

GONDWANA UNIVERSITY GADCHIROLI
SEMESTER SYSTEM SYLLABUS
FOR
M.Sc. Part I
Subject- Zoology
Semester I – Paper I
Animal Structure and function : Invertebrates

Unit-I

- 1.1 Modern scheme of animal classification into sub-kingdom, division, section, phyla and minor phyla.
- 1.2 Protozoa : Ultrastructure of locomotory organs, pseudopodia, flagella, cilia and pellicular myonemes. Mechanism of various modes of locomotion.
- 1.3 Porifera : Cellular grade of organization in sponges.
- 1.4 Coelom : formation, evolution and significance.

Unit-II

- 2.1 Origin of metazoan : colonial, syncytial and molecular theories.
- 2.2 Coelenterata : Polymorphism, metagenesis and metamorphosis.
- 2.3 Helminthes : Reproductive system, structure and mechanism of reproduction in, *Fasciola*, *Taenia* and *Ascaris*.
- 2.4 Annelida : Evolution of nephridia and mechanism of excretion in Polychaeta, Oligochaeta and Hirudinea

Unit-III

- 3.1 Onychophora : *Peripatus* structure, affinities and taxonomic position.
- 3.2 Arthropoda : Respiratory organs, mechanism of gaseous exchange - tracheal respiration in Insecta and gill respiration in Crustacea.
- 3.3 Monoplacophora : *Neopilina* - structure, affinities and taxonomic position.
- 3.4 Mollusca : Neuroanatomy in Gastropoda (*Pila*), Bivalvia (*Unio*) and Cephalopoda (*Loligo*).

Unit-IV

- 4.1 Echinodermata : Water vascular system - structure and functions.
- 4.2 Echinodermata : Larval forms, Metamorphosis and evolutionary significance.
- 4.3 Ctenophora : General account and affinities.
- 4.4 Entoprocta and Ectoprocta : General account and affinities.

Semester-I, (M.Sc. Part-I, Zoology)
Paper-II : General Physiology

Unit-I

- 1.1 Enzyme : Classification, mechanism of enzyme action. Factors affecting enzyme action, regulation of enzyme activity, activators and inhibitors.
- 1.2 Respiratory pigments : types, distribution and properties, structure of haemoglobin and mechanism of O₂ transport.
- 1.3 Neurotransmitters: chemical nature, biosynthesis and mechanism of synaptic transmission.
- 1.4 Colour change mechanism: Chromatophores and melanophores- structure, physiology and significance.

Unit-II

- 2.1 Bioluminescence: light producing organs in animals, physiology and significance.
- 2.2 Thermoregulation : poikilotherms and homeotherms, adaptations and regulatory mechanisms.
- 2.3 Osmoregulation : Mechanism in Pisces and Amphibia,
- 2.4 Molecular mechanism of peptide and steroid hormonal action.

Unit-III

- 3.1 Digestion and absorption of carbohydrate, proteins and lipids in the gastrointestinal tract.
- 3.2 Carbohydrates- classification and metabolism- glycogenesis, glycogenolysis, glycolysis, TCA cycle, electron transport system and oxidative phosphorylation.
- 3.3 Lipids- classification and metabolism- oxidation of fatty acids, cholesterol metabolism.
- 3.4 Proteins- classification and metabolism- oxidative deamination, decarboxylation and transamination of amino acids, arginine-ornithin cycle.

Unit-IV

- 4.1 Heart : Myogenic and neurogenic, Structure and working - Cardiac cycle, ECG, pace maker.
- 4.2 Cerebrospinal fluid: Chemistry and functions.
- 4.3 Mechanism of reflex action.
- 4.4 Environmental stress and strain : Physiology, tolerance, avoidance, resistance and adaptations.

Semester-I, (M.Sc. Part-I, Zoology)
Paper-III : Cell Biology and Genetics

Unit-I

1.1 Cell membrane : structure and function, models, passive and active transport, uniport, symport, antiport, membrane pumps, mechanism of sorting and regulation of intracellular transport, electrical properties.

1.2 Cell organelles : Structure and functions of - nucleus, mitochondria, endoplasmic reticulum, Golgi complex, lysosomes.

1.3 Microfilaments, microtubules : Structure and Functions.

1.4 Cell cycle - Phases and regulation of cell cycle, mitosis, meiosis.

Unit-II

2.1 Cell signaling - hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, Receptor protein- tyrosin kinase and ion channel receptors.

