

SCHEME AND SYLLABUS FOR CHOICE BASED CREDIT SYSTEM

FOR B.Sc. HONOURS ZOOLOGY

Semester	Core Course(14)	Ability Enhancement Compulsory Course AECC(2)	Skill Enhancement Course SEC(2)	Discipline Specific Elective DSE(4)	Generic Elective GE(4)
I	Non-chordates I: Protista to Pseudocoelomate	English/MIL			Chem/Bot
	Principles of Ecology				
II	Non-chordates II: Coelomates	Environmental Science			Chem/Bot
	Cell Biology				
III	Diversity of Chordates		SEC-1		Chem/Bot
	Physiology: Controlling and Coordinating Systems				
	Fundamentals of Biochemistry				
IV	Comparative Anatomy of Vertebrates		SEC-2		Chem/Bot
	Physiology: Life Sustaining Systems				
	Biochemistry of Metabolic Process				
V	Molecular Biology			DSE-1	
	Principles of Genetics			DSE-2	
VI	Developmental Biology			DSE-3	
	Evolutionary Biology			DSE-4	

Semester	Course Opted	Course Name	Credits
I	Ability Enhancement Compulsory Course-I	English Communications	2
	Core course-I	Non-chordates I:Protista to Pseudocoelomate	4
	Core course-I Practical		2
	Core course-II	Principles of Ecology	4
	Core course-II Practical		2
	Generic Elective-I	Botany or Chemistry	4
	Generic Elective-I Practical/Tutorial		2
II	Ability Enhancement Compulsory Course-II	Environmental Science	2
	Core course-III	Non-chordates II:Coelomates	4
	Core course-III Practical		2
	Core course-IV	Cell Biology	4
	Core course-IV Practical		2
	Generic Elective-2	Botany or Chemistry	4
	Generic Elective-2 Practical		2
III	Core course-V	Diversity of Chordates	4
	Core course- V Practical		2
	Core course-VI	Physiology: Controlling and Coordinating Systems	4
	Core course-VI Practical		2
	Core course-VII	Fundamentals of Biochemistry	4
	Core course-VII Practical		2
	Skill Enhancement Course-I	SEC-I	4
	Generic Elective-3	Botany or Chemistry	4
	Generic Elective-3 Practical		2
IV	Core course-VIII	Comparative Anatomy of vertebrates	4
	Core course-VIII Practical		2
	Core course-IX	Physiology: Life Sustaining Systems	4
	Core course-IX Practical		2
	Core course-X	Biochemistry of Metabolic Process	4
	Core course-X Practical		2
	Skill Enhancement Course-2	SEC-2	4
	Generic Elective-4	Botany or Chemistry	4
	Generic Elective-4 Practical		2
V	Core course-XI	Molecular Biology	4
	Core course-XI Practical		2
	Core course-XII	Principles of Genetics	4
	Core course-XII Practical		2
	Discipline Specific Elective-I	DSE-1	4
	Discipline Specific Elective-I Practical		2
	Discipline Specific Elective-2		4
	Discipline Specific Elective-2 Practical/Tutorial		2
VI	Core Course-XIII	Developmental Biology	4
	Core Course-XIII Practical/Tutorial		2

Semester	Course Opted	Course Name	Credits
	Core Course-XIV	Evolutionary Biology	4
	Core Course-XIV Practical/Tutorial		2
	Discipline Centric Elective-3	DCE-3	4
	Discipline Centric Elective-3 Practical/Tutorial		2
	Discipline Centric Elective-4	D CE-4	4
	Discipline Centric Elective-4 Practical/Tutorial		2
Total : 140			

CORE COURSES	
I	Non-chordates I:Protista to Pseudocoelomate
II	Perspectives in Ecology
III	Non-chordates II:Coelomates
IV	Cell Biology
V	Diversity of Chordates
VI	Physiology: Controlling and Coordinating Systems
VII	Fundamentals of Biochemistry
VIII	Comparative Anatomy of Vertebrates
IX	Physiology : Life Sustaining Systems
X	Biochemistry of Metabolic Processes
XI	Molecular Biology
XII	Principles of Genetics
XIII	Developmental Biology
XIV	Evolutionary Biology

CORE COURSE I

NON-CHORDATES 1: PROTISTS TO PSEUDOCOELOMATES

THEORY

Unit 1: Protista, Parazoa and Metazoa	19
General characteristics and Classification up to classes Study of <i>Paramecium</i> Life cycle and pathogenicity of <i>Plasmodium vivax</i> Locomotion, Osmoregulation, Nutrition and Reproduction in Protista	
Unit 2: Porifera	7
General characteristics and Classification up to classes Canal system and spicules in sponges	
Unit 3 : Cnidaria	12
General characteristics and Classification up to classes Metagenesis in Obelia Polymorphism in Cnidaria Corals and coral reefs	
Unit 4 : Ctenophora	4
General characteristics and Evolutionary significance	
Unit 5 : Platyhelminthes	10
General characteristics and Classification up to classes Life cycle and pathogenicity of <i>Fasciola hepatica</i>	
Unit 6 : Nematelminthes	8
General characteristics and Classification up to classes Life cycle and pathogenicity of <i>Ascaris lumbricoides</i> Parasitic adaptations in helminthes	

NON-CHORDATES 1: PROTISTS TO PSEUDOCOELOMATES

PRACTICALS

(Credits 2)

1. Study of whole mount of *Euglena*, *Amoeba* and *Paramecium*, Binary fission and Conjugation in *Paramecium*.
2. Examination of pond water collected from different places for diversity in protista.
3. Study of *Sycon* (T.S. and L.S), *Hyalonema*, *Euplectella*, *Spongilla*.
4. Study of *Obelia*, *Physalia*, *Millepora*, *Aurelia*, *Tubipora*, *Corallium*, *Alcyonium*, *Gorgonia*, *Meridium*, *Pennatula*, *Fungia*, *Meandrina*, *Madrepora*.
5. One specimen/slide of any Ctenophore.
6. Study of adult *Fasciola hepatica*, *Taenia solium* and their life cycles (Slides/micro-photographs).
7. Study of adult *Ascaris lumbricoides* and its life stages (Slides/micro-photographs).

PRINCIPLES OF ECOLOGY

PRACTICALS

(Credits 2)

1. Determination of population density in a natural/hypothetical community by quadrat method and calculation of Shannon-Weiner diversity index for the same community.
2. Study of an aquatic ecosystem : Phytoplankton and zooplankton, Measurement of area, temperature, turbidity/penetration of light, determination of pH, and Dissolved oxygen content (Winkler's method).
3. Report on a visit to National Park/Biodiversity Park/Wild life sanctuary.

