MSc ZOOLOGY

Semester II

(2020-21)

MSc Second Semester- Zoology (2020-21)

PAPER-I
GENERAL AND COMPARATIVE ANIMAL PHYSIOLOGY AND ENDOCRINOLOGY OF VERTEBRATES

Max marks: 35

Unit I

- Respiratory pigments through different phylogenetic groups.
- Transport of oxygen and carbon dioxide in blood and other body fluids
- Regulation of respiration
- Physiology of impulse transmission through nerves and synapses
- Autonomic nervous system, Neurotransmitters and their physiological Functions

Unit II

- Excretion: Patterns of Nitrogen excretion, Urine formation and Urea Cycle.
- Comparative physiology of digestion
- Osmoregulation in different animal groups (Terrestrial & Aquatic animals)
- Thermoregulation:
    - Hypothalamic mechanism of thermoregulation.
    - Hibernation and Aestivation.
- Physiology of circulation:
    - Composition and functions of blood
    - Mechanism of Blood clotting: Extrinsic & Intrinsic pathway and factors effecting Blood clotting.

Unit III

- Comparative study of Mechanoreception.
- Comparative study of Photoreception
- Comparative study of Phonoreception
- Comparative study of Chemoreception
- Comparative study of Equilibrium reception

Unit IV

- Bioluminescence as means of communication among animals
- Pheromones and other similar chemicals as means of communication among animals
- Chromatophores and regulation of their function among animals
- Hormones, their classification and chemical nature
- Mechanisms of hormone action

Unit V

- Phylogeny of endocrine glands (pituitary, thyroid ,pancreas, adrenal,)
- Ontogeny of endocrine glands(Pituitary & Thyroid)
- Neuroendocrine system: Neurohypophysial axis in Insects.
- Hormone receptor, Signal transduction mechanisms
- Hormones and reproduction
    a. Seasonal breeders
    b. Continuous breeders

Suggested Reading Materials:

- EJW Barrington-General & comparative Endoctrinology-Oxford, London Press
- R.H. Williams-Text Book of Endocrinology-W.B. Saunders
- C.R. Martin- Endocrine Physiology-Oxford University Press.
- J. Darnell, H. Lodish and D. Baltimore , Molecular Cell Biology ,Scientific American Book USA
- B.Alberts, D-Bray, J.Lewis, M. Raff, K.Roberts and J.D. -Watson, - Molecular Biology of the cell- Garland Pub. New York.

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PAPER - II

POPULATION ECOLOGY AND ENVIRONMENTAL PHYSIOLOGY

Max marks: 35

Unit I

- Populations and their characters.
- Demography: Life tables, generation time, reproductive value.
- Population growth:
    - Growth of organisms with non-overlapping generations.
    - Stochastic and time lag models of population growth.
    - Stable age distribution.
- Population interaction & Regulation.

Unit II

- Adaptations:
    - Levels of adaptations (Simple and Complex)
    - Significance of body size, Metabolism and body size, Mass specific metabolic rate, Surface hypothesis.
- Aquatic environments: Fresh water, marine, shores and estuarine environments.
- Eco-physiological adaptations to fresh water environments (Invertebrates in general and Fishes.)
- Eco-physiological adaptations to marine environments.(Marine Fishes)
- Eco-physiological adaptations to terrestrial environments.(Insect, Reptile & Birds)

Unit III

- Environmental limiting factors.
- Inter and intra-specific relationship.
- Predator- prey relationship, Predator dynamics.
- Optimal foraging theory
  (Patch choice, diet choice, Prey selectivity, and foraging time).
- Mutualism and Evolution of plant pollinator interaction.

Unit IV

- Environmental pollution and human health: Air Pollution & Solid waste pollution
- Conservation management of Natural resources: Renewable (Energy resource & Forest resource) and Non-renewable (Mineral & Soil)
- Environmental monitoring & impact assessment:
    - Biological monitoring programme
    - Biological Indicators
    - Bioremediation-Brief introduction
- Concept of Sustainable development.

Unit V

- Concept of Homeostasis; wsr to electrolyte balance
- Physiological response to oxygen deficient stress.
- Physiological response to body exercise wsr to Cardiovascular
- Meditation: Effect on Stress and body relaxation
- Yoga: Effect of Asana (Posture) on Musculoskeletal and Effect of Pranayam (Deep breathing) on ventilation.