2.2 Signal transduction : Pathways, primary and secondary messenger systems, regulation of signaling pathways.

2.3 Cellular communication - general principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix and integrins.

2.4 Cancer - genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes, cancer and the cell cycle, metastasis.

Unit-III

3.1 Mendelian, non-Mendelian inheritance - mono / dihybrid inheritance, types of dominance, multiple allelism, probability, exercises for solving genetics problems.

3.2 Extensions of Mendelian principles - codominance, incomplete dominance, gene interactions, linkage and crossing over, sex linkage, sex limited and sex influenced characters.

3.3 Population genetics – Mendelian population, Hardi-Weinberg law, applications and factors influencing deviation from Hardi-Weinberg equilibrium.

3.4 Mutation - types, causes and detection, mutant types – lethal, conditional, biochemical, loss of function, gain of function, germinal verses somatic mutants.

Unit-IV

4.1 Structural and numerical alterations of chromosomes - deletion, duplication, inversion, transversion, translocation, ploidy and their genetic implications.

4.2 Extra chromosomal inheritance - cytoplasmic inheritance, inheritance of mitochondrial genes, maternal inheritance.

4.3 Microbial genetics - recombination in bacteria and gene mapping, transformation, conjugation, transduction.

4.4 Human genetics- pedigree analysis, Human chromosomes (karyotypes) , Human traits, genetic disorders (Haemophilia, Alziemer's disease, thalassemia).

Semester-I (M.Sc. Part-I, Zoology)
Paper-IV : Reproductive Biology

Unit-I

- 1.1 Various methods of asexual and sexual reproduction in Protozoa.
- 1.2 Regeneration in *Hydra*, and Annelid worms; Morphogenesis and hormonal control.
- 1.3 Metamorphosis in insects: Partial and complete metamorphosis, metamorphic forms- nymph, larvae and pupae.
- 1.4 Mechanism of vitellogenesis in insects.

Unit-II

- 2.1 Spermatogenesis: Process, hormonal regulation and ultra-structure of human spermatozoa.
- 2.2 Mechanism of oogenesis: Process, biochemical events, hormonal regulation.
- 2.3 Cytological and molecular events of fertilization.
- 2.4 Types of cleavage, blastulation, gastrulation and embryonic induction.

Unit-III

- 3.1 Male accessory sex glands in mammals: structure, secretion and functions.
- 3.2 Semen- biochemical composition and sperm abnormality.
- 3.3 Sperm capacitation and decapacitation- molecular mechanism and significance.
- 3.4 Pheromones and sexual behavior in mammals.

Unit-IV

- 4.1 Neurohormonal control of fish reproduction.
- 4.2 Molecular induction (Morphogenetic gradients) and organizer concept.
- 4.3 Cryopreservation of gametes, embryo and test-tube baby.
- 4.4 In vitro fertilization (IVF) and its significance.

**Semester I, Practical-I, Structure and Function of Invertebrate and General
Physiology
Section-A**

1. Study of museum specimens.

Classification up to order and comments on the specimens representing all phyla.

2. Anatomical Observations

Anatomical observations, demonstration and detailed explanation of the following with the help of ICT tools/ models/ charts/ photographs etc.

- a. Digestive system – Earthworm, Leech, Cockroach, Honey bee
- b. Nervous system – Prawn, Cockroach, Honey bee
- c. Reproductive system- Earthworm, Leech, Cockroach, Honey bee.

3. Mounting - Study of permanent Preparation of the following with the help of already available permanent slides ICT tools/ models/ charts/ photographs etc.

- a. Earthworm – Nerve ring, ovary, spermatheca, nephridia.
- b. Leech – jaws, ciliated organ.
- c. Cockroach – Mouth parts, Salivary glands, trachea.
- d. Prawn –Appendages, Statocyst.
- e. Protozoans- rhizopods , flagellates , ciliates (fresh water forms).
- f. Porifera – Spicules and gemmules of fresh water sponges.
- g. Crustaceans and rotifers - Planktonic copepodes, cladoceran, ostracoderm and rotifers.
- h. Larval forms of the free living invertebrates.
- i. Larval forms of parasitic invertebrates.

Note: Student should prepare and submit at least 10 permanent stained micropreparation.

