FIRST SEMESTER:

DETAILED SYLLABUS

ZOOL. 101: STRUCTURE AND FUNCTION OF INVERTEBRATES

UNIT I

1. Organization of coelom: Acoelomates, Pseudocoelomates and coelomates
2. Protostomia and Deuterostomia
3. Locomotion: Flagellar and ciliary movement in Protozoa
4. Hydrostatic movement in Coelenterata, Annelida and Echinodermata

UNIT II

5. Patterns of feeding and digestion in lower Metazoa
6. Filter feeding in Polychaeta, Mollusca and Echinodermata
7. Organs of respiration: Gills, lungs and tracheae
8. Respiratory pigments and their functions
9. Mechanism of respiration and transport of gases

UNIT III

10. Organs of excretion: Coelom, coelomoducts, nephridia and Malphigian tubules
11. Mechanism of excretion in invertebrates
12. Primitive Nervous system of Coelenterates and Echinoderms
13. Advanced Nervous system of Annelida, Arthropoda (Crustacea and Insecta) and Mollusca (Cephalopoda)

UNIT IV

14. Trends in neural evolution
15. Larval forms of crustacean, mollusca and echinodermata
16. Larval forms of invertebrate parasites
17. Strategies and evolutionary significance of larval forms

UNIT V

18. Organization and general characters of Rotifera
19. Organization and general characters of Acanthocephala
20. Organization and general characters of Ectoprocta
21. Organization and general characters of Endoprocta
22. Organization and general characters of Phoronida

Suggested Readings:
ZOOl. 102: Quantitative Biology and Bioinformatics

UNIT I
1. Distribution: Normal, Binomial and Poisson
2. Hypothesis testing
3. Student’s t test
4. Chi Square test
5. The mean, mode, median, Standard deviation and Standard error of classified Data

UNIT II
6. Analysis of variance (one way and two way ANOVA)
7. Correlation
8. Regression
9. Graphic representation of data

UNIT III
10. Computers and their applications in biology
11. Operating systems: DOS, WINDOWS
12. Application softwares: MS Word, MS Access
13. MS Excel, MS Power Point
14. Internet and its uses

UNIT IV
15. Bioinformatics: Definition, history and scope
16. Analysis of DNA and protein sequences; molecular and genomic databases (e.g., GENEBANK, SWISS-PROT and other databases)
17. Introductory ideas on use of databases for sequence retrieval, similarity search and sequence alignment; post-transcriptional modification prediction
18. Bioinformatics in drug discovery

UNIT V
19. Types of models: Deterministic and statistical, empirical, mechanistic, simulation of biological problems.
20. Formation and properties of models - generality, precision, realism and validation
21. Building population models for biological species of different categories, wild life population models
22. Eutrophication models - cycling of nutrients in an ecosystem

Suggested Readings:
ZOOL. 103: CELLULAR AND MOLECULAR BIOLOGY

UNIT I

1. Biomembranes: Structure of Membrane (Fluid mosaic model), Molecular composition of the membrane, Functional significance
2. Transport across cell membranes: Simple diffusion and osmosis, facilitated diffusion (Transporters, uniports and antiports carriers, symports, ion channels), Active transport, Membrane pumps, Bulk transport (Endocytosis and Exocytosis)
4. Intracellular transport: Axonal transport, Transport of pigment in melanophores: Role of kinesin and dynein

UNIT II

5. Cell - cell adhesion and cell junctions: Collagen and Non-collagen components of extracellular matrix of animal cells, Fibronectins and Integrins, Cell adhesion proteins, their types, Cell junctions (occluding, Anchoring & Gap junctions)
6. Signal transduction mechanisms: Intracellular and Cell surface receptors, Signal amplification, Secondary messengers, Signaling through G-protein coupled receptors (PKA, PKC), Enzyme linked receptor signaling (Growth factor receptor signaling, Jnk, SEF pathway), Network and crosstalk between different signaling mechanisms, Role of NO and CO in cell signaling

UNIT III

7. Neurons: General organization of neurons, Classification of neurons
8. Glia: Structure & Types of glia, Functions of glia
10. Muscle contraction: Excitation – contraction coupling and Sarcoplasmic reticulum

Pielou, E.C. The Interpretation of Ecological Data: A Primer on Classification and Ordination.
De Sapio, C. Calculus for Biologists.
Rubinov, S.I. Introduction to Mathematical Biology.
Saxena, V.P. 'Jai' Gauri Ek Purushayati' (M.P. Hindi Granth Academy).
Swindell. Internet for the Molecular Biologists III. Horizon Scientific. 1996.
UNIT IV

12. Organelle genome: Mitochondrial genome: Structure and function
13. Gene mutation: Induced mutations, spontaneous mutations
14. DNA damage and repair: Types of DNA damage, Basic pathway of DNA Repair, DNA methylation
15. Gene regulation in prokaryotes: DNA binding motifs, Lac operon, Tryptophan operon

UNIT V

16. Sex determination in Drosophila: Chromosomal basis, Molecular basis
17. Sex determination in mammals: Hormonal basis, Molecular basis
18. Dosage compensation, Basic concepts in Drosophila, Basic concepts in mammals

Suggested Readings:

Darnell, J; Lodish; and Baltimore. Molecular Cell Biology. Scientific American Book, Inc., USA
De Robertis & De Robertis. Cell and Molecular Biology. Lea & Febiger

ZOOLO. 104: TOOLS AND TECHNIQUES FOR BIOLOGY

UNIT I

1. Microscopy, principle & applications of: Light microscope, phase contrast microscope and Fluorescence microscope
2. General principle and applications of Electron microscope (TEM & SEM)
3. Principle and applications of Confocal microscopy
4. Cryotechniques: Cryopreservation of cells, tissues, organs and organisms
Preparation, fracture & freeze drying

UNIT II

5. Principles and applications of photometry: Beer & Lambert's law, Absorption spectrum & absorption maxima
6. Colorimeter & spectrophotometer
7. Flame photometer
8. Atomic absorption spectrophotometer
UNIT III

9. Separation techniques: Chromatography, principle, types and applications
10. Electrophoresis, principle, types & applications, PAGE and agarose gel electrophoresis
11. Radioisotopes in biology: Units of radioactivity, Radioactive counters
12. Autoradiography

UNIT IV

13. Techniques in immunodetection: Immunocyto-/histochemistry, Immunoblotting, Immunodetection and immunofluorescence
14. Surgical techniques: Organ ablation (e.g., ovarioectomy, adrenalectomy etc.) Perfusion techniques and Stereotaxy
15. Histological techniques: Principles of tissue fixation, Microtomy, cryotomy, and Histochemical staining
16. Immunological techniques: Immunodiffusion and Immunoelectrophoresis

UNIT V

17. Cell culture techniques:
   - Design and functioning of tissue culture laboratory
   - Culture media, essential components and preparation
   - Cell viability testing
18. Cytological techniques:
   - Mitotic & Meiotic chromosome preparations from insects and vertebrates
   - Chromosome banding techniques (G-, C-, Q-, R-banding etc.)
19. Molecular cytological techniques:
   - In situ hybridization (radiolabelled & non-radiolabelled methods), FISH, and Restriction banding
20. Molecular biology techniques:
   - Southern hybridization and Northern hybridization
   - DNA sequencing
   - Polymerase chain reaction (PCR)

Suggested Readings: