

**Cotton College State University**  
**Department of Zoology**  
**Undergraduate Syllabus**

Sub Code	Subject Title	L+T+P	Credits
<b>Semester-I</b>			
ZOO 101C	Introduction to Biology	2+1+1	4
ZOO 102C	Biodiversity : 1 Non-chordata	2+1+1	4
ZOO 103C	Biodiversity : 2 Non Chordata	2+1+1	4
ZOO 104E	Animal diversity: I Non chordata	2+0+1	3
ZOO 105E	Animal diversity: II Non chordata	2+0+1	3
<b>Semester-II</b>			
ZOO 201C	Biodiversity: Chordata	2+1+1	4
ZOO 202C	Comparative Anatomy	2+1+1	4
ZOO 203C	Histology	2+1+1	4
ZOO 204E	Animal diversity: I Chordata	2+0+1	3
ZOO 205E	Animal diversity: II Chordata and Comparative anatomy	2+0+1	3
<b>Semester-III</b>			
ZOO 301C	Cell Biology	2+1+1	4
ZOO 302C	Genetics	2+1+1	4
ZOO 303C	Biostatistics, Bioinformatics, Computer Application	2+1+1	4
ZOO 304E	Cell Biology and Genetics	2+0+1	3
ZOO 305E	Taxonomy and Biostatistics	2+0+1	3
<b>Semester-IV</b>			
ZOO 401C	Economic Zoology	2+1+1	4
ZOO 402C	Biochemistry	2+1+1	4
ZOO 403C	Physiology	2+1+1	4
ZOO 404E	Physiology and Biochemistry	2+0+1	3
ZOO 405E	Economic zoology	2+0+1	3
<b>Semester-V</b>			
ZOO 501C	Developmental Biology	2+1+1	4
ZOO 502C	Endocrinology and Immunology	2+1+1	4
ZOO 503C	Biological techniques and Biotechnology	2+1+1	4
ZOO 504E	Developmental Biology	2+0+1	3
ZOO 505E	Endocrinology& Immunology	2+0+1	3
<b>Semester-VI</b>			
ZOO 601C	Animal Behaviour	2+1+1	4
ZOO 602C	Evolutionary Biology and Adaptation	2+1+1	4
ZOO 603C	Ecology and Wildlife Biology	2+1+1	4
ZOO 604E	Ecology and Wildlife Biology	2+0+1	3
ZOO 605E	Evolution and Adaptation	2+0+1	3

## Semester-I

Sub Code	Subject Title	L+T+P	Credits
ZOO 101C	Introduction to Biology	2+1+1	4
ZOO 102C	Biodiversity : 1 Non-chordata	2+1+1	4
ZOO 103C	Biodiversity : 2 Non Chordata	2+1+1	4
ZOO 104E	Animal diversity: I Non chordata	2+0+1	3
ZOO 105E	Animal diversity: II Non chordata	2+0+1	3

### ZOO 101C: Introduction to Biology

No of Lectures - 32

#### Course Outline

1. Introduction to the concept of Biology. Themes in the study of Biology, concept of ecosystem, Prokaryotic and Eukaryotic cell, Biology and everyday life.
2. Evolution: Major events in the origin of life. Micro and Macroevolution.
3. Darwin's theory of evolution, Lamarckism.
4. Principles of taxonomy, International Code of Zoological Nomenclature (ICZN) – Binomial and Trinomial nomenclature, Classification of Animal Kingdom.
5. Elementary idea of Taxidermy and Museology.
6. Chemistry of life – The constituents of matter, concept of chemical bonding, Energy transfer.
7. Water and life – properties of water.
8. Structure and function of carbon and life.
9. Structure and function of biomolecules.
10. Genetic approach to Biology.

#### ZOO 101C (Practicals)

1. Study of Prokaryotic & Eukaryotic cells.
2. To perform quantitative estimation of protein and glucose of glucose.
3. Separation of amino acids by Paper chromatography.
4. Qualitative detection of protein.

#### Recommended books:

1. Campbell, N.A. and Reece, J.B. (2008), Biology. Pearson Benjamin Cummings, San Francisco.
2. Raven, P.H. et al (2006), Biology, Tata McGraw Hill Publications, New Delhi.
3. Griffiths, A.J.F. et al (2008). Introduction to Genetic analysis, W.H. Freeman and Co., NY.
4. Lewin B., Genes VII, Oxford University Press.

## ZOO 102C: Biodiversity : 1 Non-chordata

No of Lectures – 32

### Course Outline—

#### 1. Animal diversity: Non Chordata

1. General characters of Non Chordatas.
2. Protozoa –
  - a. General characters and classification up to orders with examples.
  - b. Type study – Paramecium and Plasmodium.
  - c. Nutrition, Locomotion and Reproduction in protozoa
3. Metazoa – Origin, metamerism and coelom
4. Porifera – General characters and classification up to order with examples. Structural organization of Sycon, Canal system.
5. Coelenterata – General characters and classification up to orders with examples. Type study – Aurelia, polymorphism in Siphonophora , Corals and coral reefs.
6. Ctenophora- General characters and classification up to orders with examples. Difference between coelenterate and ctenophore and their significance.
7. Platyhelminthes – General characters and classification up to orders with examples. Fasciola –life history, parasitic adaptations.
8. Aschelminthes - General characters and classification up to orders with examples. Morphology, life history of Ascaris and its parasitic adaptation. Parasitic nematodes & diseases.

#### ZOO 102C (Practicals)

1. Identification of prepared slides: Paramecium, Volvox, Euglena, Amoeba, Noctiluca, Polystomella, Larvae of Fasciola and Taenia.
2. Study of Museum specimens: (Identification up to order, Generic name should be given) Grantia, Sycon, Spongilla, Obelia, Physalia, Aurelia, Metridium, Pennatula (Sea pen), Gorgonia, Fungia, Fasciola, Taenia, Ascaris (Male & Female).
3. Temporary mount: Spicules, Gemmules.
4. Permanent mount : Euglena, Paramecium, Hydra, Obelia colony.

#### Recommended Books:

1. Barnes, R. D. (1982) Invertebrate Zoology, Halt Saunders International Edition.
2. Barnes, R. S. K. et al. (2002) The Invertebrates: A new synthesis. Blackwell Science.
3. Barrington, E. J. W. (1979) Invertebrate Structure and functions. ELBS and Nelson.
4. Jordan, E.K., P. S. Verma; Invertebrate Zoology, S. Chand and Co. Ltd.
5. Parker and Haswell, Text book of Zoology, vol (1) Invertebrata., A. Z. T., B. S. Publishers and Distributors.
6. Hymen volume I – VI.
7. Adam Sedgwick – A Students text book of Zoology vol. I-III , Central Book Depot. Allahabad.
8. T.C. Majupuria – Invertebrate Zoology.

## **ZOO 103C: Biodiversity: 2 Non-chordata**

No of Lectures – 32

### **Course Outline—**

#### **Animal diversity: Non Chordata**

1. Annelida: General characters and classification up to orders with examples. Coelom, Coelomoduct and nephridia in Annelida. Trochophore larva and its significance. Adaptive radiation in Polychaeta.
2. Arthropoda - General characters and classification up to orders with examples. Larval forms of Crustacea, social life, moulting and metamorphosis in Insecta. Peripatus and its affinities.
3. Mollusca - General characters and classification up to orders with examples. Digestive and Nervous system of Pila. Torsion and Detorsion in Gastropoda.
4. Echinodermata - General characters and classification up to orders with examples. Water vascular system and larval forms of echinodermata.

