III rd Sem

CORE COURSE: ZOOLOGY
PAPER V
DIVERSITY AND DISTRIBUTION OF CHORDATA
(CREDITS: THEORY-4, PRACTICALS-2)
THEORY

LECTURES: 60 Marks 75

Unit 1: Protochordata and Origin of Chordates

General characters of Hemichordata, Urochordata and Cephalochordata; Study of larval forms in protochordates (Tornaria, Ascidian tadpole); Retrogressive metamorphosis in Urochordata; Dipleurula concept and Origin of chordates.

Unit 2: Introduction to Vertebrata and Agnatha

Advanced features of vertebrates over Protochordata; Agnatha and its affinities; General characters and classification of cyclostomes up to class; Structural peculiarities and affinities of *Petromyzon* and *Myxine*. Ammocoete larva.

Unit 3: Pisces and Amphibia

General characters of Chondrichthyes and Osteichthyes and classification up to order; Migration; Osmoregulation and accessory respiratory organs in fishes; Scales in fishes; Origin of *Tetrapoda*; General characters and classification up to order and Parental care in Amphibians. Neoteny.

Unit 4: Reptilia and Aves

General characters and classification upto order; Skull in Reptilia; Structure and Affinities of *Sphenodon*; Poison apparatus, snake venom and Biting mechanism in snakes; General characters and classification up to order; Principles and aerodynamics of flight, Flight adaptations; *Archaeopteryx*- a connecting link and Migration in birds.

Unit 5: Mammals and Zoogeography

General characters and classification up to order; Affinities of Prototheria and Metatheria; Dentition in mammals; Adaptive radiation with reference to locomotory appendages; Zoogeographical realms; Theories pertaining to distribution of animals and Distribution of vertebrates in different realms.

PRACTICAL **Marks 25**

1. Protochordata

1. *Balanoglossus, Herdmania, Branchiostoma* and Colonial Urochordata.
2. Sections of *Balanoglossus* through proboscis and branchiogenital regions.
3. Sections of *Amphioxus* through pharyngeal, intestinal and caudal regions.
4. Permanent slide of spicules of *Herdmania*.

2.Agnatha

5. *Petromyzon* and *Myxine*.

3. Fishes

6. *Sphyrna, Pristis, Trygon, Torpedo, Chimaera, Notopterus, Mystus, Heteropneustes, Hippocampus, Exocoetus, Echeneis, Anguilla, Tetrodon,Diodon, Anabas* and Flat fish. Preparation of temporary mounts of placoid, cycloid and ctenoid scales

4.Amphibia

7. *Ichthyophis/Ureotyphlus, Necturus, Duttaphrynus, Polypedates, Hyla, Alytes* and *Salamandra*.

5. Reptiles

8. *Chelone, Trionyx, Hemidactylus, Varanus, Uromastix, Chamaeleon, Draco, Ophiosaurus, Bungarus, Vipera, Naja, Hydrophis, Zamenis* and *Crocodylus*.
9. Key for Identification of poisonous and non-poisonous snakes.

6. Aves

10. Study of six common birds from different orders.
11. Types of beaks and claws.
12. Types of feathers.

7. **Mammalia**

13. Sorex, Bat (Insectivorous and Frugivorous), *Funambulus, Loris, Herpestes* and *Hemiechenis.*

SUGGESTED READINGS

1. Agarwal VK (2011) Zoology for degree students. S. Chand, New Delhi.
2. Arora MP (2006) Chordata-1. 1st Edition. Himalaya Publishing House, New Delhi.
3. Hall BK and Hallgrimsson B (2008) *Strickberger's Evolution*. 4th Edition. Jones and Bartlett Publishers Inc., USA.
4. Jordan EL and Verma PS (1963) Chordate Zoology. Revised Edition. S. Chand, New Delhi.
5. Mohanty PK (2000) Illustrated Dictionary of Biology. Kalyani Publishers, Ludhiana.
6. Young JZ (2004) *The Life of Vertebrates*. 3rd Edition. Oxford University Press, USA.

Question Pattern for Practical

1. Preparation of temporary mounts of placoid, cycloid and ctenoid scales 06
2. Spotting (1-7) at least one from each group and each carrying 2 marks (2X7=14)
3. Record – 02 marks
4. Viva – voce – 03 marks

IIIrd Sem

CORE COURSE: ZOOLOGY

PAPER VI

PHYSIOLOGY – CONTROLLING AND COORDINATING SYSTEM

(CREDITS: THEORY-4, PRACTICALS-2)

THEORY

LECTURES: 60 Marks 75

Unit 1: Tissues and Glands, Bone and cartilage

Structure, location, function and classification of Epithelial tissue, Types of glands and their functions; Connective tissue, Structure and types of bones and cartilages; Ossification, bone growth and resorption; Muscular tissue, Nervous tissue.

