

### M.Sc. (Previous) Zoology

<b>Paper</b>	<b>Name of Papers</b>	<b>Marks</b>
I	Non-Chordata: Structure and Function	75
II	Cell Structure and Function & Biochemistry	75
III	Genetics, Cytogenetics and Evolution	75
IV	Endocrinology and Animal Behaviour	75
V	Ecology, Biostatics & Instrumentation	75
VI	Applied Biology, Parasitology, Histology & Histochemistry	75
		<b>450</b>
	<b>PRACTICAL A</b>	75
	<b>PRACTICAL B</b>	75
	<b>TOTAL</b>	<b>600</b>

### M.Sc. (Final) Zoology

<b>Paper</b>	<b>Name of Papers</b>	<b>Marks</b>
I	Chordata: Protochordata to Mammalia	75
II	Mammalian Physiology & Immunology	75
III	Developmental Biology & Bioinformatics	75
		<b>225</b>
	<b>Special Paper (A/B/C)</b>	
	<b>FISH BIOLOGY</b>	<b>225</b>
IV A	<b>Fish Taxonomy, morphology and capture Fisheries</b>	75
V A	<b>Fish Physiology</b>	75
VI A	<b>Applied Ichthyology</b>	75
	<b>CELL BIOLOGY</b>	<b>225</b>
IV B	<b>Cell Biology I</b>	75
V B	<b>Cell Biology II</b>	75
VI B	<b>Cell Biology III</b>	75
	<b>ENDOCRINOLOGY</b>	<b>225</b>
IV C	<b>General and Clinical endocrinology</b>	75
V C	<b>Comparative Endocrinology of Non-mammalian Vertebrates</b>	75
VI C	<b>Molecular Endocrinology and Mammalian Reproductive System</b>	75
	<b>PRACTICAL GENERAL</b>	75
	<b>PRACTICAL SPECIAL</b>	75
	<b>TOTAL</b>	<b>600</b>

# M.Sc. (Previous) Zoology

## PAPER-I

### (Non-Chordata: Structure and Function)

#### Unit-1

1. Concepts of species and hierarchical taxa
2. Organization of Coelom:
  - 3.1. Acoelomates
  - 3.2. Pseudocoelomates
  - 3.3. Coelomates: Protostomia and Deuterostomia

#### Unit-2

4. Protozoa:
  - 4.1. Nucleus and reproduction.
  - 4.2. Colonial protozoans and theories of the origin of metazoans.
5. Porifera: canal system,
6. Cnidaria: Polymorphism in Siphonophora
7. Annelida:
  - 7.1. Adaptive radiation in Polychaetes.
  - 7.2. Trochophore larva: structure and significance

#### Unit-3

8. Mollusca: Torison and detorison.
9. Arthropoda:
  - 9.1. Economic significance,
  - 9.2. Crustacean larvae and their significance.
10. Echinodermata: larval forms and their significance.
11. Salient features and affinities of:  
Sipuncula, Placozoa, Mesozoa, Rotifera and Phoronida.

#### Unit-4

12. Filter feeding in Polychaeta, Mollusca and Echinodermata
13. Organs of respiration: Gills, lungs and trachea
14. Organs of excretion: Coelomoducts, nephridia and malphigian tubules
15. Primitive nervous system-Coelenterate and echinodermata

## PAPER-II

### (Cell Structure and Function & Biochemistry)

#### Unit-1

1. Structure of plasma membrane and function.
2. Structural organization and function of intracellular organelles (nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes).
3. Cytoskeleton
  - 3.1. Microfilaments: Structural organization, cell motility and cell shape
  - 3.2. Microtubule: Structural and functional organization, cilia, flagella, centriole
  - 3.3. Intermediate filaments
4. Regulation of cell cycle

#### **Unit-2**

5. Protein synthesis and processing:
  - 5.1. Genetic code
  - 5.2. Translational proof-reading
  - 5.3. Translational inhibitors
  - 5.4. Post-translational modification
6. Cell signaling:
  - 6.1. G protein coupled receptors: signaling via cAMP, PKA, IP<sub>3</sub>, Ca<sup>2+</sup>/calmodulin, PKC.
  - 6.2. Tyrosine kinase associated receptors: JAK-STAT signaling pathway
  - 6.3. Signaling by nitric oxide
7. Cell death pathways and their significance
  - 7.1. Necrosis
  - 7.2. Apoptosis