#### **ZOO 103C (Practicals)**

1. Dissection of the following systems of invertebrates:
  - a) Digestive and nervous system of earthworm.
  - b) Digestive, Nervous system, and reproductive system of Cockroach.
  - c) Digestive system and nervous system of Pila.
2. Identification/Study of prepared slides: T.S. of Ascaris (M/F), T.S. through pharynx, gizzard and typhlosolar intestine of Earthworm, T S. of arm of starfish, Larvae of Echinodermata.
3. Study of Museum specimens: (Identification up to order. Generic name should be mentioned) Aphrodite, Heteronereis, Chaetopterus, Amphitrite, Sipunculus, Tubifex, Limulus, Spider, Lepas, Scolopendra, Julus, Termite, Termitequeen, Wasp, Honeybee, Silkmoth (Eri, Muga), Bellostoma, Peripatus, Chiton, Dentalium, Teredo, Pinctada, Octopus, Cucumaria Echinus, Clypester, Antedon, Ophioderma.
4. Mounting –Temporary mounting: Setae of earthworm, statocyst of prawn, salivary apparatus and mouth parts of Cockroach.

#### **Recommended books:**

1. Barnes, R. D. (1982) Invertebrate Zoology (1982) Holt Saunders International Edition.
2. Barnes, R. S. K. et.al (2002) The Invertebrates: A new synthesis. Blackwell Science
3. Barrington, E. J. W. (1979) Invertebrate Structure and functions. ELBS and Nelson.
4. Jordan, E.K., P. S. Verma, Invertebrate Zoology, S. Chand and Co. Ltd.
5. Adam Sedgwick – A Students text book of Zoology vol. I-III, Central Book Depot, Allahabad.
6. T.C. Majumuria – Invertebrate Zoology, Vol – I.

## **ZOO 104E: Animal diversity: I Non chordata**

**No of Lectures – 32**

### **Course Outline—**

#### **Animal Diversity (Non-chordata)**

1. Introduction to Animal Kingdom.
2. Protozoa: General characters and outlines classification of the phylum up to order with examples. Structure, nutrition, locomotion and reproduction of Paramecium.
3. Porifera: General characters and outlines classification of the phylum up to order with examples. Anatomical structures and functions with special reference to canal system of Sycon.
4. Coelenterata: General characters and outline classification of the phylum up to order with examples. Anatomical structures and functions of Obelia.
5. Platyhelminthes: General characters and outline classification of the phylum up to order with examples. Structure and life history of Fasciola.
6. Aschelminthes: General characters and outline classification of the phylum up to order with examples. Structures and life history of Ascaris.

#### **ZOO 104E (Practicals)**

1. Identification:
  - a) Slides: Plasmodium, Entamoeba, Polystomella, Sponge spicules, T.S. of Ascaris (Male & Female), Miracidium, Cercaria larvae of Fasciola.
  - b) Museum specimens: (Identification up to order) Spongilla, Physalia, Metridium (Sea anemone), Pennatula (Sea pen), Gorgonia, Fasciola, Taenia, Ascaris (Male & female)
2. Mounting:
  - a. Temporary: Setae of Earthworm, Salivary gland of Cockroach, Radula of Pila.
  - b. Permanent: Daphnia, Cyclops, Crustacean larva, Obelia colony, Euglena. (Submission not required but to be incorporated in the practical note book).

## **ZOO 105E: Animal diversity: II Non chordata**

**No of Lectures – 32**

### **Course Outline—**

#### **Animal Diversity (Non-Chordata)**

1. Annelida: General characters and outline classification of the phylum up to order with examples. Anatomical structures and life history of Leech.
2. Arthropoda: General characters and outline classification of the phylum up to order with examples. Anatomical structures and appendages of Prawn. Mouth parts, life history of Mosquito and Housefly and their roles as Vector.

3. Mollusca: General characters and outline classification of the phylum up to order with examples. Anatomical structures and functions of Pila.
4. Echinodermata: General characters and outline classification of the phylum up to order with examples. Anatomical structures and functions of Starfish with special reference to Water vascular system.

### ZOO 105E (Practicals)

#### A. Dissection:

1. Leech : i) Urinogenital system
2. Cockroach : i) Digestive system ii) Nervous system
3. Pila : i) Digestive system

#### B. Identification:

1. Slides: T.S. of leech through crop, T.S. of Earthworm through pharynx, gizzard and intestine, Mouth parts of mosquitoes, larvae of Echinodermata.
2. Museum specimens: ( Identification up to order ) Echirus, Aphrodite, Limulus, Scolopendra(Centipede), Julus(Millipede), Carausius(Stick insect), Lepisma, Mantis, Termite queen, Belostoma(Giant water bug), Peripatus, Chiton, Pinctada ( Pearl oyster), Loligo, Mytilus, Limax, Cucumaria(Sea cucumber), Echinus(Sea urchin)

### Semester-II

Sub Code	Subject Title	L+T+P	Credits
ZOO 201C	Biodiversity: Chordata	2+1+1	4
ZOO 202C	Comparative Anatomy	2+1+1	4
ZOO 203C	Histology	2+1+1	4
ZOO 204E	Animal diversity: I Chordata	2+0+1	3
ZOO 205E	Animal diversity: II Chordata and Comparative anatomy	2+0+1	3

### ZOO 201C: Biodiversity: Chordata

No of Lectures – 32

#### Course Outline—

##### ANIMAL DIVERSITY: CHORDATA

1. General account of Chordatas: Introduction and origin, General characters, classification, Plan of body organization in Chordatas.
2. ProtoChordatas: General features, Phylogeny of HemiChordatas, UroChordatas and CephaloChordatas. Retrogressive metamorphosis, Structure and affinities of Amphioxus.

3. Agnatha: - Distinctive features and classification up to order with examples. Ammocoete larva: its importance in evolution. Distinction between Lamprey and Hagfish.
4. Pisces: General characters and classification up to order with examples. Accessory respiratory organ and swim bladder in fish. Osmoregulation, Migration and Parental care.
5. Amphibia: General characters and classification up to order with examples. Respiration and Parental care in Amphibia.
6. Reptilia: General characters and classification up to order with examples. Poisonous and non-poisonous snakes of India, Poison gland, biting apparatus and biting mechanism in snakes, Affinities of Sphenodon.
7. Aves: Distinctive characters and classification up to order with examples. Flight adaptation Mechanism of flight and perching Migration.
8. Mammalia:- Distinctive characters and classification up to order with examples. General organization and affinities of Monotremata and Marsupialia Origin of mammals.

### **ZOO 201C (Practicals)**

1. Dissections:
  - a) Scoliodon –
    - i. Afferent branchial system, ii. Efferent branchial system iii. V,VII, IX, and X cranial nerves
  - b) Weberian ossicle of Mystus/Rohu/Catla. c) Rat/Squirrel: Arterial & Reproductive system.
2. Temporary mounting: Placoid, Cycloid, Ctenoid scales, Squamous and Ciliated Epithelium, Straiated and Non-straiated muscles.
3. Study of Museum specimens: Identification and classification up to order. (Generic name should be given)
 

Balanoglossus, Herdmania, Amphioxus, Petromyzon, Myxine, Pristis, Torpedo, Hippocampus, Monopterus, , Notopterus, Rohu, Cyprinus, Hypophthalmichthys, Ctenopharyngodon, Clarius, Mystus, Nectures, Axoltol larva, Salamander, Hyla, Alytes, Chelone, , Draco, Chameleon, Naja, Hydrophis, Viper, Krait, King fisher, Wood pecker, Hedgehog, Manis, Bat, Monkey.