4. Study of permanent Invertebrate slides with the help of already available permanent slides ICT tools/ models/ charts/ photographs etc

- a. Porifera – T.S. and L.S. of *Sycon*, gemmules, spicules
- b. Coelenterata – T.S. of *Hydra* , T.S. of Sea anaemon, Ephyra larva
- c. Helminths – T.S. of *Planaria*, T.S. of *Taenia* , scolex W.M., Mature , gravid proglotids , T.S. of male and female *Ascaris*, W.M of *Ankylostoma* , *Enterbios*, *Dracunculus*, *Wuchereria*
- d. Annelida -T.S. of *Nereis*, T.S. of Earthworm passing through various organs, T. S. of Leech.
- e. Arthropod larvae – Nauplius, Zoea, Megalopa, Mysis.
- f. Mollusca – Veliger and Glochidium larva.
- g. Echinodermata- pedicellarae, T.S. of arm of star fish, Bipinnaria, Auricularia larva .
- h. Hemichordata – T.S. through collar, proboscis, trunk and branchio-genital regions. Tornaria larva.

Note: Students should prepare at least 10 permanent stained micropreparations.

Section-B

1. Physiology experiments –

- a) Total leucocyte count and differential leucocyte count
- b) Total R.B.C. count.
- c) Demonstration of action of salivary amylase, trypsin, pepsin.
- d) Demonstration of rate of O₂ consumption in aquatic animals, under various environmental stresses.
- e) Demonstration of haemoglobin concentration in normal and pathological condition.
- f) Estimation of sodium, potassium and chloride in blood and excretory organs by Colorimeter or flame photometer.
- g) Estimation of glucose in blood by spectrophotometer or Colorimeter.
- h) Estimation of total blood proteins by spectrophotometer or Colorimeter.
- j) Estimation of cholesterol in blood by spectrophotometer or Colorimeter.

Distribution of Marks: Total Marks: 80

Anatomical observations	:	15
Stained permanent preparation	:	05
Identification and comment on the spots (1-10)	:	20
Submission of stained permanent slides	:	05
Physiology experiment (Major)	:	15
Physiology experiment (Minor)	:	10
Class Record	:	05
Viva-voce	:	05
Total Marks	:	80

Semester-I, Practical-II, Cell Biology, Genetics and Advance Reproductive Biology

Section-A

1. Study of mitotic metaphasic chromosomes in plant material/ cultured animal cells/cleaving eggs of invertebrate/vertebrate.
2. Preparation of human karyotypes by using photographs/pictures.
3. Demonstration of Barr body in human female leucocytes.
4. Demonstration of polytene chromosome in dipteran larvae.
5. Problems on genetics based on monohybrid/dihybrid ratios, sex linked inheritance and blood groups
6. Study of various human genetic traits

Section-B

1. Study of meiotic chromosomes and spermatogenesis in grasshopper with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.
2. Demonstration of oogenesis in earthworm/ fish/ rat ovary with the help of already available permanent slides/ ICT tools/ charts/ photographs etc.
3. Semen analysis: physical viscosity, pH, liquefaction time, agglutination test, motility and sperm count. (Source of semen: Government artificial insemination centre).
4. Sperm vitality study using suitable stains. . (Source of semen: Government artificial insemination centre).
5. Histology of male and female reproductive organs and accessory reproductive glands with the help of already available permanent slides/ ICT tools/ charts/ photographs etc.

Distribution of Marks Total Marks: 80

1. Cytological preparation	:	15
2. Problems on genetics (any two)	:	20
3. Spermatogenesis/oogenesis/sperm vitality	:	10
4. Semen analysis	:	10
5. Identification and comment on spots (1-5)	:	15
6. Class record	:	05
7. Viva-voce	:	05