#### **Unit-3**

8. Principles of biophysical chemistry:
  - 9.1. pH and buffer,
  - 9.2. Thermodynamics: enthalpy and entropy, colligative properties
9. Conformation of proteins (Ramachandran plot, secondary structure,).
10. Mechanism of ATP synthesis: Electron transport chain assemblies and functions
11. Enzymes
  - 12.1 Enzyme kinetics: Determination and applications of Km
  - 12.2 Mechanism of action: Active site, substrate binding and lowering of energy of activation
  - 12.3 Regulation of enzyme activity: Feedback mechanism and Allosterism
  - 12.4 Isozymes, ribozymes and abzymes.
12. Structure and function of Co-enzymes

#### **Unit-4**

13. Carbohydrates
  - 14.1 Glycolysis and gluconeogenesis
  - 14.2 Glycogenolysis and glycogenesis
14. Lipids
  - 15.1  $\beta$ -oxidation of Fatty acid
  - 15.2 Cholesterol synthesis and transport
  - 15.3 Eicosanoids: prostaglandins, thromboxanes, leukotrienes and lipoxanes
15. Amino acid catabolism: Trans-amination, de-amination, trans-deamination and oxidative de-amination

## PAPER-III

### (Genetics, Cytogenetics and Evolution)

#### Unit-1

1. Human genetics: Inheritance patterns, Pedigree analysis, karyotypes
2. Gene mapping methods: Genetic mapping and physical mapping.
3. Mitochondrial DNA and cytoplasmic inheritance

#### Unit-2

4. Fine structure of gene (*rII* locus)
5. Regulation of gene activity in *lac* and *trp* operons of *E. coli*
6. Introduction to gene regulation in eukaryotes
  - 6.1. Organization of a typical eukaryotic gene
  - 6.2. Transcription factors, enhancers and silencers
  - 6.3. Transcriptional and post-transcriptional regulation
  - 6.4. Non-coding DNA

#### Unit-3

10. Chromosomal proteins
  - 10.1. Histones and their modifications,
  - 10.2. Non-histone proteins, scaffold/matrix proteins
  - 10.3. Centromere, kinetochore and telomere and its significance.
11. Mutation: Types and causes
12. DNA damage and repair: Endogenous and exogenous origins of DNA damage
13. Techniques in clinical cytogenetics (Banding, FISH)

#### Unit-4

14. Theories of evolution: Lamarckism, Darwinism and Modern Synthetic theories.
15. Population as unit of evolution:
  - 3.1. Gene pool and Gene frequencies in Mendelian population
  - 3.2. Hardy-Weinberg Equilibrium
16. Elemental forces of evolution
  - 4.1 Mutation
  - 4.2 Selection
  - 4.3 Random genetic drift
  - 4.4 Migration
6. Isolating mechanisms
7. Molecular Evolution: Origin of new genes and proteins, molecular divergence and molecular clocks;

**PAPER-IV**  
**(Endocrinology and Animal Behaviour)**

**Unit-1**

1. General principle of hormone action:
  - 1.1. Protein hormones-Membrane receptors and signaling pathways (G-proteins-cAMP signaling pathway)
  - 1.2 Steroid hormones
2. Hypothalamo-hypophysial System:
  - 2.1 General organization
  - 2.2 Adenohypophysial hormones: Prolactin, FSH, LH, TSH and ACTH
  - 2.3 Neurohypophysial hormones
3. Role of parathormone, calcitonin and cholecalciferol (Vitamin D) in calcium homeostasis
4. Role of insulin and glucagon in glucose homeostasis.

**Unit-2**

5. Biosynthesis and Secretion of hormones:
  - 5.1. Biosynthesis of Steroid hormones (de novo)
  - 5.2. Biosynthesis, physiological effects and regulation of thyroid hormones (T<sub>4</sub>, T<sub>3</sub>, rT<sub>3</sub>)
  - 5.3. Biosynthesis of Catecholamines
6. Oestrous and menstrual cycles and their regulation by hormones

**Unit-3**

7. Introduction to behaviour:
8. Social behavior
  - 10.1. Altruism and reciprocal altruism, group selection, kin selection, , inclusive fitness
  - 10.2. Social organization in insects and primates.
  - 10.3. Aggressive behavior
9. Reproductive behavior
  - 11.1. Courtship behavior
  - 11.2. Parental investment
  - 11.3. Sexual selection

