: Newton Box and Langstroth Box; extraction of honey and composition of honey; Pests, Parasites and Diseases and their control measures; Bee-economy: Apiculture products and their uses.		

Applied Entomology Lab: SEC-1-P

Full Marks 25	**1 Credit**	**20 Hours**
List of Practical		

1. Dissection and temporary mounting of: - Antennae and mouth parts of Cockroach, House fly and Mosquito
2. Methods of collection, preservation, and identification of economically important insects.
3. Identification of following insect pests (Order, family and specimen characters only): *Scirpophagaincertulus; Sitophilusoryzae*; *Callosobruchuschinensis, Leucinodesorbonalis*; *Anomissabulifera; Pyrillaperpusilla.*
4. Morphological studies of various castes of *Apis* sp.
5. Identification of life stages of *Bombyx mori*; Identification of Bivoltine and multivoltine mulberry cocoon.
6. Identification and medical significance of following insects (adults) through permanent slides/photographs: *Aedes* sp., *Culex* sp., *Anopheles* sp. [for mosquito, larvae and both sexes of adults], *Musca* sp., *Phlebotomus* sp., *Cimex* sp., *Pediculushumanuscapitis*., *Xenopsylla* sp.
7. Visits to **any one place of applied entomological significance** (submission ofa field report):
    a. Agricultural field/ forest for on spot study of pests and damage caused.
    b. Any Sericulture farm for studying grainage and rearing activities
    c. Visit to an apiary to study various activities o Apiculture
    d. Any rural or urban health centre to study various aspects of vector surveillance

PART I: SEMESTER 2
SEC-2 Aquaculture
Major; SEC-2-TH

Full Marks 75	**3 Credits**	**50 Hours**
Unit 1 Basics of Idea of Fish Biology		**3**
Qualities of Cultivable fish, Indigenous and Exotic		
Unit 2Sustainable Aquaculture System		**17**
Sustainable Aquaculture Culture System: Extensive, Semi intensive, Extensive Water quality in culture ponds and factors controlling water quality. Preparation and Management of Fish Culture Ponds in Composite Fish Culture Cage Culture, Pen Culture, Raceways. Flow through system. Biofloc. Cold water fishery. Jeol Fishery. Sewage fed fishery. Mariculture with special emphasis on sea weed culture.(Basic concept) Induced Breeding of Carps. Synthetic Hormones in Hypophysation. Management of Fin Fish Hatcheries. Glass Jar Hatchery, Chinese Hatchery.		
Unit 3Recent Advancement of Aquaculture		**20**
Aquarium Fisheries. Preparation and Management of Fish Aquarium. Biology of Common Ornamental Fish: Guppy, Swordtail, Angel, Blue morph fish. Anemone fish, Butterfly fish, Molly. **Fish Nutritional Requirements:** Feed Formulations and Preparation of Compound Diets. **Capture Fishery:** Fishing Crafts and Gears, Post harvesting Technology. Fish Transport and Marketing. Fish Preservation and By-products. **Fish Biotechnology:** Transgenic Fish, Sex Reversal in Fish. Aquaponics,Application of GIS and Remote Sensing in Fisheries, Fishery Laws and Regulations.		
Unit 4 Fin Fish pathology		**5**
Name of Infective Disease. Causative Agents, Symptoms, Control.Bacteria- Dropsy, Fin and Tail rot. Protozoa- White Spot Disease; Fungal-Saprolegniasis; Ectoparasite-Gyrodactylosis, Dactylogyrosis. Virus- Rhabdovirus		
Unit 5Applied Aquaculture		**5**
Breeding Techniques in Shrimps and Prawns: Eyestalk Ablation in Shrimp and Salinity shock in Prawns.Techniques of Artificial Pearl Culture.		

Aquaculture Lab: SEC-2-P

Full Marks 25	**1 Credit**	**20 Hours**
List of Practical		

1. **Identification of different fish species using Meristic characters. (Systematic position, specimen characters)**
   Rohu, Catla, Cirhinus, Puntius, Amblyphyngodon, Channapunctatus, Lates, Mystus, Notopterus, Cyprinus, Hypopthalmichthys, Ctenopharyngodon, Oreochromisniloticus, Oreochromismossambicus
   Anabas, Clarias, Heteropneustis, Mugil, Macrobrachium, Paneus .
2. **Field visit to an Aquaculture farm/ Hatchery**