### **Recommended books:**

1. Hickman,C.P. ,F.M. Hickman and L.S. Roberts, 1984.Integrated Principles of Zoology.
2. Jordan,E.K. and P.S.Verma, Chordata Zoology and Elements of Animal physiology, S. Chand and Co. Ltd.
3. Nigam,H.C., Zoology of Chordatas, Vishal Publications.
4. Newman,H.H.,The phylum Chordata, Satish book Enterprise.
5. Parker and Haswell, Text book of Zoology, vol II (Chordata). A. Z. T. B. S. Publishers and Distributors, New Delhi.
6. Waterman, Allyn. J. et.al, Chordata Structure and function, Mc Millan and co. New York.
7. Young, J.Z., The life of vertebrates, Oxford University Press.
8. F. C. Majupuria – Invertebrate Zoology – Vol-II.

## **ZOO 202C: Comparative Anatomy**

**No of Lectures – 32**

### **Course Outline—**

1. Integument: Structure and derivatives of Integument.
2. Digestive system – Alimentary canal and associated glands.
3. Respiratory system – Skin, Gills, Lungs, Air sacs and voice apparatus, Air bladder and accessory breathing organ in fishes. Mechanism of breathing
4. Circulatory system – Evolution of heart, aortic arches, venous system and lymphatic system.
5. Skeletal system – Axial and appendicular skeleton.
6. Nervous system – Central and autonomic nervous system, Cranial nerves and brain in vertebrates.
7. Sense organs – Classification of receptors, structure and working of mammalian eye and ear.
8. Urinogenital system – Succession of kidney.

### **ZOO 202C (Practicals)**

1. Study of permanent slides of Integument of Amphibia, Reptiles, Birds, Mammals.
2. Study of Skeletal system of Amphibia, Reptiles, Birds & Mammals.
3. Study of skull of Fish, Amphibia, Reptiles, Birds & Mammals.
4. Comparative study of heart of Fish, Amphibia, Reptiles, Birds & Mammals.
5. Comparative study of kidney of Fish, Amphibia, Birds & Mammals
6. Study of blood cells of Fish, Amphibia, Birds & Mammals.

### **Recommended Books:**

1. Kardong, K. V., Vertebrates Comparative Anatomy, Function and Evolution. McGraw Hill Higher Education.
2. Kent, G.C. and Carr R. K., Comparative Anatomy of the Vertebrates. The McGraw-Hill Companies.
3. Weichert, C.K., Anatomy of Chordates. McGraw-Hill, companies.
4. Fishback, D.W., Comparative Anatomy, McGraw Hill.
5. Marvalee H.W, Hyman's Comparative anatomy and Function.



## **ZOO 203C: Histology**

**No of Lectures – 32**

### **Course Outline—**

1. Differentiation, organization and maintenance of animal tissues.
2. Animal tissues: Types, structure and their functions : Epithelial, Muscular, Connective tissues ( Cartilage, bone, blood, lymph, areolar , adipose, reticular ), nervous tissue, types of glands.
3. Histology of GI Tract, Liver, Pancreas, Spleen, Lung, Kidney, Testis, Ovary of mammal.
4. Basic principles of fixation and staining, classification, composition and properties of dye, use of mordants and metachromatic dyes
5. Microtomy technique.

### **ZOO 203C (Practicals)**

1. Study of histological slides: T.S. through pharyngeal and intestinal region of Amphioxus. T.S. of skin, stomach, intestine, liver, pancreas, kidney, testis, ovary of mammals.
2. Temporary mounting: – Pecten of bird, Air-sac of bird. Blood smear of Vertebrates.
3. Preparation of permanent slides of any five mammalian tissues- Microtomy technique.

### **Recommended Books:**

1. Arey, L.B., Human Histology. IV edition, W.B. Saunders.
2. Inderbir Singh, Text Book Of Human Histology, Jaypee Brothers Medical Publishers
3. Baily, Histology.

## **ZOO 204E: Animal diversity: I Chordata**

**No of Lectures – 32**

### **Course Outline—**

1. General Characters, outline classification and plan of body organization in Chordatas.
2. ProtoChordatas: General Characters and classification, structural organization of HemiChordatas (Balanoglossus), Urochordata (Herdmania), Cephalochordata (Amphioxus). Affinities of Amphioxus.
3. Agnathostomata: General Characters and Classification, Ammocoete larva.
4. Pisces: General Characters and classification up to orders with examples. Anatomical structures of Scoliodon (Digestive, Circulatory and Nervous system). Distinction between cartilaginous fishes and bony fishes.
5. Amphibia: Distinctive Characters and classification up to orders with characters and examples. Anatomical structures of *Bufo* with special reference to respiration, metamorphosis.

## ZOO 204E (Practicals)

1. Dissection :
  - A. Scoliodon –
    - i. Internal ear
    - ii. IXth and Xth cranial nerves
    - iii. Afferent and Efferent system
2. Mounting:
  - B. Temporary –
    - i. Blood film of amphibia and mammal.
    - ii. Placoid scale
    - iii. Filoplume
  - C. Permanent – Different type of scales of bony fishes, striated and non-striated muscles, ciliated and squamous epithelium of vertebrates.
3. Identification:
  - D. Permanent slides – W.M. of Salpa, Doliolum, T.S. of amphioxus through pharynx
4. Identification of Museum specimen (up to order): Pyrosoma, Balanoglossus, Herdmania, Amphioxus, Petromyzon, Myxine, Torpedo, Pristis, Hippocampus(Sea horse), Monopterus, Cyprinus, Clarias, Anabus, Labeo, Catla, Mystus, Ichthyophis, Axolotl.

## ZOO 205E: Animal diversity: II Chordata and Comparative anatomy

No of Lectures – 32

### Course Outline—

#### Animal Diversity: Chordata

- 1) Reptilia: Distinctive Characters and classification up to orders with characters and examples. Characteristics of poisonous snakes, Poison apparatus and biting mechanism.
- 2) Aves: Distinctive Characters and classification up to orders with characters and examples. Differences between Paleognathae and Neognathae. Flight muscles and flight mechanism in Bird, Migration of Birds.
- 3) Mammalia: Distinctive Characters and classification up to orders with characters and examples. Affinities of Prototheria.
- 4) General organization of exoskeleton in vertebrates.
- 5) Comparative anatomy of heart and aortic arch in vertebrates.