Unit 2: Nervous System

Structure of neuron, resting membrane potential; Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibers; types of synapsis, Synaptic transmission; Neuromuscular junction; Reflex arc and Reflex action and its types; Physiology of hearing and vision.

Unit 3: Muscle

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 4: Reproductive System

Histology of male and female reproductive systems; Puberty; Physiology of reproduction of male and female; Methods of contraception (depicted through flow chart). Gonadal hormones; Placental hormones.

Unit 5: Endocrine System

Classification of hormones; Regulation of their secretion; Mode of hormone action; Signal transduction pathways utilized by steroidal and non-steroidal hormones; Hypothalamus (neuroendocrine gland), Functional Histology of endocrine glands - pineal, pituitary, thyroid, parathyroid, thymus, pancreas, adrenals; Hormones secreted by them and their mechanism of action.

PRACTICALS Marks 25

1. Demonstration of the unconditioned reflex action (Deep tendon reflex such as knee jerk reflex).
2. Preparation of temporary mounts: Squamous epithelium, Striated muscle fibres and nerve cells.
3. Examination of sections of mammalian skin, Cartilage, Bone, Spinal cord, Nerve cell, Pituitary, Pancreas, Testis, Ovary, Adrenal, Thyroid and Parathyroid.

Question Pattern for Practical

1. Demonstration of the unconditioned reflex action (Deep tendon reflex such as knee jerk - reflex) 08 marks

Or

Preparation of temporary mounts: Squamous epithelium, Striated muscle fibres and nerve cell

2. Spotting (sections of mammalian skin, Cartilage, Bone, Spinal cord, Nerve cell, Pituitary, Pancreas, Testis, Ovary, Adrenal, Thyroid and Parathyroid)(1-6) each carrying 2 marks (2X6=12)
3. Record – 02 marks
4. Viva – voce – 03 marks

SUGGESTED BOOKS

1. Arey LB (1974) Human Histology. 4th Edition. W.B. Saunders, USA.
2. Chatterjee CC (2008) Human Physiology. Vol. I and II. Medical Allied Agency, Kolkata.
3. Guyton AC and Hall JE (2006) Textbook of Medical Physiology. 9th Edition. W.B. Saunders Company, Philadelphia.
4. Mohanty PK (2000) Illustrated Dictionary of Biology. Kalyani Publishers, Ludhiana.
5. Tortora GJ and Derrickson B (2012) Principles of Anatomy & Physiology. 13th Edition John Wiley and sons, USA.
6. Victor PE (2008) diFiore's Atlas of Histology with Functional Correlations. 12th Edition. Lippincott W. and Wilkins, USA.

III rd Sem

CORE COURSE: ZOOLOGY

PAPER VII

COMPARATIVE ANATOMY OF VERTEBRATES AND BIOSTATISTICS

(CREDITS: THEORY-4, PRACTICALS-2)

THEORY

LECTURES: 60 Marks 75

Unit 1: Integumentary System and Skeletal System

Structure, functions and derivatives of integument; Axial and appendicular skeletons; Jaw suspensorium in vertebrates.

Unit 2: Digestive and Respiratory System

Alimentary canal and associated glands; Skin, gills, lungs and air sacs in fishes.

Unit 3: Circulatory System and Urinogenital System

General plan of circulation; Evolution of heart and aortic arches; Succession of kidney; Evolution of urinogenital ducts and Types of mammalian uteri.

Unit 4: Nervous System and Sense Organs

Comparative account of brain; Autonomic nervous system; Spinal Nerves; Spinal cord; Cranial nerves in Mammals; Classification of receptors; visual receptors, chemo-receptors and mechanoreceptors.

Unit 5: Biostatistics

Collection of data, classification and tabulation of data; Graphical representation of data (pie chart, histogram); Measurement of Central Tendency (Mean, Median and Mode); Measurement of Dispersion (Mean and standard Deviation)

PRACTICAL Marks 25

1. Problems related to biostatistics
2. Disarticulated skeleton of Frog, *Varanus,* Fowl and Rabbit.

Question Pattern

1. Problems related to biostatistics 08 marks
2. Spotting (1-6) each carrying 2 marks (2X6=12)
3. Record – 02 marks
4. Viva – voce – 03 marks

SUGGESTED READINGS

1. Hilderbrand M and Gaslow GE. Analysis of Vertebrate Structure. John Wiley and Sons., USA.
2. Kardong KV (2005) Vertebrates' Comparative Anatomy, Function and Evolution. 4th Edition. McGraw-Hill Higher Education, New York.
3. Kent GC and Carr RK (2000) Comparative Anatomy of the Vertebrates. 9th Edition. The McGraw-Hill Companies, New York.
4. Mohanty PK (2000) Illustrated Dictionary of Biology. Kalyani Publishers, Ludhiana.
5. Weichert CK and William Presch (1970) Elements of Chordate Anatomy. Tata McGraw Hill, New York.
6. Mishra and Mishra – Biostatiscs
7. Statistics: S.P. Gupta