Suggested Readings

Invertebrate structure and function

1. Hyman L.H. The Invertebrate Vol. I, Protozoa through Ctenophora. McGraw-Hill Co., New York.
2. Barrington E.J.W. Invertebrate structure and function. Thomas Nelson and sons Ltd., London
3. Jagerstein G. Evolution of Metazoan life cycle . Academic press, New York and London.
4. Hyman L.H. The invertebrate vol. 2 McGraw-Hill Co., New York.
5. Hyman L.H. The invertebrate vol. 8 McGraw-Hill Co., New York.
6. Barnes R.D. Invertebrate Zoology W.B. Saunders and Co., Philadelphia
7. Russet Hunter W.D.D. biology of higher invertebrate The Macmillan Co. Ltd., London.
8. Hyman L.H. The Invertebrates, smaller coelomate groups. Vol. 5 McGraw-Hill Co. New York.
9. Read C.P. Animal Parasitism. Prentice Hall. New-Jersey.
10. Kudo R.R. (1966) Protozoology, Charler, C. Thomas Springfield, Illinois.
11. Barradailes L.A. and potts F.A. Invertebrates (1961) The Eastham L.E. S. Saunders, Cambridge University Press, Cambridge.
12. Russel W.D. Hunter, Biology of lower invertebrates McMillan, New York.
13. Marshall A.J. and Williams W.D. (1972) J. B. Zoology of Invertebrates , EIBs and McMillan, London.
14. Gtryyrt V. and Graham A. A Functional anatomy of Invertebrates. Academic press, New York.
15. Backlemiccher W.N. Principles of comparative anatomy of Invertebrates Oliver and Boyed Edinberg.
16. Hadisi J. The Evolution of Metazoa. Pergamon Press, Oxford.
17. Dales R.P. Annelids, Hutchinson, London.
18. Green J. Biology of Crustacea, Wither by, London
19. Morton J. E. Mollusca, Hutchinson, London
20. Nichols D. Echinodermata, Hutchincon, London

General Physiology

1. Text Book of Physiology & Biochemistry : Bell, G.E. & Davidson, J.N. & Emslie D. Smith, 1922.
2. Medical Physiology : A Wiley Medical Publication, John Wiley & Sons, New York.
3. Mineral Metabolism : Comar, C.L. & Felix Bronner (1961) Acad Press, New York & London.
4. A Text Book of General Physiology : Dayson (1964) : Little Brown & Co. Boston.
5. Animal Physiology : R. Eckert & D. Randall (1983) 2nd Edn., W.H. Rexeman & Co.
6. Biochemistry & Physiology of the Cell : (2nd Edn.), M.A. Edwards & K.A. Hassall (1980) Mc. Graw Hill Co.
7. The Physiology of Cells : Cuthe F. (1968) : The Macmillan Co.
8. Textbook of Medical Physiology: Guyton, A.G. (1968). 7th Edn. Saunders Pub.
9. Samson Wrights Applied Physiology : Oxford University Press.
10. Comparative Animal Physiology C.L. Prosser, W.B. Saunders & Company.

11. Animal Physiology : Mechanism & Application, R. Eckert, W.H. Freeman & Company.
12. General & Comparative Animal Physiology : W.S. Hoar.
13. Medical Physiology : W.F. Ganong (1981) : 10th Edn. Lange Medical Publications.
14. Principles of Anatomy and Physiology: Tortora Grabowski, 9th Edn., John Willey & Sons.
15. Reproductive Physiology of Vertebrates: Van Tienhoven, A. (1983): 2nd Edn. Cornell Univ. Press, New York.

Cell Biology and Genetics

1. Cell and Molecular Biology by De Robertis- E. D. P., I. S. E. publication.
2. Molecular Biology by Turner P. C. and Mc Lennan , Viva Books Pvt. Ltd.
3. Advanced Molecular Biology by Twyman R. M., Viva Books Pvt. Ltd.
4. Molecular Biology by Freifelder D., narosa publication House.
5. Gene VI by Benjamin Lewis, Oxford press.
6. Gene VIII by Benjamin Lewis, Oxford press.
7. Molecular biology of Gene by Watson J. D. et. al., Benjamin publication.
8. Molecular cell Biology by Darnell J. Scientific American Books USA.
9. Molecular Biology of the Cell by Alberts B., Bray D. Lewis J., garland publishing Inc.
10. Genetics Vol. I and II by Pawar C. B., Himalaya publication.
12. Essentials of Molecular Biology by Freifelder D., narosa publication House.
13. Molecular Cell Biology by Laodish H., Berk A., Zipursky S. L., Matsudaira P., Baltimore D. and Darnell J., W. H. Freeman and Co.
14. The Cell: Molecular Approach by Cooper G. M.
15. Molecular Biology by Upadhay A and Upadhay K. Himalaya publication.