**CORE COURSE II
PRINCIPLES OF ECOLOGY**

THEORY **(Credits 4)**

Unit 1 : Introduction to Ecology **6**

History of ecology, Autoecology and synecology, Levels of organization, Laws of limiting factors, Study of physical factors

Unit 2 : Population **24**

Unitary and Modular populations

Unique and group attributes of population : 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 and Pradation, functional and numerical responses

Unit 3 : Community **12**

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

Theories pertaining to climax community

Unit 4 : Ecosystem **14**

Types of ecosystem 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

Human modified ecosystem

Unit 5 : Applied Ecology **4**

Ecology in Wildlife Conservation and Management

CORE COURSE III

NON-CHORDATES II : COELOMATES

THEORY	(Credits 4)
Unit 1 : Annelida	10
General characteristics and Classification up to classes Excretion in Annelida	
Unit 2 : Arthropoda	17
General characteristics and Classification up to classes Vision and respiration in Arthropoda Metamorphosis in Insects Social life in bees and termites	
Unit 3 : Onychophora	4
General characteristics and Evolutionary significance	
Unit 4 : Mollusca	12
General characteristics and Classification up to classes Respiration in Mollusca Torsion and detorsion in Gastropoda Pearl formation in bivalves	
Unit 5 : Echinodermata	12
General characteristics and Classification up to classes Water-vascular system in Asteroidea Larval forms in Echinodermata Affinities with Chordates	

CORE COURSE IV

CELL BIOLOGY

THEOR	(Credits 4)
Unit 1 : Overview of Cells	3
Prokaryotic and Eukaryotic cells, Virus, Viroids, Mycoplasma, Prions	
Unit 2 : Plasma Membrane	7
Various models of plasma membrane structure Transport across membrane : Active and Passive transport, Facilitated transport Cell junction : Tight junctions, Desmosomes, Gap junctions	
Unit 3 : Endomembrane System	10
Structure and Function : Endoplasmic Reticulum, Golgi Apparatus, Lysosomes	
Unit 4 : Mitochondria and Peroxisomes	8
Mitochondria : Structure, Semi-autonomous nature, End symbiotic hypothesis, Mitochondrial Respiratory Chain, Chemi-osmotic hypothesis Peroxisomes	
Unit 5 : Cytoskeleton	8
Structure and Function : Microtubules, Microfilaments and Intermediate filaments	
Unit 6 : Nucleus	12
Structure of Nucleus : Nuclear envelope, Nuclear pore complex, Nucleolus Chromatin : Euchromatin and Heterochromatin and packaging (nucleosome)	
Unit 7 : Cell Division	8
Mitosis, Meiosis, Cell cycle and its regulation	
Unit 8 : Cell Signaling	4
GPCR and Role of second messenger (cAMP)	

NON-CHORDATES II : COELOMATES & CELL BIOLOGY

PRACTICAL

(Credits 2)

1. Study of following specimen :

Annelids – *Aphrodites, Nereis, Heteronereis, Sabella, Serpula, Chaetopterus, Pheritima, Hirudinaria*

Arthropods – *Limulus, Palamnaeus, Palaemon, Daphnia, Balanus, Sacculina, Cancer, Eupagurus, Scolopendra, Julus, Bombyx, Periplaneta*, termites and honey bees

Onychophora – *Peripatus*

Molluscs – *Chiton, Dentalium, Pila, Doris, Helix, Unio, Ostrea, Pinctada, Sepia, Octopus, Nautilus*

Echinodermates – *Pantaceros/Asterias, Ophiura, Clypeaster, Echinus, Cucummaria and Antedon*

2. Study of digestive system, septal nephridia and pharyngeal nephridia of earthworm

3. T.S through pharynx, gizzard and typhlosolar intestine of earthworm

4. To submit a Project Report on any related topic to larval forms (crustacean, mollusc and echinoderm)

5. Preparation of temporary stained squash of onion root tip to study various stages of mitosis

6. Study of various stages of meiosis/mitosis.

CORE COURSE V
DIVERSITY OF CHORDATA

THEORY	(Credits 4)
Unit 1 : Introduction to chordates	2
General characteristics and outline classification	
Unit 2 : Protochordata	8
General characteristics of Hemichordata, Urochordata and Cephalochordata : Study of larval forms in Protochordates; Retrogressive metamorphosis in Urochordata	
Unit 3 : Origin of Chordata	3
Dipleurula concept and the Echinoderm theory of origin of chordates Advanced features of vertebrates over Protochordata	
Unit 4 : Agnatha	2
General characteristics and classification of cyclostomes up to class	
Unit 5 : Pisces	8
General characteristics of Chondrichthyes and Osteichthyes, classification up to order Migration, Osmoregulation and Parental care in fishes	
Unit 6 : Amphibia	6
Origin of Tetrapoda (Evolution of terrestrial ectotherms); General characteristics and classification up to order; Parental care in Amphibians	
Unit 7 : Reptilia	7
General characteristics and classification up to order; Affinities of Sphenodon; Poison apparatus and Biting mechanism in snakes	
Unit 8 : Aves	8
General characteristics and classification up to order Archaeopteryx—a connecting link Principles and aerodynamics of flight Flight adaptations and Migration in birds	

Unit 9 : Mammals

8

General characters and classification up to order

Affinities of Prototheria, Adaptive radiation with reference to locomotary appendages

Unit 10 : Zoogeography

8

Zoogeographical realms, Theories pertaining to distribution of animals, Plate tectonic and

Continental drift theory, distribution of vertebrates in different realms

CORE COURSE VI
ANIMAL PHYSIOLOGY : CONTROLLING AND COORDINATING SYSTEMS

THEORY **(Credits 4)**

Unit 1 : Tissues **6**

Structure, location, classification and functions of epithelial tissue, connective tissue, muscular tissue and nervous tissue

Unit 2 : Bone and Cartilage **4**

Structure and types of bones and cartilages, Ossification, bone growth and resorption

Unit 3 : Nervous system **10**

Structure of neuron, resting membrane potential, Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibres; Types of synapse, Synaptic transmission and Neuromuscular junction; Reflex action and its types – reflex arc; Physiology of hearing and vision

Unit 4 : Muscle **12**

Histology of different types of muscle; Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle twitch; Motor unit, summation and tetanus

Unit 5 : Reproductive System **10**

Histology of testis and ovary; Physiology of male and female reproduction; Puberty, Methodology of contraception in male and female

Unit 6 : Endocrine system **18**

Histology of endocrine glands – pineal, 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, Signal transduction pathways for steroidal and non-steroidal hormones; Hypothalamus (neuroendocrine gland)-principal nuclei involved in neuroendocrine control of anterior pituitary and endocrine system; Placental hormones

DIVERSITY OF CHORDATA

PRACTICAL

(Credits 2)

1. Protochordata

Balanoglossus, *Herdmania*, *Branchiostomata*, Colonial Urochordata sections of *Balanoglossus* through proboscis and branchiogenital regions, Sections of *Amphioxus* through pharyngeal regions, Sections of *Amphioxus* through pharyngeal, intestinal and caudal regions, Permanent slide of *Herdmania* spicules.

