BIOLOGY (863)

Aims:

1. To enable candidates to acquire the knowledge and to develop an understanding of biological terms, concepts, facts, principles, formulae, etc.
2. To develop the ability to apply the knowledge of biology in unfamiliar situations.
3. To develop experimental skills required in biology practical work.
4. To create awareness about the problems of the environment and the manner in which these problems can be overcome.
5. To develop the ability to appreciate biological phenomena in nature and the contribution of biology to human welfare.
6. To develop interest in plants and animals and in their respective environments.
7. To develop scientific attitude towards biological phenomena.
8. To create awareness of the fundamentals of human biology, food, health, nutrition and population control.

CLASS XI

There will be two papers in the subject.

Paper I: *Theory:*	*3 hours*	*... 70 marks*
Paper II*: Practical:*	*3 hours*	*... 20 marks*
Project Work		*... 7 marks*
Practical File		*... 3marks*

PAPER I –THEORY – 70 Marks

There will be one paper of 3 hours duration divided into 2 parts.

Part 1 (20 marks) *will consist of compulsory short answer questions, testing knowledge, application and skills relating to elementary/fundamental aspects of the entire syllabus.*

Part 2 (50 marks) *will be divided into two Sections A and B. Candidates are required to answer* ***three*** *out of* ***five*** *questions from Section A and* ***two*** *out of* ***four*** *questions from Section B. Each question in this part shall carry 10 marks.*

All structures (internal and external) are required to be taught along with diagrams.

SECTION – A

1. The Living World

(i) Tools of Biology: (Dissecting microscope, compound microscope, electron microscope); Methods of scientific research. Scope of Biology.

A brief idea of compound microscope, electron microscope with relation to magnification and resolution power. Phase contrast microscope.

Scientific methods (observation, defining a problem, making a hypothesis, testing or experimenting, theorising), scientific attitude; serendipity.

Importance of Biology in fields such as: Biomedical Engineering, Biotechnology, Biochemistry, Medicine, Biophysics, Physiotherapy, Pharmacology, Bio-informatics and Environmental Management.

(ii) Being alive: what does it mean? Life as an expression of energy; and homeostasis.

Features common to living organisms.

Open and closed systems. Examples of homeostasis – water balance, regulation of body temperature with reference to feedback mechanism.

2. Diversity of Life

(i) Taxonomy and phylogeny, shortcoming of two-kingdom classification, five-kingdom classification: general idea of Monera, Protista, Fungi, Plantae and Animalia.

Need for classification should be discussed. Definition and explanation of the terms taxonomy and phylogeny should be given for a clear understanding; common features of Plantae and Animalia; shortcomings of the two-kingdom classification should be discussed.

A brief account of the five-kingdom system of classification and characteristics of different kingdoms with examples are required.

(ii) Kingdom Monera: Bacteria - forms of bacteria, reproduction, gram +ve and gram –ve bacteria; economic importance; cyanobacteria: characteristic features; archaebacter.

Characteristics of Monera, classification into eubacteria and archaebacteria. Bacteria: plant characteristics, structure, shape, flagellation, differences between gram +ve and gram -ve bacteria; asexual and sexual reproduction.

A brief idea of photoautotrophic, chemoautotrophic, heterotrophic bacteria and economic importance. Actinomyces: general idea and importance in formation of antibiotics should be discussed. Cyanobacteria: characteristics.

A brief idea of the role of different types of archaebacteria (methanogens, halophiles and thermoacidophils in their extreme environments). A brief idea about viroids, virus and PPLO.

(iii) General characteristics of Kingdom Protista - Characteristics and examples of subgroups: (a) Chrysophytes (b) Dinoflagellates, (c) Euglenoids, (d) Slime moulds, (e) Protozoans.

Chrysophytes, i.e. diatoms, slime moulds. Protozoans to be studied under rhizopods, flagellates, ciliates and sporozoans with brief characteristics and common examples of each.

(iv) Kingdom Fungi: zygomycetes, ascomycetes, basidomycetes, deuteromycetes - general characteristics. Brief idea of lichens and mycorrhizae.

General characters with typical examples of zygomycetes, ascomycetes, basidomycetes and deuteromycetes. Definition and explanation of lichens and mycorrhiza.

(v) Plant Kingdom: Algae – Classification and economic importance of Chlorophyceae, Phaeophyceae, Rhodophyceae; structure of Spirogyra; Bryophyta: morphology of Funaria. Pteridophyta – morphology of a Fern; Gymnosperms: morphology and life cycle of Pinus; Angiosperms- monocot and dicot plants. Morphology and modification of root, stem and leaves.

Characteristics of sub-groups of algae with examples. Structure of Spirogyra; economic importance of Algae. Bryophytes: characteristics, classification into liverworts and mosses. Morphology of Funaria, Pteridophyta: characteristics. Morphology of a fern.

(Individual life cycles to be excluded. General life cycle to be explained in terms of alternation of generations only. Emphasis should be laid on gametophyte and sporophyte stages).

Gymnosperms: characteristics and life cycle of Pinus. Angiosperms: factors of dominance of angiosperms. Modification of roots, stems and leaves for storage, perennation, reproduction and mechanical support.

(vi) Animal Kingdom: animal construction - body plan, symmetry, coelom development, segmentation; distinguishing characters of Porifera, Coelenterata, Platyhelminthes, Nematoda, Annelida, Mollusca, Arthropoda, Echinodermata, Chordata – sub phyla Hemichordata, Urochordata, Cephalochordata and Vertebrata (classes - pisces, amphibia, reptilia, aves and mammalia).

Students should be able to define and explain cell aggregate plan, blind-sac plan and tube-within-tube plan, spherical, radial and bilateral symmetry, diploblastic and triploblastic animals, acoelomate, pseudocoelomate, coelomate and haemocoelomate.

Sub-classification of Chordata with reference to notochord.

(vii) Morphology and anatomy of different systems of earthworm, cockroach and frog.

The following systems to be taught: digestive, respiratory, circulatory, excretory, nervous and reproductive (Only an ***elementary*** *knowledge of morphology and anatomy of different systems of earthworm, cockroach and frog is required).*

3. Organism and Environment

(i) Species and Population: concept of species, interaction between members of a species (cooperation, communication and competition).

A general idea that they share a common gene pool and represent the lowest taxonomic group. Reasons for origin of new species; interactions between members of a species. Co-operative interactions: mating, parental care, family formation, aggregation, social organisation, animal societies, home range, territoriality and communication. Competition: intra and interspecific competition.

(ii) Biotic community: intraspecific and interspecific relationship, commensalism, predation, scavenging, parasitism, symbiosis, biotic stability and biotic succession.

Trophic organisation, stratification, dominance, variety of species, interactions. Biotic stability: should be taught with examples to show that the larger the number of diverse forms, more stable is the community. Succession: definition to explain the meaning, kinds of succession and significance of ecological succession.

(iii) Ecosystem: biotic and abiotic components, food chain, trophic levels, food webs, ecological pyramids, major ecosystems, man made ecosystem – agro ecosystem.

Brief idea about biotic and abiotic components, various types of food chains, terrestrial ecosystems, food webs, trophic levels, ecological pyramids.

Major ecosystems: tropical rain forest, deserts and aquatic (only brief idea about marine and fresh water, example: sea and lake), man-made ecosystems.

SECTION B

4. Unit of Life

(i) Biomolecules: Carbohydrates – classification, functions of Monosaccharides, Disaccharides, Oligosaccharides, Polysaccharides; Proteins – amino acids, essential and non-essential amino acids, peptide bond, classification and functions of proteins; Lipids – classification, properties and structure. Structure of nucleic acids and their functions, differences between DNA and RNA.

Carbohydrates, Proteins and Lipids - composition, linking and functions.

Properties, general classification and functions of monosaccharides (glucose, galactose and fructose), disaccharides (maltose, lactose and sucrose), polysaccharides (glycogen, starch, cellulose).

Proteins: simple (keratins, collagen) and conjugated (chromoprotein, glycoprotein, phosphoprotein, metalloprotein, lipoprotein and nucleoprotein); Lipids – classification, properties and structure of fats and oils. Nucleotides and Nucleic acids – DNA, types of RNA.

(ii) Enzymes: molecular structure, general properties, classification, mechanism of enzyme action, allosteric modulation, factors affecting enzyme activity.

General properties, nomenclature and classification of enzymes. Lock and key hypothesis and Induced Fit Theory should be explained with diagram to give a clear concept of enzyme action. Factors affecting enzyme activity should be taught. A brief idea of allosteric modulation, isozymes and zymogens should be given.

(iii) Cell membranes: unit membrane concept, fluid mosaic model, membrane transport, passive and active transport, exocytosis and endocytosis. Facilitated diffusion.