Advance reproductive Biology

1. Developmental Biology. 2nd Edition. Leon W. Browwer Saunders College publishing.
2. Current Topics in Developmental Biology eds. R. A. Pedersen and G. P. Schatten.
3. Principles

GONDWANA UNIVERSITY GADCHIROLI
SEMESTER SYSTEM SYLLABUS
FOR
M.Sc. Part I
Subject- Zoology Semester-II,
Paper- V, Animal structure and Function ,Vertebrates

Unit-I

- 1.1 Origin and ancestry of Chordata.
- 1.2 General organization and affinities of Cephalochordata.
- 1.3 General characters and affinities of Dipnoi.
- 1.4 Organs and mechanism of respiration in Pisces and Amphibia.

Unit-II

- 2.1 Vertebrate integument and its derivatives.
- 2.2 Appendicular skeleton (Limbs and girdles) in Amphibia, Reptilia, Aves and Mammals.
- 2.3 General body organization and classification in Chelonia.
- 2.4 Evolution of urinogenital organs in vertebrates.

Unit-III

- 3.1 Origin of Birds.
- 3.2 Cetacea: general characters and adaptations.
- 3.3 Comparative anatomy of the brain in vertebrates (teleost, frog, lizard, fowl and rat).
- 3.4 Autonomous nervous system in vertebrates: structure and functions.

Unit- IV

- 4.1 Structure, development and metamorphosis of Ammonoetes.
- 4.2 Evolution of heart in vertebrates.
- 4.3 Sense organs in vertebrates: lateral line system and electroreception in fishes.
- 4.4 Evolution of Man.

Semester-II, (M.Sc. Part-I, Zoology)
Paper-VI, General and comparative Endocrinology

Unit-I

- 1.1 Hormones and functions in Coelenterata and Helminths.
- 1.2 Neurosecretory system in Annelida: structure, hormones and functions.
- 1.3 Neuroendocrine system in Mollusca: structure, hormones and functions.
- 1.4 Hormones and functions in Echinodermata.

Unit-II

- 2.1 Neuroendocrine system in crustacean; structure and hormones.
- 2.2 Endocrine control of metamorphosis, reproduction and colour change mechanisms in crustacea.
- 2.3 Cephalic neuroendocrine system in insects: structure and hormones.
- 2.4 Endocrine control of metamorphosis and reproduction in insects.

Unit-III

- 3.1 Pineal organ: structure, hormones and functions.
- 3.2 Hypothalamus: Nuclei, hormones and functions.
- 3.3 Pituitary: cell types, hormones and functions.
- 3.4 Hypothalamo-hypophysial system: neuroendocrine integration and feedback mechanisms in mammals.

Unit-IV

- 4.1 Thoracic endocrine glands: thyroid, parathyroid and ultimobranchial glands: structure, hormones and regulatory mechanisms.
- 4.2 Gastro-entero-pancreatic endocrine system: endocrine pancreas and gastro intestinal tract: endocrine cells, hormones and functions.
- 4.3 Adrenal gland: structure, hormones and functions in vertebrates.
- 4.4 Gonadal hormones in vertebrates and their hormonal actions, feedback mechanisms.

Semester-II, (M.Sc. Part-I, Zoology)
Paper-VII, Molecular Biology and Biotechnology

Unit-I

- 1.1 Genome organization – C value paradox, genome size, , repetitive and non repetitive DNA sequences , pseudo- genes, gene families, gene clusters, organelle genome, chromosomal structure , chromatin organization and remodeling, DNA structure, forms of DNA.
- 1.2 DNA replication – molecular mechanisms of prokaryotic and eukaryotic DNA replication, regulation of replication.
- 1.3 DNA damage and repair – types of DNA damages, excision repair system(BER), mismatch repair(MMR), recombination repair, double strand break repair, and transcription coupled repair.
- 1.4 Recombination- homologous and non homologous recombination.

Unit-II

- 2.1 Transcription- prokaryotic and eukaryotic transcription, RNA polymerases, transcriptional unit, initiation, elongation, termination, transcriptional factors.
- 2.2 Regulation of transcription : lac operon- positive and negative control, attenuation-phage strategies , anti-termination,.
- 2.3 Translation - prokaryotic and eukaryotic translation, genetic code, , termination factors, post translational modifications.
- 2.4 Mobile DNA elements – transposable elements, IS elements, P elements, retroviruses, retroposons.