2. Agnatha

Petromyzon, *Myxine*

3. Fishes

Scoliodon, *Sphyrna*, *Pristis*, *Torpedo*, *Chimaera*, *Mystus*, *Heteropneustes*, *Labeo*, *Exocoetus*, *Echeneis*, *Anguilla*, *Hippocampus*, *Tetrodon/Diodon*, *Anabas*, Flat fish

4. Amphibia

Ichthyophis/Ureotyphlus, *Necturus*, *Bufo*, *Hyla*, *Alytes*, *Salamandra*

5. Reptilia

Chelone, *Trionyx*, *Hemidactylus*, *Varanus*, *Uromastrix*, *Chamaelon*, *Ophiosaurus*, *Draco*, *Bungarus*, *Vipera*, *Naja*, *Hydrophis*, *Zamenis*, *Crocodylus*, Key for identification of poisonous and non-poisonous snakes.

6. Aves

Study of six common birds from different orders.

Types of beaks and claws

7. Mammalia

Sorex, Bat (Insectivorous and Frugivorous), *Funambulus*, *Loris*, *Herpestes*, *Erinaceous*

Mount of weberian ossicles of *Mystus*, pecten from Fowl head

Power point presentation on study of any two animals from two different classes by students

ANIMAL PHYSIOLOGY : CONTROLLING AND COORDINATING SYSTEMS

PRACTICALS

(Credits 2)

1. Demonstration of the unconditioned reflex action (Deep tendon reflex such as knee jerk reflex).
2. Study of permanent slides of Mammalian skin, Cartilage, Bone, Spinal cord, Nerve cell, Pituitary, Pancreas, Testis, Ovary, Adrenal, Thyroid and Parathyroid .

FUNDAMENTALS OF BIOCHEMISTRY

PRACTICAL

(Credits 2)

1. Qualitative test of functional groups in carbohydrates, proteins and lipids.
2. Paper chromatography of amino acids.
3. Action of salivary amylase under optimum conditions.
4. Effect of pH, temperature and inhibitors on the action of salivary amylase.

SUGGESTED READINGS

- Young, J.Z.(2004). The Life of Vertebrates. III Edition. Oxford university press.
- Pough H. Vertebrate life, VIII Edition, Pearson International .
- Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub Co.
- Hall B.K. and Hallgrímsson B.(2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.
- Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hecourt Asia PTE Ltd./W.B. Saunders Company
- Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons
- Victor P.Eroschenko. (2008).diFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. & Wilkins.

**CORE COURSE VII
FUNDAMENTALS OF BIOCHEMISTRY**

THEORY	(Credits 4)
Unit 1 : Carbohydrates	8
Structure and Biological importance : Monosaccharides, Disaccharides, Polysaccharides and Glycoconjugates	
Unit 2 : Lipids	8
Structure and significance : Physiologically important saturated and unsaturated fatty acids, Tri-acylglycerols, Phospholipids, Glycolipids, Steroids	
Unit 3 : Proteins	14
Amino Acids : Structure, Classification and General properties of alpha amino acids	
Proteins : Bonds stabilizing protein structure; Levels of organization in proteins; Denaturation; Introduction to simple and conjugate proteins	
Immunoglobulins : Basic structure, Classes and Function, Antigenic Determinants	
Unit 4 : Nucleic Acids	12
Structure : Purines and pyrimidines, Nucleosides, Nucleotides, Nucleic acids Cot Curves : Base pairing, Denaturation and Renaturation of DNA Types of DNA and RNA, Complementarity of DNA, Hypo-Hyperchromaticity of DNA	
Unit 5 : Enzymes	18
Nomenclature and classification; Cofactors; Specificity of enzyme action; Isozymes; Mechanism of enzyme action; Enzyme kinetics; Factors affecting rate of enzyme-catalyzed reactions; Derivation of Michaelis-Menten equation, Concept of K_m and V_{max} , Lineweaver-Burk plot; Multi-substrate reaction; Enzyme inhibition; Allosteric enzymes and their kinetics; Regulation of enzyme action	

CORE COURSE VIII
COMPARATIVE ANATOMY OF VERTEBRATES

THEORY

(Credits 4)

Unit 1 : Digestive System

Alimentary canal and associated glands, dentition

Unit 2 : Respiratory system

Skin, gills, lungs and air sacs; Accessory respiratory organs

Unit 3 : Circulatory Systems

General plan of circulation, evolution of heart and aortic arches

Unit 4: Urinogenital System

Succession of kidney, Evolution of urinogenital ducts, Types of mammalian uteri

COMPARATIVE ANATOMY OF VERTEBRATES
PRACTICAL

1. Study of placoid, cycloid and ctenoid scales through permanent slides/photographs.
2. Disarticulated skeleton of Frog, Varanus, Fowl, Rabbit.
3. Carapace and plastron of turtle/tortoise.
4. Mammalian skulls : One herbivorous and one carnivorous animal.