## ZOO 205 E (Practicals)

1. Dissection
  - a) Pigeon –
    - i. Flight muscle
    - ii. Arterial system
2. Identification:
  - b. Slides: T.S. of Intestine, Liver, Kidney, Testis, Ovary of mammals.
  - c. Study of bones: Axial and appendicular skeleton of Amphibia, Fowl, Guinea pig/ Rabbit.
  - d. Museum specimen: Chameleon, Draco, Cobra, Krait, Alcedo( King fisher), Hystrix ( Porcupine ), Funumbulus ( Squirrel ), Pteropus, Echidna, Manis, Macaca

## Semester-III

Sub Code	Subject Title	L+T+P	Credits
ZOO 301C	Cell Biology	2+1+1	4
ZOO 302C	Genetics	2+1+1	4
ZOO 303C	Biostatistics, Bioinformatics, Computer Application	2+1+1	4
ZOO 304E	Cell Biology and Genetics	2+0+1	3
ZOO 305E	Taxonomy and Biostatistics	2+0+1	3

### ZOO 301C: Cell Biology

No of Lectures – 32

#### Course Outline—

1. Composition of cells: Molecules of cells, cell membrane and cell proteins.
2. Nucleus: Nuclear envelope – Nuclear pore complex, nuclear lamina, Transport across nuclear membrane, chromatin, molecular organisation, Nucleolus and rRNA processing.
3. Protein sorting and Transport: Ribosome, Endoplasmic reticulum, Golgi apparatus, Mechanism of vesicular transport, Lysosomes.
4. Mitochondria chloroplasts and peroxisomes: Structural organisation, function, Marker enzymes, mitochondrial biogenesis, Protein import in mitochondria, Semiautonomous nature of mitochondria and chloroplast, peroxisome's assembly.
5. Cytoskeleton and cell movement: - Structure, organisation and function of actin, myosin and cell movement, intermediate filaments, microtubules.
6. Plasma membrane: Structure and function, transport of molecules.
7. Cell signaling: Signaling molecules and their receptor function of cell surface receptors, Intra cellular signal transduction pathway, Signaling networks.
8. The Cell cycle: Eukaryotic cell cycle, Regulation of cell cycle progression. Events of mitotic and Meiotic phases.
9. Cell death and cell renewal: Programmed cell death, stem cells and maintenance of adult tissues, Embryonic stem cells, Cell cloning and its clinical application.
10. Cancer: Development and causes of cancer, Tumor viruses, Oncogenes, Tumor suppressor gene, Cancer treatment – molecular approach.

## **ZOO 301C (Practicals)**

1. Staining techniques of nucleus & nucleolus.
2. Micrometry- use of Ocular and Stage micrometer.
3. Study of Mitochondria.
4. Cytochemical detection of DNA- Feulgen technique
5. Cytochemical detection of DNA and RNA by methyl green pyronine technique.
6. Cytochemical detection of polysaccharide – PAS technique.
7. Extraction of DNA from tissues.

## **Recommended Books:**

1. Karp, G., 2010, Cell and Molecular Biology: Concepts and Experiments. 6<sup>th</sup> Edition. Jhon Wiley& Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F., 2006, Cell and Molecular Biology., 8<sup>th</sup> edition. Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E., 2009. The Cell: A Molecular approach. 5<sup>th</sup> edition ASM Press & Sunderland, Washington, D.C., Sinauer Associates, M.A
4. Becker, W.M., Kleinssmith, L.J., and Bertoni, G.P., 2009. The World of Cell. 7<sup>th</sup> edition. Pearson Benjamin Cummings Publishing Publiding, San Francisco.
5. Ambrose, E.J., Easty, D.M., 1970, Cell Biology, Thomas NELson & Sons Ltd.
6. Giese, A. C., 1979, Cell Phyiology, Saunders Co., Philadelphia, Londn.
7. Power, C. B., 1989, Essential of Cytology, Himalayan Publishing House.

## **ZOO 302C: Genetics**

**No of Lectures – 32**

### **Course Outline—**

1. Introduction to genetics: - Mendelism, Genetic variation, Molecular basis of genetic information, chromosome theory of inheritance, Law of probability, pedigree analysis. Incomplete dominance and co-dominance, Multiple allele, Epistasis, Pleiotropy, Environmental effects on phenotypic expression, sex linked inheritance.
2. Linkage, Crossing over and chromosomal mapping : Linkage and Crossing over, Molecular mechanism of Crossing over , Recombination frequency as a measure of linkage intensity, Gene mapping, Two factor and three factor crosses. Interference and co-incidence. Somatic cell genetics.
3. Mutations: - Chromosomal mutations, Gene mutations. Molecular basis of mutations. Detection of mutations: CLB method, DNA damage and repair.
4. Extra chromosomal inheritance.
5. Bacterial genetics – Conjugation, Transformation, Transduction.
6. Transposable genetic elements – Eukaryotic viruses. Uses of transposons.
7. Population genetics, Genetic variation and Speciation.

## **ZOO 302C (Practicals)**

1. Mounting of buccal epithelium for bar bodies.
2. Mitosis in Onion root tip/Tadpole tail.
3. Meiosis in grasshopper/grylotalpa testis by squash preparation.
4. Salivary gland chromosome in Chironomous/Drosophila larva.
5. Human blood grouping, Genotypic frequency of Human ABO blood group.
6. Population study: Hardy-Weinberg's equilibrium.

## **Recommended Books:**

1. Gardner, E. J., Simmons, M.J. Snustad, D.P., 2006, Principles of Genetics, Jhon Wiley and Sons
2. Snustad, D.P., Simmons, M. J., 2009, Principles of Genetics., John Wiley& Sons Inc.
3. Klug, W.S., Cummings M.R., Spencer, C.A., 2009, Concepts of Genetics, Benjamin Cummings.
4. Bhamrah, H.S., Text Book of Genetics, Amazon Co.
5. Lewin, B., Gene VI , Oxford Univ Press

## **ZOO 303C: Bio statistics, Bio-informatics and Computer application**

**No of Lectures – 32**

### **Course Outline—**

#### **I. Biostatistics**

1. Measures of central tendencies-mean, media & mode.
2. Standard deviation & standard error.
3. Regression & co-relations.
4. Emphasis on examples from biological sciences.
5. Sample mean & sample variation.

#### **II: Bioinformatics and Computer application**

1. Introduction to Bio-informatics: Introduction, Branches of bio-informatics, Aim, Scope, Research areas of Bio-informatics and applications.
2. Data base in informatics: Biological data base, classification format of biological data base, Biological data base retrieval system.
3. Biological sequence data bases: National Center for Biotechnological Information. (NCBI): Tools and data bases of NCBI, Database retrieval tool, Sequence submission to NCBI, Nucleotide Data base, Protein database, Gene Expression database.
4. EMBL Nucleotide Database, DNA Data Bank of Japan, Protein Information Resource (PIR) and Swiss Prot.
5. Use of Computers in Biology, Computer application, data processing, languages, Computer programmes for Biostatistical Analysis.

## **ZOO 303C (Practicals)**

### Biostatistics, Bioinformatics and Computer Application

1. Nucleic acid & protein database.
2. Sequence retrieval from database.
3. Sequence alignment.
4. Construction of phylogenetic tree.
5. Derivation of Mean, Median, Mode. Standard deviation and standard error.
6. Students 't' Test.

### **Recommended books:**

1. Ghosh, Z., and Bibekananda M, Bio informatics: Principles and Applications, Oxford University Press.
2. Pevsner, S. Bio-informatics and Functional genomics, Wiley-Black well.
3. Campbell, A. M. and Heyer L P., Discovering genomics, proteonomics and Bio-informatics, II Edition, Benjamin Cummings.
4. Categorical Data Analysis by Alan Agresti.
5. Statistics by Murray R Spiegel, Larry J Stephens.
6. Biostatistics in Brief Made Easy: K Visweswar.

