BIOLOGICAL SCIENCE (HONS./PG) [CODE -05]

ZOOLOGY

Invertebrates:

1. Classification of major phyla upto subclass with examples.
2. Special features: Reproduction a Protozoa. Polymorphism of Siphonophira, Respiration in Arthropod. Nervous system in Gastropod. Water vascular system in Starfish.

Chordates:

1. Classification of Amphibians. Reptilians & Mammalians upto order with Examples.
2. Special features, Lateral sense organ in fishes. Non-poisonous and poisonous snakes. Heart and aortic arches, Brain in man Exoskeleton structures in bird.

Cytology, Histology & development Biology:

1. Structure & function of plasma membrane. Mitochondria, Golgi complex and Endoplasmic reticulum.
2. Nucleic Acids: DNA-Physico Chemical structure-replication, transcription & role in cell cycle, RNA types: Structure of RNA function & role in protein synthesis.
3. Histology of Liver, Pancreas and Kidney.
4. Histological technique: Fixation & Fixative. Outline classification of dyes.
5. Outline knowledge of Gametogenceis; Ultra structure of sperm & ovum.
6. Morphogenetic movements and fate map.
7. Concept of organizers in development.
8. Organogenesis: Development of eye in chick.
9. Placenta types, structure and functions in rodents.

Distribution, Evolutionary Biology & Systematics:

1. Zoogeographical realms and subdivisions & their characteristic fauna.
2. Chemical basis of Origin of life.
3. Modern concept of evolution – Neo-Darwinism and Harby-Weinberg equilibrium.
4. Adaptation types: Adaptive radiation & adaptive convergence in mammals: Desert adaptation,
5. Biological species concept.
6. Importance of classification; Principles of zoological nomenclature.
7. Modes of speciation – Sympatric, allopatric & parapatire processes.

Ecology, Animal behaviour, Biodiversity & Conservation:

1. Energy flow in the ecosystem.
2. Population Ecology: growth forms; regulation of population density.
3. Community ecology: habitat & niche concept. Resource partitioning, species diversity.
4. Ecological succession.
5. Instinctive and learning behaviour.
6. Complex behaviour: fixed action pattern; circadian, rhythm; migratory behaviour in bird.
7. Concept of biodiversity: Types of biodiversity & its importance mega diversity zones & Biodiversity Hotspots with special reference to India.
8. Concept of conservation: in situ and ex situ methods.
9. Wildlife conservations strategies.

Parasitology & Immunology:

1. Lifecycle, pathogenecity, clinical features & control of ---- *Plasmodium vivax, and Wuchereria bancrofti*
2. Mosquitoes as vector for disease transmission.
3. Classification of immunoglobin; acquired & innate immune system; lymphoid & myeloid cells in immune system: T & B cell co-operation: macrophage.

Genetics & Molecular Biology:

1. Cell cycle.
2. Allele concept, multiple allele (ABO blood group); pseudo allele; isoallele; allelic interaction.
3. Sex determination with special reference to Drosophila and Man.
4. Gene as a structural & functional unit --- cistron concept; one gene – one polypeptide; sickle cell anemia; thalassemia.
5. Genetics and molecular biology of replication, transcription and translation.
6. Mutation-types, detection, molecular mechanism, chromosomal aberration.
7. Elementary idea of DNA finger printing, PCR, cloning, oncogene.

Animal Physiology & Biochemistry:

1. Enzymes: Classes, kinetics and factors affecting it.
2. Structure and function of haemoglobin.
3. Structure of mammalian nephron; Physiology of urine formation; osmoregulators & osmoconformer.
4. Nature, origin and propagation or nerve impulse along a neuron.
5. Transport of oxygen & Carbon dioxide in mammals.
6. Elementary idea of structure of carbohydrate, protein & lipid.

Endocruiology and reproductive biology:

1. Endocrine glands and hormones --- classification of hormones, mechanism and effects of hormonal actions.
2. Hormonal regulation of gametogenesis in males and females of mammals, reproductive cycle in mammals.
3. Brief notes on Endocrine disorders, RIA, ELISA, cry preservation of gametes.

Environment Biology:

1. Nature, sources & effects of major pollutants of air & water; noise pollution.

Applied Zoology:

1. Aquaculture: Induced breeding. Composite fish culture, Exotic fishes & their role. Freshwater & brackish water prawn culture.
2. Sericulture: Silk varsities in India; mulberry silkworm culture, diseases of silkworm and their control.
3. Biology & control of pests: Paddy pest *(Scirpophegor in ortutus)* Anomies sobulifra stored grain pest *(Sitophilus oryzea)* rodent pest *(Bandicoota begabusi)* Biological and Integrated Pest Management.
4. Animal husbandry: common dairy breeds (cow); techniques of dairy management (brief idea); common poultry breeds (fowl) rearing methods, diseases & control.