REFERENCES

CORE COURSE-1: Cell Biology

1. **The Cell (8th Edition) G. M. Cooper** and R.E. Hausman
2. **Karp's Cell and Molecular Biology:** Concepts and Experiments **8th edition**
3. **Lewin's CELLS (3rd Edition)** David Sharp, Eric Sikorski, George Plopper
4. **Molecular Biology of the Cell Bruce Alberts** 6th Edition
5. **Lehninger, Principles of Biochemistry** 4th edition
6. **The World of the Cell : Becker**, 6th edition
7. **Cell and Molecular Biology** 8th Edition **De Robertis**
8. **Thrive in Cell Biology, Oxford University Press**, 2013

CORE COURSE-2: Biochemistry

1. Cox, M.M and Nelson, D.L. (2008). **Lehninger Principles of Biochemistry**. V Edition, W.H. Freeman and Co., New York.
2. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). **Biochemistry. VI** Edition, W.H. Freeman and Co., New York.
3. **D. Das Biochemistry**
4. Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). **Harper's Illustrated Biochemistry**. XXVIII Edition, International Edition, The McGraw-Hill Companies Inc.
5. Hames, B.D. and Hooper, N.M. (2000). **Instant Notes in Biochemistry**, II Edition, BIOS Scientific Publishers Ltd., U.K.

SEC-1: Applied Entomology

1. **Chapman, R.F**. (2012). The Insects: Structure and function 5th Edition, Cambridge University Press.
2. Triplehorn, C.A. and Johnson, N.F. (2005). Borror and Delong's Introduction to the study of Insects. 7th Edition, Thompson Brooks/Cole, USA
3. **Atwal, A.S.** (1986). Agricultural Pests of India and South-East Asia. 2nd Edition, Kalyani Publishers, New Delhi.
4. **Pedigo, L.P. and Rice, M.E**. (2009). Entomology and Pest Management. 6th Edition, Pearson Prentice Hall.
5. **Hati, A.K**. (2010). **Medical Entomology**. Allied Book Agency.
6. Shukla, A. (2009) A handbook on Economic Entomology. Daya Publishing House, DelhiEntomology. 3rd Edition, Academic Press, United Kingdom
7. Imms, A.D. (1938). A General Text Book of Entomology. Chapman and Hall

SEC-2: Aquaculture

1. Chaudhuri,S.(2017) Economic Zoology, NCBS.
2. Sarkar, S.,Kundu,G. Chaki,K.C. (2017) Introduction to Economic Zoology. NCBA
3. Khanna,S.S. and Singh, H.R.(2017) A Text Book of Fish Biology and Fisheries. Narendra Publishing House.
4. Menon, A.G.K. (1999) the Freshwater Fishes of India, A Handbook. Z.S.I
5. Das, M.K. and Das, R.K. (1997) Fish and Prawn Diseases in India- Diagnosis and Control. Inland Fisheries Society in India, Barrackpore, West Bengal.

6. Jhingran, V.G. (2007) Hindustan Publishing Corporation. 3rd Edition.
7. Pillai, T.V.R. and Kutty. (2007) Fishing News Book. 2nd Edition.
8. Lutz. C.G.( ) Practical Genetics for Aquaculture. Fishing News Book. Oxford.
9. Govindan,T.K.(2008) Fish Processing Technology.Oxford and IBH Publishing Co. Pvt. Ltd. Kolkata.
10. Dunham, R.A. (1985) Aquaculture and Fisheries Biotechnology. Genetic Approaches. CABI.
11. Pierre Boundry, Andy Beaumont, Kathryn Hoare. (2010) Biotechnology and Genetics in Fisheries and Aquaculture. Wiley Blackwell.
12. Das,S. (2022) Aquarium Fishery.

The University will offer Zoology related IDC as the Paper of Animal Science which will be selected by Students pursuing Major and Minor Courses other than Zoology

PART I: SEMESTER 1
IDC-1: Animal Biology
IDC-1-TH

Full Marks 75	**3 Credits**	**50 Hours**
Unit 1: Animal Diversity		**10**
Phylum Characters and example: [Non-chordates-Porifera, Cnidaria, Ctenophora, Platyhelminthes, Nemathelminthes, Annelida, Arthropoda, Mollusca and Echinodermata]; Chordata		
Unit 2: Genetics		**12**
1. Mendelian Principles and Laws of inheritance 2. Linkage and Recombination basic Concepts 3. Sex Determination with reference to *Drosophila* [only genic balance theory] 4. Chromosomal Aberration [Structural and Numerical]		
Unit 3: Biodiversity and Wildlife		**15**
1. Biodiversity: Definition, typesand value 2. Biodiversity: Indices [Shannon & Simpson] 3. Conservation: *in situ* and *ex situ* [outline idea] 4. Conservation Priority: Hotspot, Megadiversity, Sensitive Ecosystem 5. Indigenous Knowledge and PBR: Basic Concepts		
Unit 4: Insect Vectors		**8**
1. Concept of Vector: Biological and Mechanical Vectors with examples 2. Disease cycle & Reservoir Concept 3. Major Vectors: Mosquito (*Anopheles* sp. &*Aedes* sp.) Life cycle, control, role as vector.		
Unit 5: Laboratory techniques and Instrumentation		**5**
1. Basics of Light Microscopy 2. Principles and Application of Colorimetry 3. Principles and application of Ultracentrifugation		