Unit-III

- 3.1 Post–transcriptional RNA processings : splicing, polyadenylation, molecular mechanisms of antisense molecules, gene silencing.
- 3.2 Isolation and sequencing of DNA : gene amplification, PCR, RAPD, RFLP, Maxam-Gilbert, Sanger’s dideoxy methods.
- 3.3 Recombinant DNA technology : Cloning vectors, plasmids, cosmids, phagemids, YACS, gene replacement, restriction enzymes.
- 3.4 Hybridization techniques – Southern- Northern hybridization, microarray.

Unit-IV

- 4.1 Medical biotechnology-Application of restriction fragment length polymorphism (RFLP) in forensic science, disease prognosis and genetic counseling.
- 4.2 Agricultural biotechnology— biofertilizers, bioinsecticides, biogas
- 4.3 Immunobiotechnology- Hybridoma technology -monoclonal antibodies.
- 4.4 Industrial and Environmental biotechnology-microbial production of fermentation products, enzymes, antibiotics, single Cell proteins and biosensors.

Semester-II, (M.Sc. Part-I, Zoology)
Paper-VIII, Advance Developmental Biology

Unit-I

- 1.1 Implantation in Mammals.
- 1.2 Foetal membranes- types, structure and functions.
- 1.3 Placenta-types, structure, functions. Hormones and their functions.
- 1.4 Metamorphosis in Amphibia: morphogenetic and biochemical mechanism, hormonal control.

Unit-II

- 2.1 Regeneration in vertebrates: tail, limb, lens and retina.
- 2.2 Apoptosis- mechanism and significance.
- 2.3 Ageing- mechanism, concepts
- 2.4 Polymorphism in insect -Termites, Honey bees and Ants.

Unit-III

- 3.1 Multiple ovulation and embryo transfer technology (MOET).
- 3.2 Embryonic sexing, cloning, screening for genetic disorder diagnosis (ICSI, GIFT etc.)
- 3.3 Cloning of animals by nuclear transfer.
- 3.4 Application of embryonic stem cells, clinical and economic significance.

Unit-IV

- 4.1 Immunocontraception- fertilization, inhibition and pregnancy termination.
- 4.2 Classical contraceptive techniques: Physical, chemical, surgical and IUCD devices.
- 4.3 Anti-androgen and anti-spermiogenic compounds (LDH-CY and SP-10)
- 4.4 Role of mutants and transgenics in human welfare.

Semester-II, Practical-III, Structure and Function of Vertebrates and Endocrinology

Section-A

1. Study of museum specimens.

Classification of vertebrates up to order and comments on the specimens representing all phyla.

2. Anatomical Observations

Anatomical observations, demonstration and detailed explanation of the following with the help of ICT tools/ models/ charts/ photographs etc. **(Any animal)**

- a) Brain and cranial nerves- Fish/Rat.
- b) Arterial and venous systems- Fish/Rat
- c) Urinogenital system- Fish/Rat.
- d) Reproductive systems -Fish/Rat.
- e) Internal ear ,Weberian ossicles, accessory respiratory organs in fish.

3. Mounting – Study of stained permanent micropreparations of scales, ampullae of Lorenzini, otolith, striated muscles, cartilage from animal waste from locally available fish market or Study of permanent Preparation of the following with the help of already available permanent slides ICT tools/ models/ charts/ photographs etc.

4. Microtomy, Histology and Skeleton

- a) Fixation, embedding, sectioning and staining of the internal organs of vertebrates.
(Source of tissue: Animal wastes from local recognized slaughter houses/ poultry farms/ fish markets etc.)
- b) Study of slides of internal organs of vertebrates with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.
- c) Axial and appendicular skeleton of fowl and rabbit using already available skeleton/ ICT tools/ models/ charts/ photographs etc.

Note: Students should prepare at least 10 permanent stained micropreparations.

Section-B

1. Microtomy - Fixation, embedding, sectioning and staining of the endocrine gland (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry farms/ fish markets etc.)

2. Histological study –

- a) Histological slide of endocrine glands and gonadal endocrine components, EM structure of endocrine gland.
- b) Identification of pituitary cell type.
- c) Identification of α , β , γ , cells of Islets

of Langerhans with the help of already available permanent slides/ ICT tools/ charts/ photographs etc.