SUGGESTED READING

- Cox, M.M and Nelson, D.L.(2008). Lehninger's Principles of Biochemistry, V Edition, W.H. Freeman and Co., New York.
- Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). Biochemistry, VI Edition, W.H. Freeman and Co., New York.
- 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 .
- Hames, B.D. and Hooper, N.M. (2000). Instant Notes in Biochemistry, II Edition, BIOS Scientific Publishers Ltd., U.K.
- Watson, J.D., Barker, T.A., Bell, S.P., Gann, A., Levine, M. And Losick, R.(2008). Molecular Biology of the Gene, VI Edition, Cold Spring Harbor Lab.Press, Pearson Pub.
- Kardong, K.V. (2005) Vertebrate's Comparative Anatomy . Function and Evolution. IV Edition. McGraw-Hill Higher Education
- Kent,G.C. and Carr R.K (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies
- Hilderbrand, M and Gaslow G.E. Analysis of Vertebrate Structure, John Wiley and Sons

- Walter, H.E. and sayles, L.P; Biology of Vertebrates, Khosla Publishing House
- Guyton, A.C. & Hall, J.E.(2006). Textbook of Medical Physiology.XI Edition. Hercourt Asia PTE Ltd. W.B. Saunders Company.
- Tortora, G.J. & Grabowski, S.(2006). Principles of anatomy & Physiology.XI EditionJohn Wiley & sons.
- Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. & Wilkins.
- Vander A, Sherma J. And Luciano D. (2014). Vander's Human Physiology : The Mechanism of Body Function. XIII Edition, McGraw Hills

CORE COURSE IX
ANIMAL PHYSIOLOGY : LIFE SUSTAINING SYSTEMS

THEORY **(Credits 4)**

Unit 1 : Physiology of Digestion **14**

Structural organization and functions of gastrointestinal tract and associated glands; Mechanical and chemical digestion of food; Absorption of carbohydrates, lipids, proteins, water, minerals and vitamins; Hormonal control of secretion of enzymes in Gastrointestinal tract.

Unit 2 : Physiology of Respiration **12**

Histology of trachea and lung; Mechanism of respiration, Pulmonary ventilation; Respiration volumes and capacities; Transport of oxygen and carbon dioxide in blood; Respiratory pigments, Dissociation curves and the factors influencing it; Carbon monoxide poisoning; Control of respiration

Unit 3: Renal Physiology **8**

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

Unit 4 : Blood

12

Components of blood and their functions; Structure and functions of haemoglobin
Haemostasis : Blood clotting system, Kallikrein-Kininogen system, Complement system & Fibrinolytic system, Haemopoiesis
Blood groups; Rh factor, ABO and MN

**CORE COURSE X
BIOCHEMISTRY OF METABOLIC PROCESSES**

THEORY

(Credits 4)

Unit 1 :Overview of Metabolism

10

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

Unit 2 : Carbohydrate Metabolism

16

Sequence of reaction and regulation of glycolysis, Citric acid cycle, Phosphate pentose pathway, Gluconeogenesis, Glycogenolysis and Glycogenesis

Unit 3 : 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 4 : Protein Metabolism

10

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

COMPARATIVE ANATOMY OF VERTEBRATES

PRACTICAL

1. Study of placoid, cycloid and ctenoid scales through permanent slides/photographs
2. Disarticulated skeleton of Frog, *Varanus*, fowl, rabbit
3. Carapace and plastron of turtle/tortoise
4. Mammalian skulls : One herbivorous and carnivorous animal

ANIMAL PHYSIOLOGY : LIFE SUSTAINING SYSTEMS

PRACTICALS

1. Determinations of ABO Blood group.
2. Enumeration of red blood cells and white blood cells using haemocytometer.
3. Recording of blood pressure using a sphygmomanometer.
4. Examination of sections of mammalian oesophagus, stomach, duodenum, ileum, rectum, liver, Trachea, lung, kidney

BIOCHEMISTRY OF METABOLIC PROCESS

PRACTICALS

1. Estimation of total protein in given solution by Lowry's method.

SUGGESTED READING

- Kardong, K.V. (2005) *Vertebrate's Comparative Anatomy, Function and Evolution*. IV Edition. McGraw Hill Higher Education

- Kent, G.C. and Carr R.K. (2000). *Comparative Anatomy of the Vertebrates*. IX Edition. The McGraw-Hill Companies
- Hilderbrand, M and Gaslow G.E. *Analysis of Vertebrate Structure*, John Wiley and Sons
- Walter, H.E. and Sayles, L.P; *Biology of Vertebrates*, Khosla Publishing House.
- Guyton, A.C. & Hall, J.E.(2006). *Textbook of Medical Physiology*. XI Edition. Hecourt Asia PTE Ltd. W.B. Saunders Company.
- Tortora, G.J. & Grabowski, S. (2006). *Principles of Anatomy & Physiology*. XI Edition John Wiley & sons.
- Victor P. Eroschenko. (2008). *diFiore's Atlas of Histology with Functional correlations*. XII Edition. Lippincott W. & Wilkins.
- Vander A, Sherman J. And Luciano D. (2014). *Vander's Human Physiology : The Mechanism of Body Function*. XIII Edition, McGraw hills.
- Cox, M.M and Nelson, D.L. (2008). *Lehninger Principles of Biochemistry*, V Edition, W.H. Freeman and Co., New York.
- Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). *Biochemistry*, VI Edition, W.H. Freeman and Co., New York.
- 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.
- Hames, B.D. and Hooper, N.M.(2000). *Instant Notes in Biochemistry*, II Edition, BIOS Scientific Publishers Ltd., U.K.

**CORE COURSE XI
MOLECULAR BIOLOGY**

THEORY

Unit 1 : Nucleic acids

Salient features of DNA
Watson and Crick model of DNA

Unit 2 : DNA Replication

DNA Replication in prokaryotes and eukaryotes, mechanism of DNA replication, Semi-conservative, bidirectional and semi-discontinuous replication, RNA priming, Replication of circular and linear *ds*-DNA, replication of telomeres

Unit 3 : Transcription

RNA polymerase and transcription Unit, mechanism of transcription in prokaryotes and eukaryotes, synthesis of rRNA and mRNA, transcription factors

Unit 4 : Translation

Genetic code, Degeneracy of the genetic code and Wobble Hypothesis; Process of protein synthesis in prokaryotes : Ribosome structure and assembly in prokaryotes, fidelity of protein synthesis, aminoacyl tRNA synthetase and charging of tRNA; Protein involved in initiation, elongation and termination of polypeptide chain; Inhibitors of protein synthesis; Difference between prokaryotic and eukaryotic translation

Unit 5 : Post Transcriptional Modifications and Processing of Eukaryotic RNA

Structure of globin mRNA; Split genes : concept of introns and exons, splicing mechanism, alternative splicing, exon shuffling, and RNA editing, Processing of tRNA

Unit 6 : Gene Regulation

Transcription regulation in prokaryotes : Principles of transcriptional regulation with examples from lac operon and trp operon ; Transcription regulation in eukaryotes : Activators, repressors, enhancers, silencer elements; Gene silencing, Genetic imprinting

Unit 7 : DNA Repair Mechanisms

Pyrimidine dimerization and mismatch repair

Unit 8 : Regulatory RNAs

Ribo-switches, RNA interference, miRNA, siRNA

THEORY **(Credits 4)**

Unit 1 : Mendelian Genetics and its Extension **8**

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 **12**

Linkage and crossing over, Cytological basis of crossing over, Molecular mechanism 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 **10**

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 **4**

Chromosomal mechanism of sex determination in Drosophila and man.