Description of fluid mosaic model; experiment to show fluidity of plasma membrane should be discussed. Functions of the plasma membrane, active and passive transport, endocytosis and exocytosis should be explained. Brief explanation of facilitated diffusion (uniport, symport and antiport) with one example.

(iv) Structural organisation of the cell: cell wall, nucleus, mitochondria, plastids, endoplasmic reticulum, Golgi complex, lysosomes, ribosomes, microfilaments, microtubules, cilia and flagella, vacuoles and cell inclusions. Prokaryotic cell and eukaryotic cell – a comparison.

Structural organisation of the cell: light and electron microscopic view of the cell should be explained by means of diagrams or charts to give a clear picture of the internal structure of the cell.

Structure and functions of the cell organelles mentioned in the syllabus to be taught with diagrams. General structure of eukaryotic cell; differences and similarities between prokaryotic cell and eukaryotic cell.

(v) Cellular respiration: aerobic and anaerobic, fermentation, glycolysis, Kreb's cycle, oxidative phosphorylation and respiratory quotient. Amphibolic pathway.

Types of respiration; mechanism of respiration: glycolysis, oxidation of pyruvate, Kreb's cycle. Brief idea of fermentation and. Amphibolic pathway.

5. Continuity of Life

(i) Cell reproduction: cell cycle, mitosis and meiosis.

Different stages with diagrams should be explained to give a clear concept of the changes taking place at each step. Significance of mitosis and meiosis should be discussed.

(ii) Fundamentals of Genetics: concept of alleles: dominant and recessive; phenotype and genotype, homozygous and heterozygous, mono and dihybrid crosses.

Homologous chromosomes, autosomes and sex chromosomes; alleles – dominant and recessive; phenotype; genotype; homozygous; heterozygous, monohybrid and dihybrid crosses; back cross and test cross, definitions to be taught with simple examples.

(iii) Mendel's experiments with peas; Mendel's Principles of inheritance, incomplete dominance, co-dominance, multiple alleles and epistasis.

Explanation of the terms heredity and variation; Mendel's Principles of inheritance; reasons for Mendel's success; incomplete dominance and co-dominance, epistasis, multiple alleles – e.g blood groups, polygenic inheritance.

(iv) Genes: packaging of hereditary material in prokaryotes, bacterial chromosome; plasmid and eukaryotic chromosomes; gene interaction, cytoplasmic inheritance, viral genes, complementary genes, linkage maps, sex determination and sex linkage; gene manipulation, genetic code, protein synthesis. Human genome project. DNA finger printing.

Chromosomal theory of inheritance; chromosomes in eukaryotic organisms, autosomes and sex chromosomes, sex-linked traits, sex-linked inheritance, extra chromosomal inheritance, complete and incomplete linkage, chromosomal mapping and its significance; replication of genetic material, functions of genes - expression of genetic information, one gene one enzyme hypothesis, viral gene expression, gene expression in prokaryotes and eukaryotes, ultrastructure of eukaryotic chromosome, genetic code. Transcription, translation, protein synthesis and its regulation.

Human genome project: goal, methodologies, salient features and applications. DNA finger printing – technique, application and ethical issues to be discussed briefly.

(v) Mutation: chromosomal and gene mutations, somatic and heritable mutations, spontaneous and induced mutations; role of mutations in speciation.

Mutations - chromosomal, gene, spontaneous and induced mutation. Chromosomal aberrations.

(vi) Recombinant DNA technology and its applications.

Restriction enzymes, DNA insertion by vectors and other methods, regeneration of recombinants. In human health – production of insulin, vaccines and growth hormones, gene therapy. In industry – production of expensive enzymes, strain improvement to scale up bioprocesses. In agriculture – GM crops by transfer of genes for nitrogen fixation, herbicide-resistance and pest-resistance including Bt crops. Brief idea about Transgenics and GMO with special reference to Bt cotton.

6. Applications of Biology

(i) Animal Husbandry: Dairy farm management, poultry farm management, bee keeping and fisheries.

Brief idea of inbreeding, outbreeding, crossbreeding, artificial insemination and measures for farm maintenance.

(ii) Plant diseases: rust and smut of wheat, blight of rice, late blight of potato, bean mosaic and root knot of vegetables.

Causative agent, symptom and prevention to be discussed for each.

PAPER II

PRACTICAL WORK – 20 Marks

1. Scientific Techniques

Study parts of a dissecting microscope and compound microscope.

The students should be able to handle the microscope independently.

2. Physiology

Students will be required to carry out sequence of instructions or experiments such as:

(i) Food tests: test for starch, glucose, sucrose, proteins and fats.