**Unit-4**

10. Biological clocks: Circadian, circannual rhythm and tidal rhythms.
11. Orientation and navigation
12. Migration of fishes, and birds
13. Communication: Chemical, visual, and acoustic
14. Role of Hormones and Pheromones in control of behavior

**PAPER-V**  
**(Ecology, Biostatics & Instrumentation)**

## Unit-1

### 1. Ecosystem:

- 1.1. Energy flow and mineral cycling (CNP)
- 1.2. Nutrient cycling in different ecosystems
- 1.3. Energy flow in terrestrial and aquatic ecosystems

### 2. Population ecology:

- 2.1. Characteristics of a population and growth curve
- 2.2. Population regulation

### 3. Applied ecology:

- 3.1. Biodiversity-status
  - 3.2. Monitoring and documentation
  - 3.4. Biodiversity management approaches.
4. Concept of habitat and niche

## Unit-2

5. Species interactions: Types of interactions
6. Ecological succession: Types; mechanisms, Concept of climax.
7. Community ecology:
- 7.1. Community structure and attributes
  - 7.2. Levels of species diversity and its measurement
  - 7.4. Edges and ecotones effects.
8. Concept of biodiversity Hotspots

## Unit-3

9. Measures of central tendency
- 2.1. Arithmetic Mean
  - 2.2. Median
  - 2.3. Mode
10. Measures of dispersion
- 3.1. Variance
  - 3.2. Standard deviation and Standard error
11. Correlation:
- 4.1. Types of correlation
  - 4.2. Calculation of correlation in continuous data and ordinal data
12. Regression:
- 5.1. Linear regression
  - 5.2. Regression coefficient
13. Analysis of variance (ANOVA): One way
14. Hypothesis testing
- 7.1. Parametric tests (Paired and unpaired t-test)
  - 7.2. Non Parametric tests (Chi-square test)

## Unit-4

15. Centrifugation
- 1.1. Principle
  - 15.2. High speed and ultracentrifuge
16. Spectrophotometry
- 16.1. Types of spectrophotometer
  - 16.2. Beer-Lambert's law
  - 16.3. Applications

17. Electrophoresis: Principle, Agarose and polyacrylamide gel
18. Detection of proteins: Western blotting
19. Recombinant DNA techniques
  - 7.1. Southern and Northern hybridizations
  - 7.2. Polymerase chain reaction: principle and applications
20. Types of microscope and their biological applications
  - 20.1. Phase contrast microscope
  - 20.2. Fluorescence microscope
  - 20.3. Transmission and scanning electron microscope

## **PAPER-VI**

### **(Applied Biology, Parasitology, Histology & Histochemistry)**

#### **Unit-1**

1. Transgenic animals
2. Biosensors.
3. Bioremediation
4. Genomics and its application to health
5. Tissue and cell culture methods for animals.

#### **Unit-2**

6. Host parasite interaction:
  - 7.1. Recognition and entry processes of different pathogens like bacteria, viruses into animal host cells
  - 7.2. virus-induced cell transformation
  - 7.3. Cell-cell fusion in both normal and abnormal cells.
7. Parasites and parasitism
  - 8.1. Types of parasites
  - 8.2. Types of host
  - 8.3. Vectors
8. Protozoan and Helminth parasites:
  - 9.1. *Leishmania donovani*
  - 9.2. *Echinococcus granulosus*
  - 9.3. General characters, organization and larval forms of Platyhelminths and Nematelminths

#### **Unit-3**

- 9. Fixation and tissue processing**
  - 9.1. Types of fixatives and their chemistry
  - 9.2. Dehydration
  - 9.3. Clearing and embedding
- 10. Microtomy**
  - 11.1. Types of microtomes and sectioning
- 11. Staining of paraffin sections**
  - 11.1. Principle and methods of staining