BOTANY

A. CELL:
   (a) Prokaryotes and Eukaryotes: Characteristics, and differences with reference to their Nuclear and cell wall compositions.
   (b) Structure, function and significance of cellular organelles and cell membrane. Chromosomes: Ultra-structures and chemical compositions.

B. PLANT ANATOMY
   Plant Tissue: Definition, Classification, Distribution and Functions including Mechanical tissues.
   Stele: Types & Evolution
   Normal and anomalous secondary growth in stems and roots in plants. Root-steam Transition.

C. ECOLOGY AND ENVIRONMENT:

Divisions of ecology, ecological factors, ecological units; Energy flow in ecosystem; Ecological niche; General ideas about global warming; Eutrophication; Ozone depletion; Acid rain; Sustainable development. Afforestation – Process and significance; Briosphere Reserve. Pollution air, water and soil.

D. PLANT GROUPS:

1. ALGAE: Range of thallus structures; Economic importance (as food, fodder, fertilizer and sources of iodine, laminarine starch, phycocolloid, agar, algin diatomite.
2. FUNGI: Structure of cell wall, mycelium, spore forms reproduction types: Homo-and heretrohallism, Parasexuality. Economic importance.
3. BRYOPHYTES & PTERIDOPHYTES: Structural organization or gametophytes and sporophytes-a brief knowledge. Economic importance.
4. GYMNOSPERMS & ANGIOSPERMS: Structural organization of ovule, male and female gametophytes in cycas and pixus post-fertilization changes in embryo-sac in angiosperms.

E. PLANT PATHOLOGY:

Necrosis, hypo plastic and hyperplastic symptoms of plant diseases, mechanism of infection Disease control-a brief knowledge, with emphasis on chemical and biological control.

F. TAXONOMY:

Concept of artificial, natural and phylogenetic system of classification; Outline classification of Cronquist (1981). Role of Cytology and Phytochemistry in tamonomic studies. Diagnostic characters, evolutionary significance of the following families: Magnoliaceae, Nymphaeacea, Compositae (Asteraceae). Alismataceae, poaceae (Graminee) and Ochidaceae.

ICBN-principles, rules of priority, effective and valid publication, brief note on cladistics. Functions of Herbaria and Botanical Gardens; Biodiversity and conservation-in-situ and ex-situ, Brief note on IUCN and Biosphere Reserves.

G. PALEOBOTANY:

Fossils --- Types, processes of fossilization, Geological time scale.

H. PLANT PHYSIOLOGY:

(b) Preliminary ideas about acid, base, and buffer.
(c) Transpiration: Mechanism and factors affecting it.
(d) Role of mineral elements in plants.
(e) Photosynthesis: Photosynthetic pigments and their properties, photo-phosphorylation. Calvin cycle, C4-cycle & photorespiration, CAM.
(f) Respiration – Concept of fermentation in terms of Industrial Bio-technology, Glycolysis, pentose phosphate pathway, Kreb's cycle and Electron transport system.
(g) Hormones-Role of auxin, gibberellins, cytokinnis, ethylene and abscistic acid in plant growth and development.
(h) Enzymes: Definition; Properties of Enzymes, and types of enzymes.

I. PLANT BIOCHEMISTRY:

General Chemistry of carbohydrate, protein and fat.

J. CYTOGENETICS & PLANT BREEDING:

Cell Cycle – Definition and different phases. Mendelism, Linkage and Crossing over - Types with examples Chromosome aberration, Aneuploidy, Euploidy; Gene Mutation – Definition, types and importance, Gene regulation (Operation concept), genetic code, protein synthesis, Brief Knowledge about Transposon. Oncogene, Gene cloning, Gene transfer ,PCR.

Definition, methods and importance of mass selection, pureline selection, hybridization and hybrid vigour. Tissue culture- Definition, Types and Prospects in Agriculture and Forestry.

K. PHARMACOGNOZY:

Active principles, macroscopic, microscopic characters and uses of the following drug-yielding plants: *Azadirachta* (neem) *Andrographis* (Kalmegh), *Rauvolfia*

L. MICROBIOLOGY:

Virus: general properties, structure of bacteriophage; concept of Plasmid. Electron microscopic structure of a bacterial cell. Development of endospore. Process of Transduction. Nutritional groups of Bacteria (Photo-autotroph. Chemoautotroph, Photoorganotroph and Chemoorganotroph).

PHYSIOLOGY

1. Cellular Physiology:

Molecular structure of cell membrane and mitochondria.

Enzymes – Properties, mechanism and kinetics of action, regulation of enzyme action, enzyme inhibitors.

2. Biochemistry & Metabolism:

Chemistry of carbohydrates, proteins, lipids and nucleic acids. Metabolic pathways – glycolsis, HMP shunt, TCA cycle, beta-oxidation of fatty acids, glycogenesis cholesterol synthesis, protein synthesis, purine and pyrimidine biosynthesis. Hormonal regulation of metabolic pathways. Oxidative phosphorylation.