Food tests: tests should be reported in tabular form. Both positive and negative tests should be reported.

(ii) To demonstrate the effect of thawing, heat and alcohol on permeability of beet root cells.

To demonstrate the effect of heat on permeability of cell membrane of beet root cells: should record the observations at very low temperature, room temperature and higher temperature to see the degree of leaching and conclude accordingly.

(iii) To demonstrate the action of an inorganic catalyst (MnO_2) and enzyme (catalase) from potato/ liver on hydrogen peroxide and effect of heat on their activity.

Living tissue from plant or animal should be used to show the presence of enzyme catalase and its action on hydrogen peroxide. Its activity should also be observed after boiling and killing the cells and compared.

(iv) Demonstration of the effect of temperature on enzyme (diastase) action on starch solution.

Self-explanatory

3. Morphology

(i) Study of different modifications in root, stem and leaves.

(ii) Preparation of temporary slide of Mucor / Rhizopus.

The teacher should guide the students on the technique of culture, staining and mounting the material and then observing under the microscope. The students should also be able to make labelled diagrams.

4. Cytology

Preparation of -

(i) Stages of Mitosis in onion root tips.

(ii) Stages of Meiosis in grasshopper testes.

Correct method of selecting the root tip, fixing, staining and mounting. Different stages should be observed first in low power and after locating the area, the students should see it under high power. Various stages should be drawn and labelled.

5. Spotting: (Three minutes to be given for each spot. Separate continuation sheets should be used which need to be collected at the end of spotting).

(a) Comment and identify:

(i) Stages of mitosis.

(ii) Stages of meiosis.

(b) Study of stained preparations/specimen of the following:

Identification of plants -

(i) Bacteria

(ii) Model of TMV

(iii) Model of bacteriophage

(iv) Rust

(v) Liverworts

(vi) Moss

(vii) Fern

(viii) Pinus

(ix) Spirogyra

(x) Mushroom

(xi) Yeast

(xii) Lichen

(c) Identification of animals -

(i) Amoeba

(ii) Paramoecium

(iii) Bath Sponge

(iv) Hydra

(v) Liver Fluke

(vi) Ascaris

(vii) Leech

(viii) Earthworm

(ix) Prawn/Crab

(x) Centipede/ Millipede

(xi) Honey Bee

(xii) Snail (Pila)

(xiii) Octopus

(xiv) Starfish

(xv) Amphioxus / Herdmania

(xvi) Dogfish

(xvii) Rohu fish

(xviii) Frog

(xix) Snake / Garden lizard

(xx) Sparrow / Pigeon

(xxi) Rabbit/ Squirrel

Students should be taught how to identify, draw, label and give significantly visible characteristics as observed in a given time.

PROJECT WORK AND PRACTICAL FILE – 10 Marks

Project Work – 7 Marks

Candidate is to creatively execute one project/assignment on any aspect of Biology. Following is only a suggestive list of projects. Teachers may assign or students may choose any one project of their choice.

(i) Project related to experiment on any aspect of plant life.

(ii) Project related to any aspect of environment.

(iii) Projects related to modern researches in Biology, e.g. test-tube babies.

(iv) Role of genetics in investigating crimes.

(v) Yeast fermentation and production of alcohol or any other commercial industry dependant on plants and/or animals or their products.

In addition, students may be taught how to culture:

Earthworms.

Protozoans.

Moulds.

Setting up of an aquarium.

Practical File – 3 Marks

Teachers are required to assess students on the basis of the Biology Practical file maintained by them during the academic year.

CLASS XII

There will be two papers in the subject.

Paper I: *Theory:*	*3 hours*	*... 70 marks*
Paper II*: Practical:*	*3 hours*	*... 20 marks*
Project Work		*... 7 marks*
Practical File		*... 3 marks*

PAPER I – THEORY - 70 Marks

There will be one paper of 3 hours duration divided into 2 parts.

Part 1 (20 marks) *will consist of compulsory short answer questions, testing knowledge, application and skills relating to elementary/fundamental aspects of the entire syllabus.*

Part 2 (50 marks) *will be divided into two Sections A and B. Candidates are required to answer* ***three*** *out of* ***five*** *questions from Section A and* ***two*** *out of* ***four*** *questions from Section B. Each question in this part shall carry 10 marks.*

All structures (internal and external) are required to be taught along with diagrams.