Unit 5 : Extra-chromosomal Inheritance **6**

Criteria for extra-chromosomal inheritance, Antibiotic resistance in Chlamydomonas, Mitochondrial mutations in Saccharomyces, Infective heredity in Paramecium and Maternal effect.

Unit 6 : Polygenic Inheritance **3**

Polygenic inheritance with suitable examples; simple numerical based on it.

Unit 7 : Recombination in Bacteria and Viruses **9**

Conjugation, Transformation, Transduction, Complementation test in Bacteriophage.

Unit 8 : Transposable Genetic Elements **8**

Transposable in Bacteria, Ac-Ds elements in maize and P elements in Drosophila, Transposons in humans.

MOLECULAR BIOLOGY

PRACTICALS **(Credits 2)**

1. Study of Polytene chromosome from Chironomous / Drosophila larvae.
2. Preparation of liquid culture medium (LB) and raise culture of E.coli
3. Preparation of solid culture medium (LB) and growth of E.coli by spreading and streaking.

THEORY**(Credits 2)****Unit 1 : Introduction****4**

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

Unit 2 : Early Embryonic Development**28**

Gametogenesis, Spermatogenesis, Oogenesis; Types of eggs, Egg membranes; Fertilization (External and Internal) : Changes in gametes, Blocks to polyspermy; Planes and patterns of cleavage : Types of Blastula; Fate maps (including techniques); Early development of frog and chick up to gastrulation; Embryonic induction and organizers.

Unit 3 : Late Embryonic Development**8**

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**12**

Metamorphosis : Changes, hormonal regulations in amphibians and insects; Regeneration : Modes of regeneration, epimorphosis, morphallaxis and compensatory regeneration (with one example each); Ageing : Concepts and Theories.

Unit 5 : Implications of Developmental Biology**8**

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

THEORY

(Credits 4)

Unit 1:

7

Life's Beginning : Chemogeny, RNA world, Biogeny, Origin of photosynthesis, Evolution of eukaryotes

Unit 2 :

4

Historical review of evolutionary concept : Lamarckism, Darwinism, Neo-Darwinism

Unit 3:

10

Evidences of Evolution : Fossil record (types of fossils, transitional forms, geological time scale, evolution of horse, Molecular (universality of genetic code and protein synthesis machinery, three domains of life, neutral theory of molecular evolution, molecular clock, example of globin gene family, rRNA/cyt c.

Unit 4:

8

Sources of variations : Heritable variations and their role in evolution

Unit 5:

13

Population genetics : Hardy-Weinberg Law (statement and derivation of equation, application of law to human population); Evolutionary forces upsetting H-W equilibrium; Natural selection (concepts of fitness, selection coefficient, derivation of one unit of selection for a dominant allele, genetic load, mechanism of working, types of selection, density-dependent selection, heterozygous superiority, kin selection, adaptive resemblances, sexual selection, Genetic Drift (mechanism, founder's effect, bottleneck phenomenon); Role of Migration and Mutation in changing allele frequencies.

Unit 6 :

7

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

Unit 7:

2

Extinctions, Back ground and mass extinctions (causes and effects); detailed example of K-T extinction.

Unit 8:

6

Origin and evolution of man, Unique hominin characteristics contrasted with primate characteristics, primate phylogeny from Dryopithecus leading to Homo sapiens, Molecular analysis of human origin.

Unit 9 :

2

Phylogenetic trees, Multiple sequence alignment, construction of phylogenetic trees, interpretation of trees.

DEVELOPMENTAL BIOLOGY

PRACTICALS

1. Study of whole mounts and sections of developmental stages of frog through permanent slides :
Cleavage stages, blastula, gastrula, neurula, tail-bud stage, tadpole (external and internal gill stages).
2. Study of whole mounts of developmental stages of chick through permanent slides : Primitive streak (13 and 18 hours), 21, 24, 28, 33, 36, 48, 72 and 96 hours of incubation (Hamilton and Hamburger stages).
3. Study of the developmental stages and life cycle of *Drosophila* from stock culture.
4. Project report on *Drosophila* culture/chick embryo development.
5. Study of fossil from models/pictures.
6. Study of homology and analogy from suitable specimens.

SUGGESTED READINGS

- Gilbert, S.F. (2010). Developmental Biology, IX Edition, Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts, USA.
- Balinsky B.I. and Fabian B.C. (1981). An Introduction to Embryology, V Edition, International Thompson Computer Press
- Carlson, R.F. Patten's Foundations of Embryology.
- Kalthoff (2008). Analysis of Biological Developmental, II Edition, McGraw-Hill Publishers
- Lewis Wolpert (2002). Principles of Development. II Edition, Oxford University Press
- Ridley, M(2004) Evolution III Edition Blackwell publishing
- Hall, B.K. and Hallgrimson, B (2008). Evolution IV Edition. Jones and Barlett Publishers
- Campbell, N.A. and Reece J.B(2011). Biology IX Edition, Pearson, Benjamin, Cummings
- Douglas, J. Futuyma (1977). Evolutionary Biology. Sinauer Associates.
- Snustad. S Principles of Genetics.
- Pevsner, J (2009). Bioinformatics and Functional Genomics. II Edition Wiley-Blackwell

DISCIPLINE CENTRIC ELECTIVE COURSES

DSE 1
ENDOCRINOLOGY

THEORY

(Credits 4)

Unit 1 : Introduction to Endocrinology

History of Endocrinology, Classification, Characteristics and Transport of Hormones, Neurosecretions and Neurohormones.

Unit 2 : Epiphysis, Hypothalamo-hypophysial Axis

Structure of Pineal gland, Secretions and their functions in biological rhythms and reproductions.
Structure of hypothalamus, Hypothalamic nuclei and their functions, Regulation of neuroendocrine glands, Feedback mechanisms.
Structure of Pituitary gland, Hormones and their functions, Hypothalamo-hypophysial portal system, Disorders of Pituitary gland.

Unit 3 : Peripheral Endocrine Glands

Structure, Hormones, Functions and Regulation of Thyroid gland, Parathyroid, Adrenal, Pancreas, Ovary and Testis
Hormones in homeostasis, Disorders of endocrine glands.

Unit 4 : Regulation of Hormone Action

Hormone action at Cellular level : Hormone receptors, transduction and regulation.
Hormone action at Molecular level : Molecular mediators, Genetic control of hormone action.

