## 58 FISH PHYSIOLOGY AND BIOCHEMISTRY

### Unit 1: Introduction to Fish Physiology

Physiology of respiration: Gill morphology, structural and functional variations of respiratory pigments (haemoglobin), mechanism of gaseous exchange, mechanism of oxygen transport by haemoglobin, $CO_2$ transport, countercurrent principle, water flow across the gills, respiratory pumps, accessory respiratory organs, oxygen sensing, buffer system in blood; Cardiovascular system: Structure and functions of heart, ultrastructure of cardiocytes, physiology of cardiac pumping, blood circulation, blood pressure, composition of blood, heart and cardiac output, structure of blood/hemolymph pigments, cardiac plasticity in fishes; Physiology of osmoregulation and excretion: Excretory and osmoregulatory organs in fish and shellfish and their functions, osmoregulatory strategies in fishes, mechanism of osmotic and ionic regulation, ion transporters and channels, acid base regulation, hormonal regulation of osmoregulation; Mechanism of excretion of nitrogenous wastes; Physiology of digestion: Food and feeding habit, digestive system,physiology of gastro-intestinal tract, absorption and assimilation of nutrients, digestive enzymes, hormonal regulation of digestion, factors affecting digestion; Stress and adaptive physiology: Stages of stress response in fish, thermal stress in fish, responses of fish during hypoxia, C-reactive proteins, HSP, anti-freeze proteins and metallothioneins.

### Unit 2: Reproductive Physiology and Endocrinology

Modes of reproduction in fishes:Sex determination and differentiation, sexual dimorphism, primary and secondary sex characters, bisexual reproduction, inter-sexes, hermaphroditism; Sex reversal; Parental care in fishes;Oogenesis; Spermatogenesis; Mechanism of oocyte maturation and ovulation, spawning, gamete activation and fertilization, environmental and neuroendocrine regulation of reproduction in fish, neuroendocrine system in crustaceans; Synthetic hormones for breeding in aquaculture;Endocrinology: Endocrine, paracrine and autocrine regulation of hormones, endocrine functions of pituitary, hypophthalamus, gonads and peripheral endocrine glands; Classification and functional properties of different hormones, hormone receptors and their regulation, mechanism of hormone action at cellular level.

### Unit 3: Fish Biochemistry

Carbohydrates: Definition, classification and biological significance, isomers, structure and properties of monosaccharides, disaccharides, polysaccharides and mucopolysaccharides; Proteins:Definition, classification, protein structure, biological significance; Amino acids: structure, classification and functions; Lipids**:**Definition, classification, biological significance; Fatty acids: Structure, properties and chemical reactions, saponification and iodine number, peroxide value of fats, cholesterol, glycolipids, phospholipids, prostaglandins, PUFA; Biochemistry of vitamins and minerals;Enzymology: Nomenclature, classification of enzymes, active site, concepts of activation energy, transition state and enzyme-substrate complex, units of enzyme activity, factors affecting enzyme activity, enzyme kinetics,Michaelis-Menten equation,

Km and Vmax values,Lineweaver and Burke Plots, enzyme inhibition, enzymes of clinical importance; Biochemical techniques: Principle and applications of spectrophotometry, chromatography, HPLC, RIA and ELISA.

**Unit 4: Metabolism of Biomolecules**

Carbohydrate metabolism: Glycolysis, TCA cycle, pentose phosphate pathway, gluconeogenesis, glycogen metabolism, regulation of blood glucose level;Protein and amino acid metabolism: Biosynthesis of protein, oxidative and non-oxidative degradation of amino acids, transamination and deamination, urea cycle, biosynthesis ofnon-essential amino acids; Lipid metabolism: Biosynthesis of fatty acids, oxidation of fatty acids, ketone bodies, desaturation and elongation of fatty acids, control of fatty acid metabolism, synthesis of prostaglandins; Synthesis and degradation of nucleic acids.