SECTION - A

1. Multicellularity: Structure and Function - Plant Life

Forms and function

(i) Tissues: types of plant tissues: Meristematic: Classification of Meristematic tissue, tunica-corpus theory, histogen theory, shoot apex and root apex.

Permanent Tissues: Structure and function of simple tissues (parenchyma, collenchyma and sclerenchyma) and complex tissues (xylem and phloem), types of vascular bundles, T. S of young dicot and monocot stem, T. S of young dicot and monocot root and V. S. of dicot and monocot leaf. Secondary growth: brief idea of formation of secondary xylem and secondary phloem by cambium ring formation, annual rings, heartwood and sapwood.

Characteristics of meristematic tissue; classification of meristems based on origin, development, location and function; A brief idea about differentiation, dedifferentiation and redifferentiation; tunica corpus theory; differences between shoot apex and root apex; brief understanding of histogen theory; quiescent centre; characteristics of permanent tissues; simple and complex tissues; types of vascular bundles to be taught with the help of diagrams; anatomical differences between dicot and monocot root, stem and leaf must be taught for better understanding.

Basic idea of how secondary growth takes place and formation of annual rings; structural and functional differences between heartwood and sapwood.

(ii) Absorption and movement of water in plants: diffusion, imbibition, osmosis, osmotic pressure, turgor pressure/ pressure potential wall pressure, water potential, diffusion pressure deficit. Types of soil water, mechanism of water absorption (active and passive absorption), root pressure, transpiration, transpiration pull theory for ascent of sap, mechanism of opening and closing of stomata (active potassium theory), guttation.

Characteristics of imbibition; factors affecting imbibition; importance of imbibition, characteristics and significance of diffusion; osmosis - endosmosis and exosmosis; significance of osmosis, plasmolysis, importance of water, soil water (gravitational, capillary, hygroscopic and combined water – ***only definitions****); active and passive absorption of water; definition of water potential. Explanation and definition of transpiration to give students a clear idea; differences between transpiration and guttation; significance of transpiration. Stomatal mechanism - K^+ transport mechanism. Mechanism of ascent of sap by cohesion – tension and transpiration pull theory.*

(iii) Mineral nutrition: macronutrients and micronutrients (role and deficiency symptoms), criteria for essentiality of elements, aeroponics and hydroponics, passive absorption (ion exchange mechanism) and active absorption of mineral nutrients, nitrogen nutrition in plants.

Criteria for essentiality of minerals, hydroponics, aeroponics, macro and micronutrients; role and deficiency symptoms of various elements. Absorption and transport of mineral salts by contact exchange theory and carbonic acid exchange theory; active absorption by carrier ion complex formation. Brief idea of nodule formation and nitrogen fixation and nitrogen-fixing organisms; importance of leghaemoglobin pigment should be discussed.

(iv) Modes of nutrition: parasitic, saprophytic, symbiotic and insectivorous (brief idea with examples), photosynthesis: ultra structure of chloroplast, photochemical and biosynthetic phases, absorption and action spectra, factors influencing photosynthesis, photophosphorylation; photorespiration, transport of solutes.

Modes of nutrition: photosynthesis; photorespiration.

Brief idea of photosynthetic pigments, photochemical phase - pigment systems, cyclic and non-cyclic photophosphorylation; biosynthetic phase- C_3 and C_4 cycles; photorespiration pathway in brief - explanation of how RuBP carboxylase acts as RuBP oxygenase. Kranz anatomy. Blackman's Law of limiting factor, factors controlling Photosynthesis.

Transport of solutes and water; Evidences which indicate that downward movement of organic solutes takes place in phloem; mechanism of translocation; mass flow hypothesis with diagram.

(v) Reproduction and development in angiosperms: vegetative reproduction, sexual reproduction: development of male and female gametophytes, types of ovules, placentation, pollination, fertilisation and formation of endosperm, embryo, seed and fruits (**broadly classified**). Apomixes, Polyembryony.

Natural and artificial vegetative propagation, advantages and disadvantages of vegetative reproduction, micropropagation – plant tissue culture. Advantages of self and cross-pollination and events leading to fertilization should be discussed. Fruits to be classified into simple (dry and fleshy), aggregate and multiple. Apomixes, Polyembryony to be explained briefly.

(vi) Differentiation and organ formation.

Embryo formation (monocot and dicot); endosperm formation; changes in the ovule and ovary for seed and fruit formation.

(vii) Plant growth: phases of growth, growth rate, measurement of growth, factors affecting growth, role of growth regulators, seed dormancy and germination, apical dominance, senescence and abscission, movements in plants (tropic and nastic).

