

**U.G. 2<sup>nd</sup> Semester**

**Paper: ZOO201C (Core)  
Animal Diversity III: Protochordates to Chordates**

**Credits: 5 = 3+0+2 (48 Lectures)**

**Theory: 48 Lectures**

**Unit 1: Introduction to chordates (9 Lectures)**

1. General characteristics, and outline classification of Chordata. **(3L)**
2. Origin of Chordata-Dipleurula concept and the Echinoderm theory of origin of chordates; 3. Advanced features of vertebrates over protochordates

**Protochordata (6L)** 1. General characteristics and classification of sub-phylum Hemichordate, Urochordata and Cephalochordata up to Classes; 2. Salient features and affinities of Balanoglossus; 3. Retrogressive metamorphosis in urochordata (Ascidia); 4. Affinities of Amphioxus

**Unit 2: Agnatha and Pisces (11 Lectures)**

**2.1: Agnatha: (5L)**

1. General characters and classification of cyclostomes up to order with examples; 2. Ammocoete larva and its evolutionary significance; 3. Distinction between Petromyzon and Myxine.

**2.2: Pisces : (6L)**

1. General characters and classification of Chondrichthyes and Osteichthyes up to subclass/order with examples; 2. Accessory respiratory organ, osmoregulation in fishes; 3. Migration and parental care in fishes.

**Unit 3: Amphibia and Reptilia (15 Lectures)**

**3.1: Amphibia: (8L)**

1. General characters and classification up to living Orders with examples; 2. Respiration and parental care in Amphibia 3. Neoteny and paedogenesis; 3. Origin of tetrapoda (evolution of terrestrial ectotherms)

**3.2: Reptilia: (7L)**

1. General characters and classification up to living Orders with examples; 2. Poisonous and non poisonous snakes; 3. Poison apparatus and Biting mechanism in Snake; 4. Affinities of Sphenodon

**Unit 4: Aves and Mammalia (13 Lectures)**

**4.1: Aves : 5L**

1. General characters and classification up to living orders with examples; 2. Migration in Birds; 3. Archaeopteryx- a connecting link; 4. Flight adaptation and flight mechanism.

**4.2: Mammals: 8L**

1. General characters and classification up to living orders with examples; 2. Affinities of Prototheria and Marsupialia; 3. Adaptive radiation w.r.t. locomotory appendages; 4. Echolocation in chiropterans.

## **Practicals: (2 Credits)**

1. Dissections/ models:
  - a) Scoliodon – Afferent branchial system, Efferent branchial system, V,VII, IX, and X cranial nerves (demonstration through already dissected specimen).
  - b) Weberian ossicle of *Mystus* /Rohu/ Catla.
  - c) Mice: Arterial & Reproductive system (demonstration).
2. Temporary mounting: Placoid, Cycloid, Ctenoid scales, Squamous and Ciliated Epithelium, Striated and non-striated 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, House sparrow, Owl, Hedgehog, Manis, Bat, Monkey.

**\*\*Lab note book, with drawing and labelling; methods where applicable.**

## **Recommended books:**

1. Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.
2. Pough H. Vertebrate life, VIII Edition, Pearson International.
3. Parker, T. J. & Haswell, W. (1972). Text Book of Zoology , Volume II: Marshall and Willam (Eds.) 7th Ed. Macmillan Press, London.
4. Kardong, K. V. (2002). Vertebrates: Comparative anatomy, function evolution. Tata McGraw Hill. McGraw Hill.
5. Romer, A. S. & Parsons, T. S. (1986). The vertebrate body. 6th Ed. Saunders College Publishing.
6. Jordan, E.L. & Verma, P.S. (2003). Chordate Zoology. S. Chand & Company Ltd. New Delhi.
7. Sinha, K. S., Adhikari, S., Ganguly, B. B. & Bharati Goswami, B. D. (2001). Biology of Animals. Vol. II. New Central Book Agency (p) Ltd.
8. Futuyama, D. (1997). Evolutionary Biology. 3rd Ed. Sinauer Associates, INC. Note: Classifications for Protochordata, Agnatha, Reptilia, Aves and Mammalia to be followed from
9. Young (1981), for Pisces to be followed from Romer (1959), for Amphibia to be followed from Duellman and Trueb (1986).

**Paper: ZOO202C (Core)**

**Cell Biology**

**Credits: 5=3+0+2 (48 Lectures)**

## **Theory: 48 Lectures**

### **Unit 1:**

**(8 Lectures)**

#### **1.1: Overview of Cells (3L)**

1. Introduction to Cell Theory
2. Basic structure of Prokaryotic and Eukaryotic cells and their comparison, viruses
3. Elementary idea of microscopy and cell fraction.

### **1.2: Organization of cell-I: (5L)**

1. Ultra structure and composition of Plasma membrane: Various models; 2. Function of plasma membrane: permeability, osmosis, transport across membrane (active and passive), facilitated transport; 3. Elementary knowledge of cell communication and cell junctions.

### **Unit 2: Organization of the cell-II**

**(18 Lectures)**

#### **2.1: Cytoplasmic organelles I: (8L)**

1. Structure and Functions: Endoplasmic Reticulum, Golgi Apparatus, Lysosomes, Ribosomes;
2. Protein sorting and mechanisms of vesicular transport

#### **2.2: Cytoplasmic organelles II: (5L)**

1. Mitochondria: Structure and function; 2. Mitochondrial Respiratory Chain and electron transport, Chemi-osmotic hypothesis; biogenesis of mitochondria; 3. Peroxisome: structure and function.

#### **2.3: Nuclear organization (5L)**

1. Structure of nucleus (nuclear envelope, nuclear pore complex, nucleolus) and function, biogenesis of ribosome, 2. Interface chromatin and its compaction into metaphase chromosome, euchromatin and heterochromatin.

### **Unit 3: Cytoskeleton and cell reproduction**

**(12 Lectures)**

#### **3.1: Cytoskeleton (3L)**

1. Types of cytoskeleton and their role in cell movement; 2. Structure and function of microtubules, microfilament and intermediate filament.

#### **3.2: Cell reproduction (9L)**

1. Basic features of cell cycle, regulation of cell cycle progression; 2. Events of mitosis, mitotic spindle and chromosome movement; 3. Events and phases of meiosis and its significance.

### **Unit 4: Multiplicative cell division and cell signaling**

**(10 Lectures)**

1. Elementary knowledge of cancer: its development, types and causes; 2. Concept of tumor viruses, oncogenes and tumor suppressor genes with special reference to p53. 3. Cell signalling transduction pathways; Types of signaling molecules and receptors; 4. GPCR and Role of second messenger (cAMP); 5. Apoptosis and Necrosis/cell death and cell renewal: programmed cell death and necrosis.

### **Practicals: (2 Credits)**

1. Familiarization with the student's light microscope and stereo binocular microscope.
2. Diversity of eukaryotic cells – methylene blue staining of buccal epithelium, striated muscle cells; Leishman staining of mammalian blood cells
3. Permeability of plasma membrane – effect of isotonic, hypotonic and hypertonic solutions on mammalian RBC.
4. Staining of nucleus and nucleolus from any given sample.
5. Staining of mitochondria from buccal epithelium.
6. Staining of Golgi complex.
7. Study various stages of mitosis from the temporary squash preparation of onion root tip/ tadpole tail.
8. Study of meiosis from the temporary squash preparation in grasshopper/grylotalpa testes.
9. Demonstration of preparation of polytene chromosomes from salivary glands of Chironomous larva.

**\*\*Lab note book, with drawing and labelling; methods where applicable.**

## Reference Books-

1. Lewin's Cells – 3rd Edition – Cassimeris/Lingappa/Plopper – Johns & Bartlett Publishers (2013).
2. Biology of Cancer by Robert. A. Weinberg. 2nd edition., Garland Science (2013).
3. The Cell: A Molecular Approach. V Edition. Cooper, G.M. and Hausman, R.E. (2009), ASM Press and Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Molecular Biology of the Cell, V Edition, Garland publishing Inc., New York, Bruce Albert, Bray Dennis, Levis Julian, Raff Martin, Roberts Keith and Watson James (2008).
5. Karp G. 2010, Cell and Molecular Biology, John Wiley Publication, 6thEdn. John Wiley and Sons.
6. De Robertis, E.D.P. and De Robertis, E.M.F. (2006) Cell and Molecular Biology 8thEdn. Lippincott and Williams and Wilkins, Philadelphia.
7. Lodishet et al. 2008: Molecular Cell Biology (Freeman)
8. Becker W.M. et al. 2009: The World of the Cell, 7thEdn. Pearson Benjamin Cummings Publishing, San Fransisco.

## Paper Code – ZOO203G (General Elective) Environment and Public Health

Credits: 4=2+1+1 (32 Lectures)

### Theory: 32 Lectures

#### UNIT I: Introduction (3 Lectures)

Sources of Environmental hazards, hazard identification and accounting, fate of toxic and persistent substances in the environment, dose Response Evaluation, exposure Assessment.

#### UNIT II: Climate Change and Pollution (12 Lectures)

Greenhouse gases and global warming, Acid rain, Ozone layer destruction, Effect of climate change on public health; Air, water, noise pollution; sources and effects, Pollution control.

#### Unit III: Waste Management Technologies (9 Lectures)

Sources of waste, types and characteristics, Sewage disposal and its management, Solid waste disposal, Biomedical waste handling and disposal, Nuclear waste handling and disposal, Waste from thermal power plants, Case histories on Bhopal gas tragedy, Chernobyl disaster, Seveso disaster and Three Mile Island accident and their aftermath.

#### Unit IV: Diseases (8 Lectures)

Causes, symptoms and control of tuberculosis, Asthma, Cholera, Minamata disease, typhoid

#### Practicals: (1 Credit)

Determination of pH, Cl, SO<sub>4</sub>, NO<sub>3</sub> in soil and water samples from different locations.

**\*\* Lab notebook with labelled diagrams, methods (wherever applicable) and results must be incorporated.**

### **Recommended Books-**

1. Cutter, S.L., Environmental Risk and Hazards, Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.
2. Kolluru Rao, Bartell Steven, Pitblado R and Stricoff —Risk Assessment and Management Handbook]], McGraw Hill Inc., New York,1996.
3. Kofi Asante Duah —Risk Assessment in Environmental management]], John Wiley and sons, Singapore, 1998.
4. Kasperson, J.X. and Kasperson, R.E. and Kasperson,R.E., Global Environmental Risks, V.N.University Press, New York, 2003.
5. Joseph F Louvar and B Diane Louver Health and Environmental Risk Analysis fundamentals with applications, Prentice Hall, New Jersey 1997.