## **ZOO 304E: Cell Biology and Genetics**

**No of Lectures – 32**

### **Course Outline—**

#### **A. Cell Biology:**

1. Structure of Prokaryotic and Eukaryotic cells.
2. Structure and function of Plasma membrane and membrane transport.
3. Cell reproduction – Mitosis and Meiosis, Concept of cell cycle.
4. Ultra structure and functions of – Mitochondria, Endoplasmic reticulum, Ribosome and Golgi bodies.
5. Chromosomes- Structure and organization, Giant chromosome and its significance.

#### **B. Genetics:**

1. Linkage and Crossing over and their mechanism and significance. Gene Mapping.
2. Sex determination – chromosomal, sex linked inheritance.
3. Gene expressions: Incomplete dominance, multiple alleles, lethal genes, pleiotropic genes, epistasis.
4. Mutation: chromosomal, gene mutation. Harmful and beneficial effects of mutation.
5. Genetic Counseling.

### ZOO 304E (Practicals)

1. Study of the structure of prokaryotic and eukaryotic cells.
2. Mitosis in onion root tip / tadpole tail by squash method
3. Meiosis in the testis of Grasshopper / Gryllotalpa by squash preparation
4. Study of bar bodies in buccal epithelium.
5. Determination of Blood groups in man.

### ZOO 305E: Taxonomy and Biostatistics

No of Lectures – 32

#### Course Outline—

##### A. Taxonomy:

1. Definition and basic concept of Taxonomy.
2. Chemotaxonomy, Cytotaxonomy, Molecular taxonomy.
3. Taxonomic procedures – taxonomic collections, preservation, process of identification.  
Taxonomic keys – different types of taxonomic keys.
4. Concept of taxonomic terms.
5. Systems of classification.
6. International Code of Zoological Nomenclature – Binomial, Trinomial nomenclature.

##### B. Biostatistics:

1. Mean, median & mode.
2. Standard deviation & standard error.
3. Emphasis on examples from biological sciences.
4. Sample mean & sample variation.

### ZOO 305E (Practicals)

1. Derivation of Mean, Median, Mode
2. Standard deviation and standard error
3. Students 't' test

### Semester-IV

Sub Code	Subject Title	L+T+P	Credits
ZOO 401C	Economic Zoology	2+1+1	4
ZOO 402C	Biochemistry	2+1+1	4
ZOO 403C	Physiology	2+1+1	4
ZOO 404E	Physiology and Biochemistry	2+0+1	3
ZOO 405E	Economic zoology	2+0+1	3

## **ZOO 401C: Economic Zoology**

**No of Lectures – 32**

### **Course Outline—**

1. Human diseases: Epidemiology of infectious diseases, transmission, prevention and control of diseases: Tuberculosis, Amoebiasis, Dengue, Malaria, bird flu, Swine flu. Life history and pathogenicity: Fasciola, Schistosoma, Ancylostoma, Wuchereria.
2. Human Reproductive health and Welfare: Health and disease during pregnancy, Infertility in male and female – cause, diagnosis and management. Assisted reproductive technology, sex selection, sperm banks, frozen embryos, In vitro fertilisation, ET, IFT, IVT, ZIFT, GIFT, ICSI, PROST. Modern contraceptive technologies: Demographic terminology used in family planning.
3. Applied Entomology: Bionomics and control of crop pest and stored grain pests, their control and management. Sericulture: Silkworms, life history, varieties of silk and silk products and their economics in India. Disease prevention and control measures of silk worm pest, storage, spinning and reeling of silk. Apiculture: Life history of honey bee, colony, nest, caste distinction, economics of bee keeping. Lac culture, Enemies of lac, uses of lac. Insect control: Mechanical, Physical, Cultural and Biological control of Pests. Classification of insect control with reference to chemical pesticides. Integrated Pest management.
4. Fish technology: Fresh water fish groups in India. Captive and culture fisheries, Prawn culture, Composite fish culture, Induced breeding and transportation of fish seed. Construction and lay out of ponds of a fish farm. Indigenous ornamental fishes.

### **ZOO 401C (Practicals)**

1. Study of permanent slides and specimen of Protozoa, helminthes and arthropod vectors.
2. Visit to centers of proficiency in reproductive physiology.
3. Study of some important pests of Paddy, Jute, Tea, Cane sugar, vegetables and stored grain pest.
4. Study of the lifecycle of silk worms (Eri, Muga and Mulberry), life history of honey bee.
5. Sting gland of honey bee.
6. Silk gland from silk worm larva.
7. Identification of commercially important fishes(10 spp) and ornamental fish (5 spp)
8. In vivo demonstration of pituitary gland from commonly found fishes.
9. Maintenance of fresh water aquarium.

### **Recommended books:**

1. Park, K., Preventive and Social Medicine, B. B. Publishers.
2. Arora, D. R. and Arora B, Medical parasitology, C.B.S. publication.
3. Chaudhury, S.K., Practice of fertility control, A Comprehensive text book. B.I. Churchill Living Ston Pvt. Ltd.
4. Hafez, E.S.E. and Evans, T.N., Human reproduction: Contraception and Conception. Harper and Row, New York.
5. Atwal, A.S., Agricultural Pests in India and South East Asia. Kalyani Publishers.



6. Pradhan, S, Insect pests of crops. NBT, India.
7. Prost, P.J., Apiculture, Oxford and IBH ,N. Delhi.
8. Srivastava, C. B. L., Fishery Science and Indian Fisheries. Kitab Mahal Publications, India.

## **ZOO 402C: Biochemistry**

**Nos of Lectures – 32**

### **Course Outline—**

1. Carbohydrate: Structure and properties of important mono-, di-, and polysaccharide.
2. Lipids: Structure, properties and functional significance of fatty acids, triglycerides and steroids.
3. Amino acids and proteins: Structure and general properties of amino acids, four levels structures of proteins.
4. Carbohydrate metabolism : Glycolysis, Fermentation, Citric acid cycle , pentose phosphate pathway, Gluconeogenesis , Shuttle systems ( Malate-aspartate, Glycerol – 3- phosphate and cori cycle) , Glycogen metabolism.
5. Lipid metabolism: Biosynthesis and  $\beta$  – oxidation of saturated fatty acids, ketogenesis, Types and properties of lipoprotein.
6. Protein metabolism: Catabolism of amino acids, transamination, Deamination, urea cycle, Fate of gluconeogenic and ketogenic amino acids with example of serine and leucine respectively.
7. Intermediary metabolism: Interrelationship of carbohydrates, lipid and protein metabolism.
8. Enzymes: Introduction, kinetics, mechanism of action, inhibition, allosteric enzymes.
9. Laws of thermodynamics.
10. Oxidative phosphorylation: Oxidative phosphorylation in mitochondria, Respiratory complexes, Respiratory chain, ATP synthesis, Inhibitors and uncouplers.

### **ZOO 402C (Practicals)**

1. Estimation of Glycogen following Colorimetric method.
2. Quantitative Estimation of Lipid.
3. Qualitative analysis of the enzyme action of salivary Amylase.
4. Study of the activity of enzyme Trypsin/ Pepsin
5. Estimation of enzymes alkaline phosphates and LDH.