#### **Unit-4**

12. Principles and methods of histochemical localization and identification of the following
  - 12.1. Carbohydrate moieties
    - 13.1.1 Glycogen and glycoproteins with oxidizable vicinal diols by periodic acid Schiff method
    - 13.1.2 Glycoproteins with carboxyl groups and/or O-sulphate esters by alcian blue methods
  - 12.2. Protein end groups
    - 12.2.1 –NH<sub>2</sub> groups by ninhydrin-Schiff method
    - 12.2.3 –SS- groups by performic acid –Schiff and performic acid- alcian blue methods
  - 13.3. Lipids moieties
    - 13.3.1. Sudan black B method
    - 13.3.2. Sudan III and Sudan IV methods
    - 13.3.3. Differentiation of neutral lipids from acidic lipids by Nile blue sulphate method
  - 13.4. Nucleic acids
    - 13.4.1. Methyl green pyronin-Y for DNA and RNA

# M.Sc. (Final) Zoology

## PAPER-I

(Chordata: Protochordata to Mammalia)

### Unit-1

1. Basic concepts of biosystematics and taxonomy
  - 1.1 Chemotaxonomy
  - 1.2 Cytotaxonomy
  - 1.3 Molecular taxonomy
2. Procedure keys in taxonomy, ICZN its principles and applications.

### Unit-2

2. Characteristic features and affinities of:
  - 1.1. Hemichordata
  - 1.2. Urochordata
  - 1.3. Cephalochordata
  - 1.4. Cyclostomes.
3. Transition from agnatha to gnathostomata
4. Origin of vertebrates

### Unit-3

4. Adaptive radiation in vertebrates: theories and types.
5. Parental care in amphibians
5. Oviparity in mammals
6. General plan of circulation in chordates



## **Unit-4**

7. Respiratory system in chordates
9. Skeletal system in chordates
10. Organs of olfaction and taste
11. Lateral line system
12. Adaptation in flightless birds

## **PAPER-II**

### **(Mammalian Physiology & Immunology)**

#### **Unit-1**

1. Blood and circulation:
  - 1.1. Blood corpuscles, Haemopoiesis, blood groups, haemoglobin and haemostasis
  - 1.2. Origin and conduction of cardiac impulse
  - 1.3. ECG-its principle and significance
2. Respiration:
  - 2.1. Exchange and transport of gases
  - 2.2. Neural and chemical regulation of respiration
  - 2.3. Respiratory adaptation to low oxygen tension
3. Excretion:
  - 3.1. Urine formation
  - 3.2. Regulation of water balance
  - 3.3. Electrolyte balance
  - 3.4. Acid-base balance

#### **Unit-2**

4. Digestion:
  - 5.1. Digestion and absorption of carbohydrates, lipids and proteins
  - 5.2. Hormonal and neural regulation of gastrointestinal function
5. Muscle: Mechanism of muscle contraction
6. Nervous system:
  - 6.1. Membrane potential and action potential
  - 6.2. Transmission of nerve impulse
  - 6.3. Types of synapses
7. Thermoregulation

#### **Unit-3**

8. Concept of Immunity:

- 8.1. Innate and adaptive immunity
- 8.2. Immune cells: Activation and differentiation of B and T cells.
- 9. Innate Immunity
  - 10.1. Toll-like receptors
  - 10.2. Complement system
- 10. Humoral immunity
  - 10.1. Antigen and hapten
  - 10.2. Antibody: types, structure and functions
  - 10.3. Generation of antibody diversity
- 11. Cell mediated immunity
  - 12.1. T cell receptors
  - 12.2. Major Histocompatibility Complex (MHC)
  - 12.3. Antigen: processing and presentation

#### **Unit-4**

- 12. Proteins in immune system:
  - 12.1. Monoclonal antibodies
  - 12.2. Interferons
- 13. Inflammation, hypersensitivity and autoimmunity
- 14. Vaccination
- 15. Basic concept of cancer.

### **PAPER-III**

#### **(Developmental Biology & Bioinformatics)**

#### **Unit- 1**

- 1. Gametogenesis:
  - 1.1. Spermatogenesis - formation of spermatids and spermiogenesis;
  - 1.2. Oogenesis- oocyte growth, maturation and vitellogenesis,
- 2. Types of eggs
- 3. Ovulation and ovum transport in mammals.
- 4. Regeneration
- 5. Stem Cells

#### **Unit- 2**

- 6. Fertilization:
  - 6.1. Molecular events during pre- and post-fertilization
  - 6.2. Prevention of polyspermy and egg activation,
  - 6.3. IVF
- 7. Extra-embryonic membranes.
- 8. Cleavage- patterns and mechanisms;
- 9. Reorganization of embryonic cells-gastrulation and fate of germinal layers.
- 10. General concept of potency and induction