IV 2th Sem

CORE COURSE: ZOOLOGY
PAPER VIII
BIOCHEMISTRY OF METABOLIC PROCESSES
(CREDITS: THEORY-4, PRACTICALS-2)
THEORY

LECTURES: 60 Marks 75

Unit 1: Biomolecules and their Separation Techniques

Structures and properties of important mono-, di- and polysaccharides; Fatty acids, triglycerides and steroids; and amino acids and proteins. A brief idea on the principles and applications of Spectroscopy, Centrifuagation and Chromatography.

Unit 2: Carbohydrate Metabolism

Glycolysis; Citric acid cycle; pentose phosphate pathway; Gluconeogenesis; Glycogenolysis; Glycogenesis.

Unit 3: Lipid Metabolism

β-oxidation of saturated fatty acids with even and odd number of carbon atoms; Biosynthesis of palmitic acid and Ketogenesis and its regulation.

Unit 4: Protein Metabolism

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

Unit 5: Enzymes

pH and Buffer; Kinetics (Michaelis - Menten derivation) and Mechanism of action of enzymes; Inhibition of enzyme action; Allosteric enzymes; Inhibitors and Uncouplers.

PRACTICALS **Marks 25**

1. Identification of unknown carbohydrates in given solutions (Starch, Sucrose, Lactose, Galactose, Glucose, Fructose).
2. Colour tests of functional groups in protein solutions.
3. Action of salivary amylase under optimum conditions.
4. Effect of pH on the action of salivary amylase.
5. Effect of temperature on the action of salivary amylase.
6. Estimation of total protein in given solutions by Lowry's method.

Question Pattern

Q1. Major Experiment (Any one) 12 marks

a) Identification of unknown carbohydrates in given solutions (Starch, Sucrose, Lactose, Galactose, Glucose, and Fructose).
b) Estimation of total protein in given solutions by Lowry's method.

Q2. Minor Experiment (Any one) 08 mark

a) Colour tests of functional groups in protein solutions.
b) Action of salivary amylase under optimum conditions.
c) Effect of pH on the action of salivary amylase.
d) Effect of temperature on the action of salivary amylase.

Q3. Record – 02 marks

Q4. Viva – voce – 03 marks

SUGGESTED READINGS

1. Berg JM, Tymoczko JL and Stryer L (2007) Biochemistry. 6th Edition, W.H. Freeman and Co., New York.

2. Cox MM and Nelson DL (2008) Lehninger Principles of Biochemistry. 5th Edition. W.H. Freeman and Co., New York.
3. Devesena T (2014) Enzymology. 2nd Edition. Oxford University Press, UK.
4. Hames BD and Hooper NM (2000) Instant Notes in Biochemistry. 2nd Edition. BIOS Scientific Publishers Ltd., U.K.
5. Mohanty PK (2000) Illustrated Dictionary of Biology. Kalyani Publishers, Ludhiana.
6. Murray RK, Bender DA, Botham KM, Kennelly PJ, Rodwell VW and Well PA (2009) Harper's Illustrated Biochemistry. 28th Edition. International Edition. The McGraw-Hill Companies Inc., New York.

CORE COURSE: ZOOLOGY
PAPER IX
CELL BIOLOGY
(CREDITS: THEORY-4, PRACTICALS-2)
THEORY
LECTURES: 60 Marks 75

Unit 1: Cells and Plasma Membrane

Prokaryotic and Eukaryotic cells; Mycoplasma;Virus, Viroids,Virionsand Prions; Various models of plasma membrane; Transport across membranes; Cell junctions:Occluding junctions (Tight junctions), Anchoring junctions (desmosomes), Communicating junctions (gap junctions) and Plasmodesmata.

Unit 2: Endomembrane System, Mitochondria and Peroxisomes

The Endoplasmic Reticulum; Golgi apparatus; Mechanism of vesicular transport; Lysosomes; Structure and function of mitochondria: Chemi-osmotic hypothesis; Semiautonomous nature of mitochondria; Endosymbiotic hypothesis and Peroxisomes.

Unit 3: Cytoskeleton and Nucleus

Structure and functions of intermediate filament, microtubules and microfilaments; Ultra structure of nucleus; Nuclear envelope: Structure of nuclear pore complex; Chromosomal DNA and its packaging; Structure and function of Nucleolus.