ENDOCRINOLOGY

PRACTICALS

(Credits 2)

1. Dissect and display of Endocrine glands in laboratory bred rat*.
2. Study of the permanent slides of all the endocrine glands.
3. Compensatory ovarian/adrenal hypertrophy in vivo bioassay in laboratory bred rat*.
4. Demonstration of Castration/ovariectomy in laboratory bred rat*.
5. Estimation of plasma level of any hormone using ELISA.
6. Designing of primers of any hormone.

SUGGESTED READINGS

- General Endocrinology C. Donnell Turner Pub-Saunders Toppan
- Endocrinology : An integrated Approach; Stephen Nussey and Saffron Whithead
- Oxford : BIOS Scientific Publishers; 2001.
- Hadley, M.E. and Levine J.E. 2007. Endocrinology, 6th Edition. Pearson Prentice-Hall, Pearson Education Inc., New Jersey.
- Vertebrate Endocrinology by David O. Norris

FISH AND FISHERIES

THEORY

(Credits 4)

Unit 1 :Introduction and Classification

General description of fish; Account of systematic classification of fishes (upto classes); Classification Based on feeding habit, habitat and manner of reproduction.

Unit 2 : Morphology and Physiology

Types of fins and their modifications; Locomotion in fishes; Hydrodynamics; Types of Scales, Use of scales in Classifications and determination of age of fish; Gills and gas exchange; Swim bladder: Types and role in respiration, buoyancy; Osmoregulation in Elasmobranchs; Reproductive strategies (special reference to Indian fishes); Electric organs; Bioluminescence; Mechanoreceptors; Schooling; Parental care; Migration.

Unit 3 : Fisheries

Inland Fisheries; Marine Fisheries; Environmental factors influencing the seasonal variations in fish catches in the Arabian Sea and Bay of Bengal; Fishing crafts and Gears; Depletion of fisheries resources; Application of remote sensing and GIS in fisheries; Fisheries law and regulations.

Unit 4 : Aquaculture

Sustainable Aquaculture; Extensive, semi-intensive and intensive culture of fish; Pen and cage culture; Polyculture; Composite fish culture; Brood stock management; Induced breeding of fish; Management of finfish hatcheries; Preparation and maintenance of fish aquarium; Preparation of compound diets for fish; Role of water quality in aquaculture; Fish diseases : Bacterial, viral and parasitic; Preservation and processing of harvested fish, Fishery by-products.

Unit 5 : Fish in research

Transgenic fish, Zebrafish as a model organism in research.

FISH AND FISHERIES

PRACTICAL

(Credits 2)

1. Morphometric and meristic characters of fishes.
2. Study of Petromyzon, Myxine, Pristis, Chimaera, Exocoetus, Hippocampus, Gambusia, Labeo, Heteropneustus, Anabas.
3. Study of different types of scales (through permanent slides/photographs).
4. Study of crafts and gears used in Fisheries.
5. Water quality criteria for Aquaculture : Assessment of pH, conductivity, Total solids, Total dissolved solids.
6. Study of air breathing organs in Channa, Heteropneustus, Anabas and Clarias.
7. Demonstration of induced breeding in Fishes(video).
8. Demonstration of parental care in fishes (video).
9. Project Report on a visit to any fish farm/ pisciculture unit/ Zebrafish rearing lab.

SUGGESTED READINGS

- Q Bone and R Moore, Biology of Fishes, Taylor and Francis Group, CRC Press, U.K.
- D.H. Evans and J.D. Claiborne, The Physiology of Fishes, Taylor and Francis Group, CRC press, UK von der Emde, R.J. Mogdans and B.G. Kapoor. The Senses of Fish : Adaptions for the Reception of Natural Stimuli, Springer, Netherlands
- C.B.L. Srivastava, Fish Biology, Narendra Publishing House
- J.R. Norman, A history of Fishes, Hill and Wang Publishers
- S.S. Khanna and H.R. Singh, A text book of Fish biology and Fisheries, Narendra Publishing House.

IMMUNOLOGY

THEORY

(Credits 4)

Unit 1 : Overview of Immune System

Historical perspective of Immunology, early theories of Immunology, Cells and organs of the Immune system.

Unit 2 : Innate and adaptive Immunity

Anatomical barriers, Inflammation, Cell and molecules involved in innate immunity, Adaptive immunity (Cell mediated and humoral), Passive : Artificial and natural immunity, Active : Artificial and natural immunity, Immune dysfunctions (brief account of autoimmunity with reference to Rheumatoid Arthritis and tolerance, AIDS).

Unit 3 : Antigens

Antigenicity and immunogenicity, Immunogens, Adjuvants and haptens, Factors influencing immunogenicity, B and T-cell epitopes

Unit 4 : Immunoglobulins

Structure and functions of different classes of immunoglobulins, Antigen-antibody interactions, Immunoassay (ELISA and RIA), Polyclonal sera, Hybridoma technology: Monoclonal antibodies in therapeutics and diagnosis.

Unit 5 : Major Histocompatibility Complex

Structure and functions of MHC molecules, Endogenous and exogenous pathways of antigen processing and presentation.

Unit 6 : Cytokines

Properties and functions of cytokines, Therapeutics Cytokines.

Unit 7 : Complement System

Components and pathways of complement activation.

Unit 8 : Hypersensitivity

Gell and Coomb's classification and brief description of various types of hypersensitivities.

Unit 9 : Vaccines

Various types of vaccines.

IMMUNOLOGY

PRACTICAL

(Credits 2)

1. Demonstration of lymphoid organs.
2. Histological study of spleen , thymus and lymph nodes through slides/photographs.
3. Preparation of stained blood film to study various types of blood cells.
4. Ouchterlony's double immune-diffusion method.
5. ABO blood group determination.
6. Cell counting and viability test from splenocytes of farm bred animals/ cell lines.
7. Demonstration of :

- a.ELISA
- b.Immunoelectrophoresis

* The experiments can be performed depending upon usage of animal in UG courses.

SUGGESTED READING

- Kindt, T.J., Goldsby, R.A., Osborne, B.A. and Kuby, J (2006). *Immunology*, VI Edition. W.H. Freeman and Company.
- David, M., Jonathan, B., David, R.B. and Ivan R. (2006). *Immunology*, VII Edition, Mosby, Elsevier Publication.
- Abbas, K. Abul and Lechtman H. Andrew (2003). *Cellular and Molecular Immunology*. V Edition. Saunders Publication.