### **Recommended books:**

1. Berg, J.M. et. al. , Biochemistry, W.H. Freeman and Co.
2. Nelson,D.L., COX, M. M. and Lehninger, A.L. , Principles of Biochemistry.
3. Murray, R.K. , Granner, D.K. , et. al. , Harper's Illustrated Biochemistry,Lange Medical Books / Mc Graw – Hill.
4. Lehninger Principles of Biochemistry.
5. Biochemistry, Seventh Edition by Jeremy Mark Berg

## **ZOO 403C: Physiology**

**No of Lectures – 32**

### **Course Outline—**

#### Animal Physiology

1. Digestive system: Mechanical and chemical digestion of food. Role of gastrointestinal hormones, GI tract secretions, Absorptions of carbohydrates, lipids, proteins, water, minerals, vitamins. Disorders of digestive tract.
2. Respiratory system: Pulmonary ventilation, Respiratory volumes and capacities, Transport of oxygen in the blood, Carbon monoxide poisoning, Transport of gases in the blood, Regulation of acid base balance, Control of respiration.
3. Excretory system: Renal blood supply. Mechanism and regulation of urine formation. Regulation of acid-base balance, renal failure and dialysis.
4. Blood: Composition, Structure and function of Haemoglobin, Haemopoiesis, Haemostasis, Coagulation of blood, disorders of blood.
5. Heart : Structure of heart, Coronary circulation, origin and conduction of cardiac impulse, Cardiac cycle , Cardiac output and its regulation – Frank Starling Law of the heart, Autonomic control and Chemical regulation of heart rate, Blood pressure and its regulation, ECG.
6. Nervous system : General organization, Neuron , Resting membrane potential, origin of action potential and its propagation in myelinated and non-myelinated nerve fibers, Synaptic transmission and types of synapsis, Neuromascular junction, Relex activity, Types of reflexes, Physiology of hearing and vision.
7. Muscular system :. Ultra structure of skeletal muscle, Molecular and Chemical basis of muscle contraction. Characteristics of muscle twist, Motor unit, Summation, tetanus, muscular dystrophy.

### **ZOO 403C (Practicals)**

1. Recording of simple muscle twist by electric stimulation
2. Enumeration of RBC using haemocytometer.
3. TLC and DLC of RBC and WBC.
4. Estimation of haemoglobin.
5. Preparation of haemin crystal and haemochromogen crystal.

### **Recommended books:**

1. Guyton, A. C. and Hall, J.E.(2006) Text book of Medical physiology, Hercourt Asia PET Ltd./W.B. Saunders coup.
2. Tortora, G.J. and Grabowski, S, Principles of Anatomy and Physiology, Jhon Wiley and Sons. Inc.
3. Arey, L.B., Human Histology, IV ed. W.B. Saunders.

## **ZOO 404E: Physiology and Biochemistry**

**Nos of Lectures – 32**

### **Course Outline—**

1. Physiology of digestion, Digestion of Carbohydrate, protein and lipid. Function of different digestive glands, Absorption.
2. Respiration: organs of respiration, exchange of gases, transport, respiratory pigments, oxygen association and dissociation. Transport of CO<sub>2</sub>
3. Excretion: Structure and function of kidney. Nephron, Nitrogenous wastes, Different modes of excretion, physiology of excretion.
4. Blood – composition and functions of blood and lymph, blood group, blood coagulation.
5. Nervous system: Neuron, Transmission of nerve impulse, Neuro transmitters.
6. Bio molecules: Carbohydrate, Protein and Lipid. Structure, classification and significance.
7. Enzyme: Classification and mechanism of enzyme action.
8. Cellular respiration.

### **ZOO 404E (Practicals)**

1. Qualitative analyses of activities of Pepsin/ trypsin
2. Preparation of blood smear and study of blood cell types.
3. Preparation of haemin crystal from the blood of toad and mammal
4. Qualitative analyses of Carbohydrate, Protein and Lipid.

## **ZOO 405E: Economic Zoology**

**Nos of Lectures – 32**

### **Course Outline—**

1. Human diseases: Epidemiology of infectious diseases, transmission, prevention and control of diseases: Tuberculosis, Amoebiasis, Dengue,
2. Pathogenicity : Fasciola and Ascaris
3. Crop pests and stored grain pest and their control
4. Silk worms – Types, life history, products, prevention and control of Silk worm pests.
5. Different methods adapted for control of pests. Integrated pest management.
6. Captive and culture fisheries, composite fish culture and induced breeding technique. Indigenous ornamental fishes.

### **ZOO 405E (Practicals)**

1. Study of slides and specimens of Entamoeba, Fasciola and Ascaris
2. Study of important crop pest and stored grain pests.
3. Study of life cycle of Eri, Muga and Mulberry silk worm
4. Study of commercially important fishes and ornamental fishes.

## Semester-V

Sub Code	Subject Title	L+T+P	Credits
ZOO 501C	Developmental Biology	2+1+1	4
ZOO 502C	Endocrinology and Immunology	2+1+1	4
ZOO 503C	Biological techniques and Biotechnology	2+1+1	4
ZOO 504E	Developmental Biology	2+0+1	3
ZOO 505E	Endocrinology& Immunology	2+0+1	3

### ZOO 501C: Developmental Biology

No of Lectures – 32

#### Course Outline—

1. Introduction: History, Principles of development – life cycles, Developmental patterns, Experimental embryology, Role of gene in development.
2. Gametogenesis: Spermatogenesis and Oogenesis, Types of egg.
3. Fertilisation: Changes in gametes, mono and polyspermy. Early development of *C. elegans*. The early development of *Xenopus* – Cleavage, Gastrulation, embryonic induction and organizers. The early development of Chick-cleavage, Gastrulation.
4. Parthenogenesis: Natural and artificial and its significance.
5. Fate map construction in frog and chick.
6. Organogenesis: Development of brain and heart.
7. Extra embryonic membrane in birds and mammal. Placenta in mammal – its structure, type and physiology of Placenta.
8. Metamorphosis: Changes and hormonal regulation in insects and amphibia.
9. Regeneration: mode of regeneration – epimorphosis.
10. Medical implications: Infertility, IVF, Teratogenesis and teratogenic agents.

### ZOO 501C (Practicals)

#### Developmental Biology

1. Study of developmental stages - whole mounts and sections through permanent slides- cleavage, blastula, gastrula, neurula, tail bud stage, tadpole of amphibia and developmental stages in Chick.
2. Regeneration of tadpole tail.
3. Study of developmental stages –Primitive streak, 18 hrs – 96 hrs by raising chick embryo in the laboratory, Isolation and preparation of permanent slides.

#### Recommended books:

1. Sku Robert A., Embryology, Epigenesis and Evolution. Cambridge University press.
2. Stone L S., Foundations of Embryology.
3. Carlson B and Grawn Mc., .Foundations of Embryology.
4. Merrill P Bradely., Foundations of Embryology.