Suggested Reading Materials:

1. Cherrett,J.M. Ecological Concepts. Blackwell Science Publication, Oxford, U.K.
2. Elseth,B.D. and K.M. Baumgartner,population Biology,Van Nostrand Co., New York.
3. Jorgensen,S.E. Fundamentals of ecological modeling. Elsevier, New York.
4. Krebs, C.J. Ecology. Harper and Row, New York.
5. Krebs,C.J. Ecological Methodology. Harper and Row , New York.
6. Eckert, R. Animal Physiology: Mechanism and Adaptation. W.H. Freeman and Co., New York.
7. Hochachka, P.W. and G.N., Somero. Biochemical adaptation. Priceton, New Jersey.
8. Gyton, Medical Physiology

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PAPER- III
TOOLS AND TECHNIQUES IN BIOLOGY

Max marks: 35

Unit I

1. Microscopy: Principle and Applications
    - Light microscope and Phase contrast microscope
    - Fluorescence microscope
    - Electron microscope (TEM & SEM)
    - Confocal microscope
2. Colorimeter y: Principle and Applications
    - Beer and Lambert's law.
    - Spectrophotometer
    - Flame photometer
3. Microbiological techniques
    - Media Preparation and sterilization
    - Inoculation and growth monitoring.
    - Microbial assays (Vitamins and Amino acids)
    - Microbial identification (cytological staining methods for bacterial and fungal strains)
    - Structure and Use of Fermentors.

Unit II

1. Computer aided techniques for data presentation, data analysis, and statistical techniques: (Power point Presentation and Word excel.)
2. Cryotechniques:
    - Cryopreservation of cells, tissues, organs and organisms.
    - Cryosurgery
    - Cryotomy
    - Freeze fracture and freeze drying.
3. Separation techniques.
    - Chromatography: Principle, Types and Application.
    - Electrophoresis: Principle, Types and Application.
      (PAGE and Agarose gel electrophoresis)
    - Ultra centrifuge: Principle & Organelle separation by centrifugation.

Unit III

1. Radioisotope and Isotope techniques in biology:
    - Sample preparation for radioactive counting and elementary idea of apparatus used.
    - Autoradiography.
2. Immunological techniques:
    - Immunodiffusion (Single & Double)
    - Immuno electrophoresis
3. Immunodetection techniques:
    - Immunocyto / histochemistry
    - Immunoblotting, immunodetection, immunofluroscence.
4. Surgical techniques.
    - Organ ablation (eg. Ovariactomy, adrenalectomy)
    - Perfusion techniques
    - Stereotaxy
    - Indwelling cathethers
5. Biosensors.

Unit IV

1. Histological techniques
    - Principles of tissue fixation
    - Microtomy
    - Staining & Mounting
    - Histochemistry (proteins, carbohydrates and nucleic acids)
2. Cell culture techniques.
    - Design and functioning of tissue culture laboratory
    - Culture media, essential components and Preparation
    - Cell toxicity and Cell viability testing.

Unit V

1. Cytological techniques:
    - Mitotic and meiotic chromosome preparations from insects & vertebrates.
    - Chromosome banding techniques (G.C.Q. R. banding)
    - Flowcytometry.

2. Molecular cytological techniques:
    - In situ hybridization (radio labelled and non-radio labelled methods)
    - FISH
    - Restriction banding

3. Molecular biology techniques:
    - Southern hybridization
    - Northern hybridization
    - DNA Sequencing
    - Polymerase chain reaction (PCR)

Suggested Reading Materials:

1. Robert Braun - Introduction to instrumental analysis-McGraw Hill.
2. K, Wilson and K.H. Goulding -A biologist Guide to principles and Techniques of Practical Biochemistry- ElBS Edition.
3. Clark & Swizer. Experimental Biochemistry. Freeman, 2000.
4. Locquin and Langeron. Handbook of Microscopy. Butterwaths, 1983
5. Boyer- Modern Experimental Biochemistry. Benjamin, 1993
6. Freifelder. Physical Biochemistry. Freeman, 1982.
7. Wilson and Wlaker. Practical Biochemistry. Cambridge, 2000.
8. Cooper. The Cell-A Molecular Approach. ASM, 1997
9. John R.W. Masters. Animal Cell culture- A practical approach. IRL Press.