Brief idea of various theories leading to discovery of auxins by Went; brief idea about growth rate, role of growth regulators in development and growth of plants; definition and explanation of dormancy and quiescence; causes and methods of breaking seed dormancy; definition of hypogeal, epigeal and viviparous germination; brief idea of apical dominance, senescence, abscission, applications of synthetic growth regulators; tropic and nastic movements; role of auxins in phototropic responses.

(viii) Photomorphogenesis in plants including a brief account of phytochrome.

Brief idea of short day, long day and day neutral plants; critical day length, photoperiodic induction; experiment to prove that photoperiodic induction is perceived by the leaves; brief idea of phytochromes; differences between photoperiodism and vernalisation.

2. Multicellularity: Structure and Function - Animal Life

(i) Tissues: epithelial; connective; muscular; nervous (location, structure and function).

Epithelial; connective; muscular; nervous.

Location, structure and functions of epithelial tissues with examples, location and general structure of areolar tissue - functions of different types of cells; difference between collagen and elastin fibres; difference between bone and cartilage; hyaline cartilage, T.S and L.S of bone, lymph and blood, different types of muscles and their functions; structure of a neuron.

(ii) Nutrition (human): Organs of digestive system (histology not required), digestive process and disorders of the digestive system.

Structure and functions of the digestive organs and their associated glands; hormonal regulation of digestive juices; absorption of food; factors controlling the absorptive power and small intestine as principal site for absorption, assimilation of digested food; disorders of the digestive system – jaundice, constipation, diarrhoea.

(iii) Respiration (human): Organs of respiratory system, breathing mechanism (inspiration and expiration), pulmonary gas exchange, transport of respiratory gases, pulmonary air volumes and lung capacities. Disorders of respiratory system.

Pulmonary gas exchange and organs involved; transport of gases in blood; mechanism of pulmonary gas exchange; breathing process should be explained showing the action of diaphragm and intercostal muscles; organs involved and pulmonary air volumes must be taught. Transport of oxygen in the blood as dissolved oxygen and as oxyhaemoglobin; transport of CO_2 as carbonic acid and as bicarbonates. Chloride shift. Disorders of respiratory system such as amphysema, asthma, occupational respiratory disorders.

(iv) Circulation: closed and open vascular systems, structure of human heart, cardiac cycle, systemic and pulmonary circulation, portal system, arterial blood pressure, types of hearts, origin and conduction of heart beat, blood vessels (structure and adaptation), lymphatic system. ABO group, coagulation of blood.

Difference between closed and open vascular system should be discussed; advantages of closed vascular system; external and internal structure of heart to be taught with diagram to provide a clear idea; functions of different valves to be discussed; neurogenic and myogenic hearts; properties of heart muscles; working of the heart and blood flow through the heart during different phases should be described under the following headings - auricular systole, auricular diastole, ventricular systole, ventricular diastole and joint diastole; brief idea of cardiac output; arterial blood pressure (systolic and diastolic) and lymphatic system. The internal structure of artery, vein and capillary with the adaptations for their functions should be discussed. Importance of ABO groups in blood transfusion; clotting of blood to be taught briefly.

(v) Excretion: ammonotelism, ureotelism, uricotelism, structure of human kidney (L.S.), structure of nephron, role of skin and lungs in excretion, physiology of urine formation, counter current system; functions of the kidney; dialysis. Disorders of the excretory system.

Define and explain the terms ammonotelism, ureotelism and uricotelism; external and internal structure of the kidney with functions of the various parts; structure of nephron; physiology of urine formation - ultra filtration, selective reabsorption and active secretion. (Students are expected to know which product is reabsorbed in each part of uriniferous tubule and the type of mechanism).

Regulation of urine formation. Counter current system, functions of the kidney. Role of skin and lungs in excretion. Brief idea of process of dialysis, haemodialysis and peritoneal dialysis. Disorders of the excretory system. (i) renal calculi, (ii) glomerulonephritis, (iii) uremia.

(vi) Endocrine System (human): hormones of pituitary, thyroid, parathyroid, thymus, pancreas, adrenal glands and gonads; effect of hyposecretion and hypersecretion, feedback mechanism.

Brief idea of location of endocrine glands, tropic hormones of pituitary and their functions; feedback control of tropic hormones to be discussed giving examples for better understanding; role of hypothalamus; hormones secreted by different lobes of pituitary and their functions; hypophysectomy, hormones of thyroid, parathyroid, pancreas, adrenal and gonads; effects of hypo secretion and hyper secretion of various hormones; differences between mineralocorticoids and glucocorticoids.