## ZOO 502C: Endocrinology and Immunology

No of Lectures – 32

### Course Outline—

#### Unit I: Endocrinology

1. Brief account of structural features, histological structure and function of endocrine glands – Pituitary, Thyroid, Pancreas, Adrenal and Gonads.
2. Hypothalmo-hypophysial axis.
3. Classification of hormones and mechanism of hormone actions, Synthesis of thyroxine. Metabolic regulation and physiological action of Thyroxine, Insulin and Glucagon.
4. Signal transduction pathways utilized by steroidal and non steroidal hormones.
5. Effects of abnormal secretions of hormones, Placental hormones.
6. Insect hormones

#### Unit – II: Immunology

1. Immune system: Historical perspective of immunology, Early theories of immunology.
2. Components of Immune system : Innate and adaptive (Cell mediated and humoral), Passive: Artificial and Natural immunity, Active: Artificial and Natural immunity.
3. Haematopoiesis and role of haematopoietic factors, Cells of the immune system, Organs of Immune system, Primary and Secondary lymphoid organs, Lymphatic system.
4. Antigenicity and immunogenicity, Immunogens, Adjuvants and Haptens, Factors influencing immunogenicity. B and T cell epitops.
5. Immunoglobulins : Structure, classes and functions, Antigen-Antibody interactions.
6. Major histocompatibility complexes.
7. Immune system in health and disease. Vaccines: bacterial viral toxoid and 3rd generation vaccines. Immunodeficiency, Autoimmunity. Immunity and organ transplantation.

### ZOO 502C (Practicals)

1. Dissection and display of different endocrine glands in vertebrates.
2. Dissection and display of lymphoid organs.
3. Demonstration of antigen –antibody reactions with ABO blood grouping.
4. Preparation of cell suspension of spleen and bone marrow.
5. Study of the macrophages in blood and cell counting.
6. ELISA test.

#### Recommended books:

1. Besser GM and Throner MG, Clinical Endocrinology, Times Mirror.
2. Groot L De .Endocrinology. 3rd edn.
3. Melmed Williams Textbook of Endocrinology.
4. Kindt TJ, Goldsby RA, Osborne BA, Kuby J., VIth Ed, Immunology, WH Freeman and Company.
5. Delves PJ, Martin SJ, Burton DR, Roitt RM., XI<sup>th</sup> Ed. Essential Immunology, Blakewell Publishing.

## ZOO 503C: Biological techniques and Biotechnology

No of Lectures – 32

### Course Outline—

#### Unit- I. Biological techniques:

1. Principles and uses of analytical instruments: pH meter. Colorimeter, Spectrophotometer, Centrifuge and Ultra centrifuge.
2. Microscopy – working principle of light, electron, phase contrast and fluorescence microscopy. Concept of resolution and contrast.
3. Separation techniques in biology – chromatography and electrophoresis
4. Application of Radio Isotope in Biology, Autoradiography.
5. Cryopreservation.
6. Animal cell and tissue culture, molecular techniques in gene manipulation, transgenic animal technology.

#### Unit –II: Biotechnology

1. Concept and scope of biotechnology, tools and techniques of biotechnology.
2. Cell culture media (natural, defined and artificial) , preparation and sterilization , Primary cell culture, cell lines , Pleuripotent stem cells, Cryopreservation of cultures.
3. Introduction to the concept of Recombinant DNA Technology, Cloning vectors, Restriction and modifying enzymes, Transformation Techniques( microbial plants and animals) , Construction and screening of DNA libraries, agarose and Polyacrylamide Gel Electrophoresis, Molecular analysis of DNA, RNA and proteins( i.e. Southern , Northern and Western Blotting) , DNA sequencing ( Maxam Gilbert and Sanger methods) , Polymerase chain reaction and DNA microarrays.
4. Production of Transgenic animal –nuclear transplantation, Retroviral method, DNA micro injection method, application of transgenic mice, sheep, goat, pig, birds, and fish, Dolly and Polly, Scientific significance , Therapeutic applications, Human cloning , Ethical issues of transgenic animals.
5. Molecular diagnosis of genetic diseases (Cystic fibrosis, Huntington's disease, Sickle cell animal), RFLP, RAPD and DNA fingerprinting, Vaccines and therapeutic agents, Recombinant DNA in Medicines (Recombinant insulin and human growth hormone), Gene therapy, Enzymes in detergents and leather industries, Heterologous protein production, Bioremediation.
6. Intellectual property rights, Biosafety levels and guidelines.

### ZOO 503C (Practicals)

1. Determination of pH using pH meter.
2. Preparation of histological sections using microtomy technique.
3. Silica gel/agarose gel electrophoresis technique (separation of protein).
4. PO<sub>4</sub> and NO<sub>3</sub> estimation by using Colorimeter/Spectrophotometer.
5. Preparation of primary cell line/single cell suspension of bone marrow and spleen.
6. Elementary knowledge cell media preparation.

### Recommended books:

1. Glick *et al.*, Molecular Biotechnology, Principles and applications of recombinant DNA, ASM Press.
2. Griffith, A J F *et al.*, An Introduction to genetic analysis, Freeman and Co., New York, USA.
3. Butter, M., Animal cell culture and technology: The basics: Bios Scientific Publishers.
4. Wilson K., Walker J. (Ed). Principles and Techniques of Biochemistry and Molecular Biology.
5. Walt R., Field K.G., Molecular Biology Techniques: An Intensive Laboratory Course [Paperback]

## **ZOO 504E: Developmental Biology**

**No of Lectures – 32**

### **Course Outline—**

1. Gametogenesis – Spermatogenesis and Oogenesis.
2. Fertilisation – sperm egg interactions, Activation of egg, Gamete fusion in sea urchin.
3. Types of eggs, cleavage pattern.
4. Extra embryonic membranes in birds and mammals.
5. Reproduction cycle in Vertebrates.
6. Regeneration.
7. Parthenogenesis.

### **ZOO 504E (Practicals)**

1. Study of developmental stages of fertilized egg of Amphibia and Chick.
2. Study of Chick embryo: 18 hrs – 96 hrs.

## **ZOO 505E: Endocrinology and Immunology**

**No of Lectures – 32**

### **Course Outline—**

1. Brief outline of the organization of endocrine system in mammals with special reference to pituitary, thyroid and gonads.
2. Mechanism of hormone action.
3. Brief outline of Insect hormones and their function
4. Immune system, Components of Immune system: Innate and adaptive (Cell mediated humoral), Passive and active immunity.
5. Immunoglobulins – Structure, classes and function, antigen- antibody reactions.

### **ZOO 505E (Practicals)**

1. Demonstration antigen antibody reaction with ABO blood grouping.
2. Study of permanent slides of endocrine glands and lymphoid organ in vertebrates

## **Semester-VI**

<b>Sub Code</b>	<b>Subject Title</b>	<b>L+T+P</b>	<b>Credits</b>
ZOO 601C	Animal Behaviour	2+1+1	4
ZOO 602C	Evolutionary Biology and Adaptation	2+1+1	4
ZOO 603C	Ecology and Wildlife Biology	2+1+1	4
ZOO 604E	Ecology and Wildlife Biology	2+0+1	3
ZOO 605E	Evolution and Adaptation	2+0+1	3

## **ZOO 601C: Animal Behaviour**

**No of Lectures – 32**

### **Course Outline—**

1. Introduction, Scope and methods of Ethology.
2. Behaviour equipment – Sign, Stimuli, Stimulus filtering.
3. Patterns of behaviour : Individual behavioural pattern
4. Homing behaviour.
5. Genetic basis of behaviour.
6. Circadian chronobiology.
7. Motivation: Models of motivation, feeding and drinking.
8. Learning behaviour: Types of learning, Habituation, Conditional reflex, Insight-learning, Associative learning, Reasoning and Imprinting.
9. Socio-Biology: Social organization, Individual Social interactions, Animal communications, Dance language in insects, Aggregation, Social behaviour of bee, ant and monkey, Role of Pheromones.
10. Communication: Chemical, Visual, Audio, Language of behaviour, Habitual selection, Aggression, Territoriality, Dispersal.