### Unit- 3

11. Morphogenesis, cell aggregation and differentiation in Dictyostellium.
12. Axes and pattern formation in *Drosophila*, amphibia and chick
13. Formation of neural tube in vertebrates
14. Development of limb in vertebrates: role of HOX and other pattern-forming genes

### Unit-4

1. Basic concept of bioinformatics:
  - 1.1. Concept of digital laboratory
  - 1.2. Basics of information technology for biologist
2. Basic features and management systems of following
  - 2.1. Nucleic acid sequences databases
  - 2.2. Protein sequence, structures and interacting proteins databases
3. Basic knowledge of data archiving systems (FASTA format, Accession and GI-Number)
4. Introduction to data retrieval systems
  - 4.1. Search engines
  - 4.2. Entrez, protein identification resource

## SPECIAL-I

### PAPER-IV A

#### Fish Taxonomy, morphology and capture Fisheries

##### Unit-1

Classification of fish up to orders as proposed by L.S. Berg (1940).

Taxonomic study of marine and freshwater fishes with special reference to identification of local forms.

##### Unit-2

**Integument:** general organization of skin, barbules, types of scales and skin.

**Specialized organs:** nervous and lateral line system, sense organs and Specialized organs (electric organs, poison glands, sound producing organs and light producing organs and sense organs) Swim bladder and Weberian ossicle: morphology and function.

##### Unit-3

**Inland capture fishery resources of India:**

**Riverine fisheries:** river systems, resources, exploitation, regulation and effect of river pollution.

**Cold water fishery:** fishery resources, management and development.

**Estuarine fisheries:** resources and problems of brackish water.

**Marine fisheries:** resources, exploitation and management.

Pollutants affecting fishery waters with special reference to oil spills, domestic pollutants, industrial water, radioactive wastes.

**Unit-4**

**Crafts and Gears :** Important traditional and modern crafts used for fish catch in inland and marine water, Conventional and unconventional fishing methods used in inland and marine sector Age and growth determination

Common enemies and symptoms, etiology and treatment of diseases of food fishes

**SPECIAL-II**

**PAPER-V A**

**Fish Physiology**

**Unit-1**

Nutrition: Alimentary canal and its modifications in relation to food and feeding habits associated glands, digestion and energy utilization.

Circulatory system: heart structure and blood vessels, composition of blood.

**Unit-2**

Respiration: Structure and function of gills gill rakers and their uses, counter current mechanism, gas exchange. Transport of oxygen and carbon dioxide.

Accessory respiratory organ and physiological adaptation in air breathing fishes. Swim bladder.

### Unit-3

Excretion: Kidney structure and modifications, nitrogenous excretory products ,urine formation.

**Osmo regulation:** Osmoregulation in fresh water and marine fishes. Osmoregulation in migratory fishes.

### Unit-4

Endocrine glands: Pineal, hypophysis, thyroid, adrenal, ultimobranchial body, corpuscles of stannous and urophysis

Reproduction: gonad structure spermatogenesis, oogenesis, and endocrine control of reproduction.

## SPECIAL-III

### PAPER-VI A

#### Applied Ichthyology

#### Unit-1

**Fish Farming:** Type of fish farming,

**Fish ponds:** construction and lay out of different types ponds, physico-chemical and biological characteristics of ponds, control of weed and predators.

Planktons in relation to fish production.

Predatory and weed fishes and their eradication.

#### Unit-2

**Fertilization and management of fishery pond:** spawning, hatcheries, rearing, stocking, transport, and mortality of fish fry.

**Fish culture systems:** composite culture, cage culture, sewage culture, pen culture, beel culture and paddy culture

#### Unit-3

**Principal and importance of fish preservation:** traditional and advanced methods of fish preservation – sun drying, salt-wring, pickling smoking, chilling, frying and canning etc. Processing and preservation of fish production and by products like oil, fish sauce, fish glue etc.

Breeding Techniques: Induced breeding, Spawning habits, factors affecting spawning, spawning seasons and frequency.

#### Unit-4

**Application of genetics in aquaculture:**

Sex manipulation, chromosomal manipulation, gene engineering.  
Transgenic fishes

Production of monosex and sterile fishes and their significance in aquaculture.