(vii) Nervous System (human): Central, autonomic and peripheral, structure of spinal cord, reflex action, transmission of nerve impulse, saltatory

conduction; receptors (mechanoreceptor, chemoreceptor, photoreceptor and thermoreceptors), sense organs (eye and ear).

Nervous co-ordination: central, autonomic and peripheral nervous systems.

*Structure and functions of various parts of the brain and spinal cord; names of cranial nerves and their functions; differences between sympathetic and parasympathetic nerve fibres; conduction of nerve impulses through nerve fibre and through synapse; conduction of nerve impulse through a myelinated nerve fibre; reflex arc to be taught with diagram showing the pathway by means of arrows; physiology of reflex action, natural reflex and conditioned reflex; structure and working of eye and ear; classification of sense organs. Students are expected to know the functions of various types of rec*eptors.

(viii) Locomotion: joints, structure of skeletal muscle, sliding filament theory of muscle contraction, classification of muscles on the basis of function, red and white muscles, summation, tetanus and rigor mortis. Disorders of muscular and skeletal system.

Locomotion: joints, muscle movements, types of skeletal movements, basic aspects of human skeleton.

Functions of human skeleton; different types of joints - their location and function; general properties of muscles; types of muscles according to type of movement; sliding filament theory of muscle contraction; chemical events during muscle contraction should be dealt with separately; summation, tetanus, rigor mortis, red and white muscles. Disorders of muscular and skeletal system (i) Muscular dystrophy, (ii) Arthritis, (iii) Gout, (iv) Osteoporosis, (v) Tetany, (vi) Myasthenia gravis.

(ix) Reproduction (human): internal structure of human testis and ovary, menstrual cycle, gametogenesis, embryonic development in mammals (up to three germ layers). Medical termination of pregnancy, infertility.

Organs of male and female reproductive system and their functions; internal structure of testis and ovary; gametogenesis-spermatogenesis and oogenesis; menstrual cycle - different phases and hormone action, capaciation, fertilisation, physio-chemical events during fertilisation, implantation, embryonic development up to three germ layers, foetal membranes, placenta and its functions. Parturition; brief knowledge about medical termination of pregnancy and causes of infertility.

(x) Growth, Ageing and Death: types of growth, growth curve, morphological and physiological changes during ageing, causes of death.

Definition of auxetic, multiplicative and accretionary growth, sigmoid curve should be discussed; brief idea of reparative and restorative regeneration should be given; general idea of changes that take place with advancement of age.

SECTION - B

3. Origin and Evolution of Life

(i) Origin of life: living and nonliving; chemical evolution; organic evolution - Oparin ideas, Miller-Urey experiments; interrelationship among organisms and evidences of evolution, morphological evidence, homology and analogy, vestigial organs, physiological, embryological, palaeontological (fossils) and biogeographical evidences.

Origin of life.

Important views on the origin of life, modern concept of origin of life, Oparin Haldane theory, coacervates, Miller and Urey experiment, evidences of evolution: vestigial organs, atavism, homologous and analogous organs, missing links (Archaeopteryx) and connecting links; physiological evidence (serology), Darwin's finches.

(ii) Theories of evolution: Lamarckism: evidences in favour of Lamarckism (giraffe's neck), criticism of Lamarckism; Darwinism: basic postulates of Darwinism, drawbacks of Darwinism, Neo-Darwinism; variations: causes of variation, selected examples of natural selection (DDT resistance in mosquito, malaria in relation to G-6-P-D deficiency and sickle-cell anaemia); artificial

selection; adaptations (Lederberg's replica plating experiment). Human evolution: Dryopithecus, Australopithecus, Homo erectus, Homo neanderthalensis, Cromagnon man and Homo sapiens; differences between apes and man.

Brief idea of Lamarck's theory to be given for better understanding of evolution; salient features of Darwinism; causes of variation, examples of natural selection - resistance of mosquitoes to DDT, sickle cell anaemia, G-6-P-D deficiency; difference between natural and artificial selection, Lederberg's replica plating experiment with Darwinian interpretation, mechanism of speciation, definition of gene pool; evolution of man - brief idea of ancestors leading to man of today; comparison and homology in chromosomes of apes and man.