Animal Biology Lab: IDC-1-P

Full Marks 25	**1 Credit**	**20 Hours**

List of Practical
1. Karyotype analysis of Klinefelter, Down, Turner, Edward & Patau Syndrome 2. Identification (Phylum and specimen characters): *Amoeba, Paramoecium, Sycon, Neptune's Cup, Taenia, Ascaris, Nereis, Pheretima, Pila, Lamelledens, Penaeus, Macrobrachium, Musca, Anopheles, Culex, Asterias*. 3. One Local-Outdoor Trip for Biodiversity Studies.

SEC G For MDC
Applied Zoology-Theory

Full Marks 75	**3 Credits**	**50 Hours**
Unit I: Agricultural Entomology		**6**
Pest- definition and types (major and minor pests with example); Lifecycle, nature of damage and control of Pests: *Scirpophagaincertulus*of paddy,*Anomissabulifera*of Jute, *Bandicoota*–stored house pest; Insect Pest control: Chemical, Mechanical, Cultural and Biological control measures; Integrated Pest Management (IPM).		
Unit II: Sericulture		**8**
Types of Silkworms with special reference to their scientific name, geographical distribution and host plants; *Bombyx mori*: Silk gland, Composition of silk, Uses of silk; Lifecycle; Rearing, Extraction and Reeling of mulberry silk; Silkworm diseases, pests and their control.		
Unit III: Apiculture		**7**
Various domesticated species of Honeybee; Social organization of Honeybee; Bee keeping: Langstroth Box for rearing of honey bee, Extraction and processing of honey; Composition of honey, apiculture by products and their uses; Pests and Diseases of bees and their control measures		
Unit IV: Vermiculture		**7**
Scope of Vermiculture; Habit categories of earthworms; methodology of vermicomposting: containers for culturing, raw materials required, preparation of bed, environmental pre-requisites, feeding, harvesting and storage of vermicompost; Advantages of vermicomposting; Diseases and pests of earthworms.		
Unit V: Aquaculture		**8**
Principles, definition and scope; Prawn culture: Penaeid and Palaemonid features with examples; Semi-intensive method of prawn culture; Application of prawn culture; Difference between major and minor carps with examples; Composite fish farming: General concepts, advantages and disadvantages; Induced breeding: method and advantages; Integrated fish farming.		
Unit VI: Live Stock Management		**8**
Dairy: Introduction to common dairy animals: Types of Cattle breeds and their distribution in India; Exotic cattle breeds; Artificial insemination and MOET in breeding; Cattle feed: Roughage and Concentrate; dairy by products, preservation and uses. Dairy pathology and vaccination programme. Poultry: Types of breeds (fowl) with features and examples; Rearing method: Deep litter system; feed formulation for chicks; poultry by products with economic importance; Diseases		

of poultry and their control measures.	
Unit VII: Lac Culture	**6**
Life cycle, host plants and strains of Lac insect; Lac cultivation: Local practice, improved practice, propagation of Lac insect, inoculation period, harvesting of Lac; Lac composition, processing, products and uses; Natural enemies of lac insect and their management	

SEC G For MDC
Applied Zoology-Practical

Full Marks 25	**1 Credit**	**20 Hours**
List of Practical		

1. Identification of various castes of Honey bee, life stages of *Bombyx mori*, various life stages of *Kerrialacca,* various earthworm species used in vermiculture and ectoparasites of Poultry birds
2. Identification of the following fish and prawn specimens (Specimen characters only): *Labeorohita, Catlacatla, Cirrhinusmrigela, Cyprinuscarpio, L. bata, Penaeusmonodon, Macrobrachiumrosenbergi*
3. Collection of any two pests and submission of specimen it along with a small report on its identifying features, life cycle, nature of damage and control: *Sitophilusoryzae, Triboliumcastaneum, Nilaparvatalugens, Anomissabulifera*and*Leucinodesorbonalis*
4. Visit to any one of the following and submission of report on the visit
   a) Apiary
   b) Freshwater fish farm
   c) Any agricultural field
   d) Poultry farm
   e) Sericulture farm
   f) Lac culture farm