4. **Anatomical Observations-** Anatomical observations, demonstration and detailed explanation of the a. endocrine glands in Cockroach and b) Endocrine glands- pituitary, thyroid parathyroid, adrenal in fish/rat with the help of ICT tools/ models/ charts/ photographs etc.

Distribution of Marks Total Marks: 80

Anatomical observations fish/rat	:	15
Stained permanent preparation	:	05
Identification and comment on the spots (1-10)	:	20
Submission of stained permanent slides	:	05
Anatomical observations Endocrine glands	:	15
Histological staining of endocrine gland	:	10
Class Record	:	05
Viva-voce	:	05

Practical –IV, Molecular Biology, Biotechnology and Developmental Biology

Section-A

1. Demonstration of glycogen/ carbohydrate- PAS reaction (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry forms/ fish markets etc.)
2. Demonstration of DNA: Feulgen's reaction. (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry forms/ fish markets etc.)
3. Demonstration of DNA: RNA: Methyl Green- Pyronin reaction. (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry forms/ fish markets etc.)
4. Demonstration of Lipid: Sudan Black B staining. (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry forms/ fish markets etc.)
5. Demonstration of Protein: HgBP staining. (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry forms/ fish markets etc.)
5. Histochemical analysis of alkaline phosphatase (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry forms/ fish markets etc.)
6. Histochemical analysis of acid phosphatase (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry forms/ fish markets etc.)
7. Biochemical estimation of sugar: O-toluidine method. (Source of blood: local recognized pathology laboratory.)
8. Biochemical estimation of protein: Lowrey's method. (Source of blood: local recognized pathology laboratory.)
9. Biochemical estimation of DNA: Diphenylamine method. (Source of blood: local recognized pathology laboratory.)
10. Biochemical estimation of RNA: Orcinol method. (Source of blood: local recognized pathology laboratory.)
11. To perform tests for qualitative analysis of saliva
12. To perform tests for qualitative analysis of bile
13. Separation of amino acids by paper chromatography and TLC.

Section-B

1. Study of the reproductive system in mammals with the help of ICT tools/ models/ charts/ photographs etc.
2. Study of different types of eggs on the basis of their yolk content.
3. Study of developmental stages of live eggs of Lymnea or any gastropod with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.
4. Study of developmental stages of insects/ fishes with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.
5. Study of developmental stages of frog and whole mounts with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.
6. Chick embryo mounting by window method.
- 7 . Study of developmental stages of chick through slides and whole mounts.

8. Morphological study of different types of placenta with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.
- 8 Histological study of placenta with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.
- 9 Sperm count from any domestic animal (Source of semen: Government artificial insemination centre).

Distribution of Marks Total Marks: 80

1. Histochemical demonstration of DNA/RNA protein / carbohydrate/lipids/enzymes	15
2. Estimation of sugar/protein/DNA/RNA/ qualitative analysis of saliva/bile	20
3. Whole mount preparation of chick embryo/spermcount/ Viginal snear/hypoosmotic test for fertility.	10
4. Preparation of development stages of live eggs of Lymnea	10
5. Identification and comment on spots (1-5)	15
6. Class record	05
7. Viva voce	05

Suggested Readings

Structure and function of Vertebrate

1. Alexander R.N., The Chordata, Cambridge University Press London.
2. Barrington EJW, The Biology of Hemichordates and Protochordates, Oliver and Boid Edinberg.
3. Bourne G.H., The structure and function of nervous tissue Academic press New York.
4. Kingslay J.S, Out lines of Comparative anatomy of vertebrates, Central Book Depot, Allahabad.
5. Honyelli A.R. The Chordates Cambridge University Press, London
6. Smith H.S. Evolution of Chordate structure, Hold Rinehart and Wintoin Inc. New York
7. Walter H.A. and Sayles L.D. Biology of Vertebrates Macmillan and co. New York
8. Romer A.S. Vertebrate body W.P. Sanders co., Philadelphia.
9. Young J.Z. Life of Vertebrates Oxford University Press, London.
10. Young J.Z. Life of Mammals Oxford University Press, London.
11. Colbert E.H. Evolution of Vertebrates John Wiley and sons Inc. New York.
12. Kent C.J. Comparative anatomy of Vertebrates.
13. Waterman A.J. Chordate Structure and Functions Macmillan Co. New York.
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