## **Cell Biology (SPECIAL PAPER)**

### **SPECIAL-I**

#### **PAPER-IV B**

#### **Cell Biology I**

##### **UNIT I**

Molecular organization of eukaryotic chromosomes; Chromosome compaction (Nucleosome, solenoid); Organisation and significance of heterochromatin; Specialized chromosomes: Structural organization and functional significance of polytene chromosomes in cells of dipterans, lampbrush chromosomes of vertebrate oocytes and salivary gland of *Drosophila*.

##### **UNIT II**

Cell signaling: Signaling through membranes receptors (G protein coupled receptors, Receptor Tyrosine kinase) ; intracellular receptors (signaling of steroid molecules)

##### **UNIT III**

Communication between cells and their environment: Interaction of cells with extracellular matrix and other cells; Integrin, selectins and cadherins, cellular junction.

##### **UNIT IV**

Cytoskeleton: structure and dynamics of microfilaments, intermediate filaments and microtubules.

Cell cycle and its regulation; Cell aging

### **SPECIAL-II**

## **PAPER-V B**

### **Cell Biology II**

#### **UNIT I**

Bioenergetics: Laws of energy changes (concept of entropy, free energy), Free radicals and redox couples, coupled reactions.

#### **UNIT II**

Special cell function: Immunocompetent cells; Differentiation of B lymphocytes and humoral immune response, Differentiation of T lymphocytes and cellular immune response; Antigen Processing and Presentation, Antigen presenting cells, Major Histocompatibility Complex (MHC), MHC Restriction of Lymphocytes.

#### **UNIT III**

Polyclonal antibody, Types, structure and function; antibody diversity

#### **UNIT IV**

Monoclonal antibody, hybridomas; Function of monoclonal antibody. Cancer: Cytological characteristics of transformed cells, cancer causing agents. Molecular Biology of cancer: tumor suppressor genes and oncogenes

## **SPECIAL-III**

### **PAPER-VI B**

### **Cell Biology III**

#### **UNIT I**

Tools and Techniques of cell Biology Microscopy Principles of light and electron microscopy Tissue preparation: Fixation of tissue for paraffin and cryocut sectioning and electron microscopy: Tissue embedding (Paraffin and epoxy resin) Tissue sectioning (Rotary and semi-ultra microtome)

#### **UNIT II**

Histochemical techniques for detection of carbohydrates, lipids, proteins, Techniques for detection of special cells: Neuronal staining: Cresyl violet and Silver Impregnation staining (Golgi Cox)

#### **UNIT III**

Autoradiography: Uses of radioisotopes as tracers in cell Immunocytochemistry/ Immunohistochemistry, in situ hybridization, Light microscopic immunocytochemistry

#### **UNIT IV**

Immunoelectron microscopy: Nano-gold immunoprobe and Protein A-gold immunocytochemistry Applications of Immunocytochemistry/Immunohistochemistry: Detection of histopathology of diseases. Study of histogenesis and cytogenesis. Cell culture: Cell death, Detection of apoptotic and necrotic cells (AO/EB staining) Direct and Indirect Method Fluorescence and Enzymatic Method

## **ENDOCRINOLOGY (SPECIAL PAPER)**

### **SPECIAL-I**

#### **PAPER-IV C**

##### **General and Clinical endocrinology**

###### **Unit-I**

- 1. Aims and scope of endocrinology**
- 2. Pineal gland**
  - 2.1 Biosynthesis of Melatonin
  - 2.2 Sleep disorders, and jet lag
- 3. Pituitary gland**
  - 3.1 General organization
  - 3.2 Hormones and their functions
  - 3.3 Diseases and disorders related to Pituitary gland

###### **Unit-II**

- 4. Thyroid gland**
  - 4.1 General organization
  - 4.2 Hormones and their functions
  - 4.3 Diseases and disorders related to Thyroid gland
- 5. Parathyroid gland**
  - 5.1 General organization
  - 5.2 Hormones and their functions
  - 5.3 Diseases: osteoporosis and tetany

###### **Unit-III**

- 6. Endocrine pancreas**
  - 6.1 General organization
  - 6.2 Hormones and their functions
  - 6.3 Disease: diabetes mellitus (type I and type II)
- 7. Adrenal gland**
  - 7.1 General organization
  - 7.2 Hormones and their functions
  - 7.3 Diseases and disorders related to Adrenal gland