### **ZOO 601C (Practicals)**

1. Study on photo taxis in earthworm, cockroach and bird.
2. Geotropism in earthworm.
3. Temperature tolerance of housefly (cold & hot).
4. Study of behavioural pattern of different species of monkey.
5. Social behaviour in honey bee.

### **Recommended Books:**

1. Davies N. B., Krebs J. R., West S. A., An Introduction to Behavioural Ecology.
2. Alcock J., Animal Behavior: An Evolutionary Approach.
3. Pearce J. M., Animal Learning and Cognition, 3rd Edition.
4. Aubrey M., Dawkins M. S., An Introduction to Animal Behaviour.
5. Barnard C., Animal Behaviour: Mechanism, Development, Function and Evolution.
6. Breed Michal D., Moore J., Animal Behavior.
7. Slater P. J. B., Essentials of Animal Behaviour (Studies in Biology).

## **ZOO 602C: Evolutionary Biology and Adaptation**

**No of Lectures – 32**

### **Course Outline—**

#### **Unit – I: Evolutionary Biology**

1. Life beginning- an overview –chemogeny, biogeny, the RNA world.
2. Neo-darwinism and neo –Lamarckism.



3. Evidences of organic evolution: Paleontological, Embryological, biochemical and molecular evidences.
4. Processes of evolutionary changes – organic variations, population genetics, Natural selection and genetic drift.
5. Phylogeny of horse.
6. Origin and evolution of man.
7. Species concept, Speciation-Genetic and Geographical, Isolating mechanisms.
8. Zoo-geography: factor influencing animal distribution.
9. Geological time scale.
10. Extinction and mass extinction.
11. Fossils: definition, fossilization and significance, dating of fossils.

### **Unit – II: Adaptation.**

1. Principles of adaptation. Types of adaptation – Aquatic, terrestrial and Volant adaptation.
2. Adaptive Radiation in mammal.
3. Cryptic and Warning coloration, Mimicry.

### **ZOO 602C (Practicals)**

1. Construction of phylogenetic trees and interpretation of results.
2. Designing primer for a gene (16S r RNA).
3. DNA database and sequence retrieval from databases.

### **Recommended books:**

1. Ridley. M, Evolution, Blackwell Publishing.
2. Barton, N. H., et.al. Evolution Cold Spring Harbon Laboratory Press.
3. Hal, B. K. et al. Evolution Jones and Barlett Publishers.
4. Lemurs, Ecology and adaptation, (Development in Primatology: Progress and Prospects) Edited by L Gould M L Seuther.
5. Parker G., Adaptation and Ecology.
6. Rose E., Animal adaptation for survival; The Rosen Publishing Group.

### **ZOO 603C: Ecology and Wildlife Biology**

**No of Lectures – 32**

#### **Course Outline—**

##### **Unit: I Ecology**

1. History of ecology, autecology, synecology. Species (Sympatric and Allopatric), Population, Community.
2. Abiotic factors: Temperature- distribution, as a limiting factor. Light- composition, as a limiting factor. Moisture and Humidity.
3. Laws of Limiting factors: Liebig's law of minimum. Shelford law of tolerance Soil types and soil erosion.

4. Population: It's unique and group attributes- density, natality, mortality, Life tables, survivorship curves, age-ratio, sex-ratio.
5. Population growth: Exponential/Malthusian and Sigmoid growth pattern, Verhulst- Pearl growth equation, 'r' and 'k' strategies.
6. Niche concept, Gause's principle of Competitive exclusion.
7. Community: diversity & diversity index, community stratification, edge- effect, succession, climax community.
8. Environmental Biology- Elementary knowledge of pollution and toxicology

#### Unit: 2 Wildlife Conservation & Management

1. Definition of Wildlife.
2. Strategies for Wildlife Conservation & Management.
3. Wildlife protection Act of 1972.(amended, 1991).
4. Wildlife sanctuaries, national parks, Biosphere reserves of N E India.
5. IUCN Red list categories.
6. Endangered mammalian species of N E India.

#### ZOO 603C (Practicals)

1. Study and estimation of pH, alkalinity, CO<sub>2</sub>, DO, turbidity of water.
2. Temperature, moisture content and pH of soil.
3. Study and analysis of population density by quadrat method.
4. Study and measurement of environmental factors- humidity, temperature etc.
5. Study of pug marks.
6. Study of food plants of herbivorous animals.

#### **Recommended books:**

1. Colinvuax, P.A.(1993). Ecology.II Edition.Wiley, John and Sons, Inc.
2. Krebs, C.J.(2001). Ecology, VI Edition., Benjamin Cummings.
3. Odum, E.P.,(2008). Fundamentals of Ecology, Indian Edition, Brooks/Cole.
4. Kotpal,R.L. and N.P. Bali,1986. Concepts of Ecology, Vishal Publications, Delhi- 7, 264 pp.
5. Rastogi V.B. and M.S. Jayarai, 1988-89. Animal Ecology and distribution of animals, Kedar Nath Ram Nath, Meerut- 250001, 429 pp.
6. Eugene P. Odum, 1971. Fundamentals of Ecology. Saunders International Student Edition, W.B.Saunders company, Philadelphia, London, Toronto, 574 pp.
7. Verma, P.S. and V.K. Agarwal, 1986. Environmental Biology, S. Chand & Co. Ltd., 591pp.
8. Richard Manual of Wildlife life Conservation.

#### ZOO 604E: Ecology and Wildlife Biology

No of Lectures – 32

#### Course Outline—

##### Ecology:

1. Definition: Auto ecology and Syn ecology.
2. Ecosystem concept, Ecosystem energetics.
3. Pollution and Control measures: Air, Water, Noise and other types of pollution.

### **Wildlife Biology:**

1. Definition of Wild life, Wild life protection act, 1972.
2. Principles of Wild life Protection and management.
3. Conservation of Wildlife and importance of Biodiversity.
4. Wild life of N.E. region with special reference to Kaziranga and Manas National Park.

### **ZOO 604E (Practicals)**

1. Estimation of pH, D.O of water
2. Measurement of humidity, temperature of environment.
3. Measurement of pH of soil
4. Study of food plants of herbivorous animals

### **ZOO 605E: Evolution and Adaptation**

**No of Lectures – 32**

#### **Course Outline—**

#### **Evolution:**

1. Concept of evolution: Macro and Micro evolution.
2. Origin of life: Spontaneous generation, formation of organic compounds, sources of energy and food.
3. Evidences of organic evolution: Embryological, Paleontological and Biochemical evidences.
4. Darwinism and Neo-Darwinism
5. Lamarckism and Neo- Lamarckism.
6. Evolution of Man.

#### **Adaptation:**

- |                                  |                           |
|----------------------------------|---------------------------|
| 1. Principles of adaptation      | 2. Types of adaptations.  |
| 3. Volant and Aquatic adaptation | 4. Coloration and Mimicry |

### **ZOO 605E (Practicals)**

1. Study of homologous and analogous organs
2. Study of museum specimens of evolutionary significance
3. Study of animals with reference to mimicry