PARASITOLOGY

THEORY (Credits 4)

Unit 1 : Introduction to Parasitology 3

Brief introduction of Parasitism, Parasite, Parasitoid and Vectors (mechanical and biological vector) Host parasite relationship.

Unit II : Parasitic Protists 15

Study of Morphology, Life Cycle, prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Entamoeba histolytica*, *Giardia intestinalis*, *Trypanosoma gambiense*, *Leishmania donovani*, *Plasmodium vivax*.

Unit III : Parasitic Platyhelminthes 15

Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Fasciolopsis buski*, *Schistosoma haematobium*, *Taenia solium* and *Hymenolepis nana*.

Unit IV : Parasitic Nematodes 15

Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Ascaris Lumbricoides*, *Ancylostoma duodenale*, *Wuchereria bancrofti* and *Trichinella spiralis*. Study of structure, life cycle and importance of *Meloidogyne* (root knot nematode), *Pratylenus* (lesion nematode)

Unit V : Parasitic Arthropoda 10

Biology, importance and control of ticks, mites, *Pediculus humanus* (head and body louse), *Xenopsylla cheopis* and *Climex lectularius*.

Unit VI : Parasitic Vertebrates 2

A brief account of parasitic vertebrates; Cookcutter Shark, Candiru, hood Mockingbird and Vampire bat.

PARASITOLOGY

PRACTICAL

(Credits 2)

- Study of life stages of *Entamoeba histolytica*, *Giardia intestinalis*, *Trypanosoma gambiense*, *Leishmania donovani* and *Plasmodium vivax* through permanent slides/ micro photographs.
- Study of adult and life stages of *Fasciola buski*, *Schistosoma haematobium*, *Taenia solium* and *Hymenolepis nana* through permanent slides/micro photographs.
- Study of adult and life stages of *Ascaris lumbricoides*, *Ancylostoma duodenale*, *Wuchereria bancrofti* and *Trichinella spiralis* through permanent slides/ micro photographs.
- Study of plant parasitic root knot nematode, *Meloidogyne* from the soil sample.
- Study of *Pediculus humanus* (Head louse and Body louse), *Xenopsylla cheopis* and *Cimex lectularius* through permanent slides/ photographs.
- Study of monogenea from the gills of fresh/marine fish [Gills can be procured from fish market as by product of the industry].
- Study of nematode/cestode parasite from the intestine of Poultry bird [Intestine can be procured from poultry/market as a by product].

Submission of a brief report on parasitic vertebrates.

SUGGESTED READING

- Arora, D.R. and Arora, B. (2001) *Medical Parasitology*. II Edition. CBS Publications and Distributors.
- E.R. Noble and G.A. Noble (1982) *Parasitology : The biology of animal parasites*. V Edition, Lea & Febiger.
- Ahmed, N., Dawson, M., Smith, C. And Wood, Ed.(2007) *Biology of Disease*. Taylor and Francis Group.
- Parija, S.C. *Textbook of medical parasitology, protozoology & helminthology (Text and Colour Atlas)*, II Edition, All India Publishers & Distributors, Medical Books Publishers, Chennai, Delhi.
- Rattan Lal Ichhpujani and Rajesh Bhatia. *Medical Parasitology*, III edition, Jaypee Brothers Medical Publishers (P) Ltd., New Delhi
- Meyer, Olsen & Schmidt's *Essential of Parasitology*, Murray, D. Dailey, W.C. Brown Publishers
- K.D. Chatterjee (2009). *Parasitology : Protozoology and Helminthology*. XIII Edition, CBS Publishers & Distributors (P) Ltd.

REPRODUCTIVE BIOLOGY

THEORY

(Credits 4)

Unit 1 : Reproductive Endocrinology

Gonadal hormones and mechanism of hormone action, Steroids, glycoprotein hormones, and prostaglandins, hypothalamo—hypophyseal—gonadal axis, regulation of gonadotrophin secretion in male and female ; Reproductive System: Development and differentiation of gonads, genital ducts, external genitalia, mechanism of sex differentiation.

Unit 2 : Functional anatomy of male reproduction

Outline and histological of female reproductive system in rat and human; Testis : Cellular functions, germ cell, stem cell renewal; Spermatogenesis : kinetics and hormonal regulation ; Androgen synthesis and metabolism; Epididymal function and sperm maturation; Accessory glands function; Sperm transportation in male tract.

Unit 3 : Functional anatomy of female reproduction

Outline and histology of female reproductive system in rat and human; Ovary: folliculogenesis, ovulation, corpus luteum formation and regression; Steroidogenesis and secretion of ovarian hormones; Reproductive cycles (rat and human) and their regulation, changes in the female tract; Ovum transport in the fallopian tubes; Sperm transport in the female tract, fertilization; Hormonal control of implantation; Hormonal regulation of gestation, pregnancy diagnosis, foeto-maternal relationship; Mechanism of parturition and its hormonal regulation; Lactation and its regulation.

Unit 4 : Reproductive Health

Infertility in male and female : causes, diagnosis and management; Assisted Reproductive Technology : Sex selection, sperm banks, frozen embryos, in vitro fertilization, ET, EFT, IUT, ZIFT, GIFT, ICSI, PROST; Modern contraceptive technologies ; Demographic terminology used in family planning.

REPRODUCTIVE BIOLOGY

PRACTICAL

(Credits 2)

1. Study of animal house : set up and maintenance of animal house, breeding techniques, care of normal and experimental animals.
2. Examination of vaginal smear rats from live animals.
3. Surgical techniques : principles of surgery in endocrinology. Ovariectomy, Hysterectomy, castration and vasectomy in rats.
4. Examination of histological sections from photomicrographs/ permanent slides of rat/ human : testis, epididymis and accessory glands of male reproductive systems; Sections of ovary, fallopian tube, uterus (proliferative and secretory stages), cervix and vagina.
5. Human vaginal exfoliate cytology.
6. Sperm count and sperm motility in rat.
7. Study of modern contraceptive devices.

SUGGESTED READINGS

- Austin, C.R. and Short, R.V. reproduction in mammals, Cambridge University Press.
- Degroot, L.J. and Jameson, J.L.(eds). Endocrinology. W.B. Saunders and Company.
- Knobil, E. Et al.(eds). The Physiology of Reproduction. Raven Press Ltd.
- Hatcher, R.A. et al. The Essentials of Contraceptive Technology. Population Information Programme.

WILD LIFE CONSERVATION AND MANAGEMENT

THEORY

(Credits 4)

Unit 1 : Introduction to Wild Life

Values of wild life-positive and negative; Conservation ethics; importance of conservation; Causes of depletion; World conservation strategies.