3. Nutrition & Dietetics:

Digestion and absorption of nutrients, composition, functions and regulations of salivary juice, gastric juice, pancreatic juice and bile, Balanced diet, RDA, BMR, RQ, Specific dynamic action. Calorie value of foods, Biological value of proteins, NPU Vitamins – sources, functions, deficiency symptoms, hypervitaminosis, antivitamins. Minerals – functions and deficiency symptoms. Undernutition and overnutrition and overnutrition. Diet chart formulation for adult person and pregnant woman.

4. Body fluid and Immunology:

Composition and functions of blood. Buffers in blood and regulation of blood pH. Coagulation of blood. Blood Groups. Formation, circulation and functions of lymph and tissue fluid. Immunity – Innate and acquired immunity, Humoral an cell mediated immunity. Hypersensitivity, Acquired Immuno Deficiency Syndrome.

5. Heart & Circulation:

Heart rate and its regulation. Cardiac output-measurement and factors affecting. ECG-normal ECG, leads, vectocardiogram. Blood pressure-vasomotor centres, vasomotor reflexes, capacitance and resistance vessels. Molecular mechanism of vasoconstriction and vasodilatation. Hypertension, arterial and venous pulse. Peculiarities of coronary of coronary and cerebral circulation.

6. Respiration:

Volumes and capacities of lungs, Mechanics of breathing-lung compliance, intrathoracie & intrapleural pressure, surfactant, work of breathing, Hypoxia, Oxygen toxicity Neural centers and reflexes regulating respiration.

7. Physiology of Excitable Tissue:

Molecular mechanism of contraction and relaxation of different types of muscles, Sarcotubular system and excitation – contraction coupling. Different elastic components of muscles, Heat production in muscles during activity.
Nerve impulse. Compound action potential of nerve. Membrane current and conductance. Voltage gated channels, molecular basis of synaptic transmission. Electron microscopic structure of my neural junction-active zones, gutter, post synaptic receptors, EPP, MEPP.

8. Nervous System:

Stretch reflex, inverse myototic reflex, muscle spindle, propiospinal reflex, spinal shock, Structure, connections and functions of cerebellum, basal ganglia, thalamus, Hypothalmic control of food and water intake, neuro-endocrine functions. Functions of association cortex, Asymmetric functions of cerebral cortex, Functions of limbic system,

Neural basis of memory. Sleep and REM Sleep. Impulse transmission in autonomic ganglia. Molecular basis of autonomic neural activity on effector organs.

9. Special Senses:

Receptors as biological transducer, Muller's law of specific nerve energies**,** Transduction mechanism in rods and cones, auditory hair cells, gustatory and olfactory Neural basis of sensory coding – Pitch And loudness perception, odor and taste discrimination, physiology of colour vision, visual acuity.

10. Renal Physiology:

Histological structure of nephron and filtering membrane, glomerular filtration, counter current exchanger and multiplier. Physiological mechanism of tubular reabsorption and secretion. Diuresis. JG apparatus.

11. Endocrine system and Chronobiology:

Physiological functions of the hormones – pituitary, thyroid, parathyroid, pancreas, adrenal. Cell signaling mechanism of hormones – cAMP, IP_3 , DAG, Tyrosine kinase, Jak-STAT Pathway. Hypo and hyperactive states of endorcrine glands – Acromoegaly, Frolich's Syndrome, hashimoto's disease, Cursching's syndrome, Pheochromocytoma, Biorhythm, Zeitgeber, Free running rhythms, Cardian rhythm in adrenal, pineal and sleep-wake behaviour, neural basis of single and multiple oscillators of cardian rhythm jet-lag.

12. Reproductive Physiology:

Hormonal control of ovulation. Physiology of implanation, Hormonal control of preganancy and lactation, Spermatogenesis and its hormonal control. Control of fertility and population.

13. Exercise and Sports Physiology:

Maximum aerobic power and factors affecting it. Excess post exercise oxygen consumption (EPEOC). Effect on training on physiological systems. Anaerobic threshold. Anaerobic capacity. Anaerobic and aerobic requirements in different sports activities.

14. Body temperature Regulation:

Structure of skin, composition of sweat, channels of heat loss and gain. Neural and humoral control of body temperature.

15. Environmental Physiology:

Physiological changes in extreme environment: Hot, Cold, Hypobaric and Hyperbaric conditions. Heat stress. Acclimatization in high altitude, hot and cold environment Cardiovascular and respiratory effects of positive and negative G-Forces, Noise pollution and its impact on human life, lonizing radiation hazards, Toxicology of industrial wastes-diseases due to excess accumulation of Pb, Hg and Cd in body. Addiction to tobacco, alcohol and narcoties, Over population – its causes and effects.

16. Biomedical Instruments:

Basic principles and uses of following instruments : UV – Spectrophotometer, ECG, EMG, EEG, Pulmonary function analyzer, CT Scan, MRI, Ultrasonography (USG), Dialyser, Pacemaker, Endoscopy.