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PAPER- IV
MOLECULAR CELL BIOLOGY AND GENETICS

Max marks: 35

Unit I

Bio membranes

- Molecular composition, arrangement and functional consequences.
- Transport across cell membrane : Diffusion, Active transport, Pumps, Uniports, Symports and Antiports
- Micro filaments and microtubules structure and dynamics
- Cell movements intracellular transport, role of kinesis and dynein

Unit II

Cell- Cell signalling

- Cell surface receptors: G-Protein, coupled receptor and their signal transduction.
- Second messenger system (cAMP, Phosphatidylinolsitol)
- Regulation of Blood glucose level
- Signalling from plasma membrane to nucleus
- Signal transduction – Protein Tyrosine kinase, & Insulin)

Unit III

1. Cell-Cell adhesion and communication
    - Ca++ dependant homophilic cell- cell adhension (Selectins, Integrins and cadherins)
    - Ca++ independant homophilic cell-cell adhension (Immunoglobins)
    - Gap junctions and connexins
- Genome organization, hierarchy in organization
- Chromosomal organization of genes and non-coding DNA

3 Cot-values in relation to non repetitive ,moderately and highly repetitive DNA. .

Unit IV

Sex determination

- Sex determination in Drosophila
- Sex determination in mammals with special reference to TdF
- Basic concept of dosage compensation
- Cytogenetic of human chromosomes: Structure & Karyotype.
- Human genome project (HGP) : purpose and implications.
- Transgenic and Knock out animals and their applications.

Unit V

Genetic Diseases and Genomics

- Human gene therapy & General idea of genetic diseases wsr Cystic fibrosis,Thalasimia,Sickle cell anemia.
- Prenatal diagnosis & Genetic counseling
- Genetic screening (Screening of recombinants)
- Structural Genomics (Study of structure of Genome : cytological and genetic mapping of chromosomes, RFLP , Contig and STS mapping.)
- Functional Genomics. (Study of function of Genome: RNA and protein assays of genome function by a study of expressed sequence through assay hybridization and gene chips.)
- Gene libraries

Suggested Reading Materials:

- J. Darnell, H. Lodish and D. Baltimore - Molecular cell biology -Scientific American book.Inc. USA
- B. Alberts, D. Bray, J. Lewis, M. raff, K. Roberts and J.D. Watson - Molecular biology of the cell- Garland Publishing Inc. New York.
- John R. W. - Animal cell culture A practical approach - Masters. Irl. Press
- Alberts et. All- Essentials cell biology-Garland publishing Inc. New York 1998
- J.M. Barry - Molecular biology
- Philip E. Hartman- Gene Action
- L.C. Dunn- Principals of Genetics
- A.M. Winchester -Genetics
- Edgar Alterbrg -Genetics
- L.C. Dunn -Genetics and the origin of species
- Gardener- Principles of Genetics
- Karp G – Cell and Molecular Biology
- Deroberties- Cell andMolecular Biology
- Schaum,s Series- Molecular Biology
- Snustad- Principles of Genetics.

Semester II (2020-21)

PRACTICAL I
(Based on Paper I & II)

Practical Course

- Spots related with Endocrine glands and related disorders (Slides, Models, Display Cards)
- Microtomy slide preparation and staining of various organs of any Vertebrate.
- Study of Adaptations, Inter and Intra specific relationships.
- Demonstration of Consumption of Oxygen (Respiratory rate) in any Vertebrate.
- Detection of Protein, Carbohydrate and Fat and Nitrogenous waste products(NH_3, Uric acid and Urea)

Practical Scheme

Max.marks :-50 **Min**:-20 **Time** :- 4 hrs

Exercise	Marks Allotted
Spotting	10
Microtomy : Preparation and Staining of slide	10
Exercise related to Adaptations & species relationships	10
Demonstration of O_2 consumption	04
Biochemical detection in a given sample	06
Viva voce	05
Record	05
	Total Marks : 50

Semester II (2020-21)

PRACTICAL II

(Based on Paper III & IV)

Practical Course

- Study of Structure, Principle and Application of analytical Instruments:
  - pH meter
  - Colorimeter
  - Spectrophotometer
  - ESR & NMR Spectrophotometer
  - Ultracentrifuge
- **Separation techniques:**
  Separation of Amino Acids by Chromatography technique.
- **Immunological technique:**
  - Study of antigen (Ag) and antibody (Ab) diffusion pattern by Ouchterlony double diffusion test.
- **Cytological techniques:**
  - Demonstration of Gram's staining in Bacteria and Lactophenol staining in Fungi.
  - Study and Preparation of Mitotic (onion root tips), Meiotic (grasshopper testis) and Polytene chromosomes (in chironomous or drosophila larva).
  - Demonstration of Barr Body as sex determination.

5. **Estimation technique:**
   - DNA Estimation based on Colorimeter.
   - RNA Estimation based on Colorimeter.
6. **Exercise based on Pedigree Analysis.**

Practical Scheme

Max.marks :-50 **Min**:-20 **Time** :- 4 hrs

Exercise	Marks Allotted
Comments(Structure Principle Application) on given Analytical Instrument	05
Separation Immunological technique	10
Cytological techniques	10
Estimation technique	10
Exercise based on Pedigree Analysis	05
VivaVoce	05
Record	05
	Total Marks : 50