###### **Unit-IV**

- 8. Testis**
  - 8.1 General organization of testes, Sertoli Cell and Leydig Cell



- 8.2 Biosynthesis and functions of hormones
- 8.3 Male infertility
- 8.4 Cryptorchidism
- 9. Ovary**
  - 9.1 General organization
  - 9.2 Biosynthesis and functions of hormones
  - 9.3 Female infertility:
    - 9.3.1 Polycystic ovary disease, hirsutism, and hyperandrogenism
- 10. GI Hormones:
  - 10.1 Types
  - 10.2 Functions

## **SPECIAL-II**

### **PAPER-V C**

#### **Comparative Endocrinology of Non-mammalian Vertebrates**

##### **Unit-I**

- 1. Basic concept of neurosecretion.**
  - 1.1 Neurosecretory system in invertebrates with special reference to insects.
  - 1.2 Comparative anatomy and functions of hypothalamic neurosecretory centers in different groups of vertebrates (fish to birds).
  - 1.3 Comparative anatomy of neurohypophysis and its hormones in different groups of vertebrates (fish to birds)
  - 1.4 Median eminence: structure and functions in different groups of vertebrates (fish to birds)
- 2. Structure and functions of adenohipophysis**
  - 2.1 General organization in different groups of vertebrates (fish to birds)
  - 2.2 Cell types and functions (fish to birds)

##### **Unit-II**

3. Functions of pars intermedia in non-mammalian vertebrates
4. Comparative aspects of the Epiphysial Complex (fish to birds)
5. Comparative anatomy, cellular characteristics and functions of thyroid gland in different groups of vertebrates emphasizing the role of thyroid hormones in amphibian metamorphosis.

##### **Unit-III**

6. Cellular organisation and functions of parathyroid hormones.
7. Cellular organisation and functions of endocrine pancreas.
8. Comparative anatomy, histology and functions of adrenal glands (interrenal/cortex and chromaffin tissue/medulla) in different groups of vertebrates (fish to birds).

##### **Unit-IV**

- 9. Gonad as endocrine organ**
  - 9.1. Anatomical and histological organisation of testis and ovary (from fish to birds)

- 9.2. Functions of testicular and ovarian hormones.
- 10. Endocrine control of osmoregulation in vertebrates with special reference to fish
- 11. Nonapeptides: localization and regulation of secretion, mechanism of action

## **SPECIAL-III**

### **PAPER-VI C**

#### **Molecular Endocrinology and Mammalian Reproductive System**

##### **Unit-I**

- 1. Classification of hormones on the basis of chemical nature**
- 2. Mechanism of hormone actions**
  - 2.1 Action of peptide and glycol-peptide hormones
    - 2.1.1 Classification of Membrane receptors
    - 2.1.2 G-proteins mediated hormonal actions
    - 2.1.3 Cyclic AMP signaling cascade
    - 2.1.4 PKC signaling pathway
- 3. Mechanism of actions of steroid hormones (genomic and nongenomic pathways)**

##### **Unit-II**

- 4. Control of hormone secretion**
  - 4.1 Synthesis, processing, and sorting of pre-prohormone precursor
  - 4.2 Regulation of secretory pathway with reference to thyroxine
- 5. Feedback regulation: General Concept**

##### **Unit- III**

- 6. Testis**
  - 6.1 Spermatogenesis and its hormonal regulation
- 7. Male sterility**
  - 7.1 Parameters of male sterility
  - 7.2 Origin and cause of male sterility
    - 7.2.1 Azoospermia
    - 7.2.2 Oligozoospermia
- 8. Reproductive pheromones**
  - 8.1 Pheromones in regulation of estrous cycle, puberty and pregnancy
  - 8.2 Human reproductive pheromones

## **Unit-IV**

### **9. Reproductive cycles**

9.1 Estrus and Menstrual cycle

9.2 Control of seasonal reproductive cycle by environmental cues (photoperiod and temperature)

### **10. Regulation of ovarian function**

10.1 Ovarian steroids in regulation of

10.1.1 Pre-ovulatory condition

10.1.2 Oocyte maturation

10.1.3 Corpus luteum

10.1.4 Follicular atresia

### **11. Hormonal control of pregnancy and implantation**