Unit 2 : Evaluation and management of wild life

Habit analysis, Physical parameters : Topography, Geology, Soil and water; Biological Parameters : food, cover, forage, browse and cover estimation; Standard evaluation procedure :remote sensing and GIS.

Unit 3 : Management of habitats

Setting back succession; Grazing logging; Mechanical treatment; Advancing the succession process; Cover construction; Preservation of general genetic diversity; Restoration of degraded habitats.

Unit 4 : Population estimation

Population density, Natality, Birth rate, Mortality, Fertility schedules and sex ratio computation; Faecal analysis of ungulates and carnivores : Faecal samples, slide preparation, Hair identification, Pug marks and census method.

Unit 5 : Management planning of wild life in protected areas

Estimation of carrying capacity; Eco tourism/wild life tourism in forests ; Concept of climax persistence; Ecology of perturbation.

Unit 6 : Management of excess population

Bio-telemetry; Care of injured and diseased animal; Quarantine; Common diseases of wild animal.

Unit 7 : Protected areas

National parks & sanctuaries, Community reserve; Important features of protected areas in India; Tiger conservation- Tiger reserves in India; Management challenges in Tiger reserve.

WILD LIFE CONSERVATION AND MANAGEMENT

PRACTICALS

(Credits2)

1. Identification of flora, mammalian fauna, avian fauna, herpeto-fauna.
2. Demonstration of basic equipment needed in wildlife studies use, care and maintenance. (Compass, Binoculars, Spotting scope, Range Finders, Global Positioning System, Various types of cameras and lenses).
3. Familiarization and study of animal evidences in the field; identification of animals through pug marks, hoof marks, scats, pellet groups, nest, antlers.
4. Demonstration of different field techniques for flora and fauna.
5. PCQ, Ten tree method, Circular, Square & Rectangular plots, Parker's 2 step and other Method for ground cover assessment, Tree canopy cover assessment, Shrub cover assessment.
6. Trail/ transect monitoring for abundance and diversity estimation of mammals and bird (direct and indirect evidences).

SUGGESTED READINGS

- Caughley, G., and Sinclair, A.R.E. (1994). Wildlife Ecology and Management. Blackwell Science.
- Woodroffe R., Thirgood, S. And Rabinowitz, A. (2005). People and Wildlife, Conflict or Co-existence? Cambridge University.
- Bookhout, T.A. (1996). Research and Management Techniques for Wildlife and Habitats, 5th edition. The Wildlife Society, Allen Press.
- Sutherland, W.J.(2000). The Conservation Handbook : Research, Management and Policy. Blackwell Sciences.
- Hunter M.L., Gibbs, J.B. and Sterling, E.J.(2008). Problem-Solving in Conservation Biology and Wildlife Management : Exercise for Class, Field, and Laboratory. Blackwell Publishing.

SKILL ENHANCEMENT COURSES

SEC 1

AQUARIUM FISH KEEPING

(Credits 2)

Unit 1 : 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.

SERICULTURE

(Credits 2)

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 : Protozoans, viral, fungal and bacterial
Control and prevention of pests and diseases

Unit 5 : Entrepreneurship in Sericulture

Prospectus of Sericulture in India : Sericulture industry in different states, employment, potential in mulberry and non-mulberry sericulture. Visit to various sericulture centres.

SUGGESTED READING

- Manual on sericulture; Food and agriculture Organisation, Rome 1976.
- Handbook of Practical Sericulture : S.R. Uliyal and M.N. Narasimhanna
CSB, Bangalore
- Silkworm Rearing and Disease of Silkworm, 1956, Ptd. By Director of Ptg., Stn &
Pub. Govt. Press, Bangalore
- Appropriate Sericulture Techniques; Ed. M.S. Jolly, Director, CSR & TI, Mysore
- Handbook of Silkworm rearing : Agriculture and Technical Manual-1, Fuzi Pub.
Co. Ltd., Tokyo, Japan 1972
- Manual of Silkworm Egg Production; M.N. Narasimhana, CSB, Bangalore 1988.
- Silkworm Rearing; Wupang—Chun and Chen Da-Chung, Pub. By FAO, Rome 1988.
- A Guide for Bivoltine Sericulture; K. Sengupta, Director, CSR & TI, Mysore 1989.
- Improved Method of Rearing Young age silkworm; S. Krishnaswamy, reprinted
CSB, Bangalore, 1986.

B.Sc. Part - 1
Subsidiary/General
1 st Semester

Group A – Non-Chordata

1. Bionomics, general character and classification (upto orders) of the following phyla :
Protozoa, Porifera, Coelenterata, Platyhelminthes, Aschelminthes.
2. Detailed study of the structure and life history of the following types :-
 - a. Protozoa – Paramecium
 - b. Porifera – Sycon
 - c. Coelenterata – Obelia
 - d. Platyhelminthes – Fasciola
 - e. Aschelminthes – Ascaris

Group B - Ecology

Unit 1 : Introduction to Ecology

History of ecology, Autoecology and synecology, Levels of organization, Laws of limiting factors, Study of physical factors.

Unit 2 : Community

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

Unit 3: Ecosystem

Types of ecosystem with one example in detail,
Food chain : Detritus and grazing food chains, Linear and Y-shaped food chains.

Practicals

1.Experiments

Time : 3 Hrs

- 1.Dissection
- 2.Temporary mounting/Study of Planktons
- 3.Identification
 - (a)Permanent slides-2
 - (b)Museum specimen-2
 - (c)Plankton slides-1

4. Practical Record & Viva.

B.Sc. Part - 1
Subsidiary/General
2nd Semester

Group A-Nonchordates

1. Binomics , General character and classification (upto orders) of the following phyla : Annelida, Arthropoda, Mollusca, Echinodermata.

2. Detailed study of the structure and life history of the following types

- (a) Annelida – Pheritima
- (b) Arthropoda—Palaemon
- (c) Mollusca—Pila
- (d) Echinodermata—Asterias

Group B-Cell Biology

- 1. Diversity of cell size & shape
- 2. Cell theory
- 3. Structure & function of Plasma membrane & cytoplasmic organelles.
- 4. Cell division.
- 5. Cell cycle.

Practicals

- 1. Dissection
- 2. Temporary mounting/Cytology
- 3. Identification
 - (a) Permanent slides-2
 - (b) Museum specimens-2
 - (c) Cytological slides-1 (Meiosis/Mitosis).
- 4. Practical Record & Viva.