Unit 4: Cell Cycle and Cell Signaling

Cell cycle, Regulation of cell cycle; Signaling molecules and their receptors.

Unit 5: Apoptosis and Cancer

Extrinsic (Death Receptor) Pathway and Intrinsic (Mitochondrial) Pathway; Growth and development of tumors and Metastasis.

PRACTICAL **Marks 25**

1. Gram's staining technique for visualization of prokaryotic cells.
2. Study various stages of mitosis from permanent slides.
3. Study various stages of meiosis from permanent slides.
4. Study the presence of Barr body in human female blood cells/cheek cells. (Preparation of permanent slides).
5. Cytochemical demonstration (Preparation of permanent slides).

i. DNA by Feulgen reaction.
ii. Mucopolysaccharides by PAS reaction.
iii. Proteins by Mercurobromophenol blue.
iv. DNA and RNA by Methyl Green Pyronin.

Question Pattern:

Q1. Major Experiment 08

a) Gram's staining technique for visualization of prokaryotic cells.
b) Temporary squashing of onion root tip or grasshopper testis for various stages of mitosis or meiosis

Q2. Spotting two slides from mitosis and two from meiosis (1-4) each carrying 1.5 marks (1.5 X 4 = 06)

Q3 Permanent slide submission; any three (DNA, PAS, Proteins, MGP, Barr body slide / models of any biomolecule) (3X2=06)

Q3. Record – 02 marks

Q4. Viva – voce – 03 marks

SUGGESTED READINGS

1. Becker WM, Kleinsmith LJ, Hardin J and Bertoni G P (2009) The World of the Cell. 7th Edition. Pearson Benjamin Cummings Publishing, San Francisco.
2. Bruce Albert, Bray Dennis, Levis Julian, Raff Martin, Roberts Keith and Watson James (2008) Molecular Biology of the Cell. 5th Edition. Garland publishing Inc., New York.
3. Cooper GM and Hausman RE (2009) The Cell: A Molecular Approach. 5th Edition. ASM Press, Washington D.C.
4. De Robertis EDP and De Robertis EMF (2006) Cell and Molecular Biology. 8th Edition. Lippincott Williams and Wilkins, Philadelphia.
5. Karp G (2010) Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley and Sons. Inc., USA.
6. Mohanty PK (2000) Illustrated Dictionary of Biology. Kalyani Publishers, Ludhiana.

IV th Sem

CORE COURSE: ZOOLOGY
PAPER X
PRINCIPLES OF GENETICS
(CREDITS: THEORY-4, PRACTICALS-2)
THEORY

LECTURES: 60 Marks 75

Unit 1: Mendelian Genetics and its Extension

Principles of inheritance; Incomplete dominance and co-dominance; Multiple alleles, Lethal alleles; Epistasis; Pleiotropy; Sex-linked inheritance.

Unit 2: Linkage, Crossing Over and Chromosomal Mapping

Linkage and crossing over; Cytological basis of crossing over; Molecular mechanisms of crossing over; Recombination frequency as a measure of linkage intensity; Two factor and three factor crosses; Interference and coincidence and Somatic cell hybridization.

Unit 3: Mutations

Gene mutations; Chromosomal mutations: Deletion, duplication, inversion, translocation;Aneuploidy and polyploidy; Induced versus spontaneous mutations; Backward and forward mutations; Suppressor mutations; Molecular basis of mutations in relation to UV light and chemical mutagens; Detection of mutations: CLB method, attached *X* method and DNA repair mechanisms.

Unit 4: Sex Determination and Quantitative Genetics

Chromosomal mechanisms of sex determination; Sex-linked, sex-influenced and sex limited characters; Polygenic inheritance and Transgressive variation.

Unit 5: Extra-chromosomal Inheritance

Criteria for extra-chromosomal inheritance; Antibiotic resistance in *Chlamydomonas*; Mitochondrial mutations and Maternal effects.

PRACTICAL Marks 25

1. To study the Mendelian laws and gene interactions and their verification by Chisquare analyses using seeds/beads/*Drosophila*.
2. Identification of various mutants of *Drosophila*.
3. To calculate allelic frequencies by Hardy-Weinberg Law.
4. Linkage maps based on data from crosses of *Drosophila*.
5. Study of human karyotype (normal and abnormal).
6. Pedigree analysis of some human inherited traits.
7. Preparation of polytene chromosomes from larva of *Chironomous/Drosophila*.
8. To study mutagenicity in *Salmonella/E. coli* by Ames test.

Question Pattern:

Q1. Major Experiment 10
Genetic Problems related course
Q2. Pedigree analysis of some human inherited traits 05
Q3. Study of human karyotype (normal and abnormal) 05
Q3. Record – 02 marks
Q4. Viva – voce – 03 marks