4. Applications of Biology

(i) Domestication of plants and crop improvement: methods of crop improvement: selection, hybridisation, plant breeding, plant introduction, tissue culture; uses of medicinal plants: Cinchona calisaya (quinine), Azadirachta (neem) Ocimum sanctum (tulsi), Aegle marmelos (bel), Emblica officinalis (amla), Adhatoda vasica (vasaka), Withana somnifera (ashwagandha), Aloe vera.

Plant breeding, introduction, selection, and techniques of hybridisation. Polyploidy - origin of wheat must be discussed. Definition of heterosis, protoplast culture and protoplasmic fusion. Applications of tissue culture to be discussed; students are expected to know only the importance of the plants named in the syllabus.

(ii) Crops today: Gene pool and genetic conservation, gene banks, cryopreservation.

Definition of gene pool and genetic conservation, genetic erosion, gene bank, cryopreservation; factors affecting genetic erosion.

(iii) Biofertiliser: green manure, nitrogen fixation – symbiotic and non-symbiotic organisms.

Brief explanation of green manure; reasons for preference of biofertiliser to chemical fertiliser should be discussed. Brief idea of different types of manures and role of bacteria in improving the soil fertility.

(iv) Pesticides: advantages and disadvantages of pesticides. Bioinsecticides and bioherbicides. Integrated Pest Management (IPM).

Advantages and disadvantages of pesticides; biological methods of pest control. Integrated Pest Management (IPM) - a general idea of the concept; Bioinsecticides e.g. Bacillus thuringiensis, Bioherbicides e.g. Cochineal insect.

(v) Human Diseases: body's defence mechanisms: (specific and non-specific); immune disorders (SCID and AIDS); allergies, interferons, communicable diseases: causative agent, symptoms and prevention of the following: bacterial diseases (tuberculosis, typhoid, pneumonia, cholera, tetanus), viral diseases (chicken pox, common cold, poliomyelitis, rabies and hepatitis), protozoa (malaria and amoebiasis), helminthes (ascariasis and filariasis); non-communicable diseases: diseases of the heart, diabetes (types), cancer (types, causes, diagnosis and treatment); human genetic disorders: (haemophilia, albinism, Down's syndrome, Klinefeltor's syndrome, Turner syndrome). Rh factor incompatibility; amniocentesis. Genetic counselling; a brief idea of stem cells, organ transplants and immunosuppression.

Skin, blood vessels, WBC, antibodies to be discussed as non-specific defence mechanisms; Humoral and cell-mediated immune system; antibody and antigen; cells of the immune system; mechanism of action of T cells to antigens; brief idea of SCID and AIDS; diseases should be discussed on basis of causative agent, symptoms and prevention; diseases of the heart – angina, ischemia, heart attack, arthrosclerosis; diabetes (types), cancer (types, causes, diagnosis and treatment); human genetic disorders: (haemophilia, albinism, Down's syndrome, Klinefeltor's syndrome, Turner syndrome). Rh factor incompatibility – role of Rh factor in blood transfusion and pregnancy; amniocentesis – role in detecting genetic defects, sex determination; brief idea of

genetic counselling, role of genetic counsellor and role of immunosuppressants. A brief idea of the role of stem cells in medical treatment.

(vi) Mental Health and Community Health: types, causes and treatment of mental illness; causes of addiction; activities of community health services.

Psychosis, neurosis and epilepsy should be discussed; general causes of mental illness and treatment to be discussed; reasons for drug addiction; adolescent issues; general activities of community health services.

(vii) Biomedical Engineering: (only basic concepts) Instruments – ECG, EEG, CT scan, ultrasound, MRI, pacemakers, implants, disposables, external prosthesis.

Students should know the instruments used for diagnosis of various disorders. Details are not required.

(viii) Human population: population growth curves, causes of increase in population.

Terms biotic potential, environmental resistance and carrying capacity; types of growth curves; causes and measures to control population.

PAPER II

PRACTICAL WORK – 20 Marks

1) Taxonomy: Study floral characteristics through dissection of flowers, drawing floral formula and diagrams of following families:

(i) Malvaceae - type-china rose / hollyhock.

(ii) Compositae – type -sunflower/ Cosmos/ marigold (with single whorled ray florets).

(iii) Leguminosae - subfamily - papilionaceae - type-sweet pea/ pea /bean.

(iv) Solanaceae - type – petunia / datura.

(v) Liliaceae - type – onion or Amarallydaceae - type – lily.

Floral characteristics should be explained by dissection of flowers. Students should be taught how to take vertical section of the flower and draw accordingly labelled diagrams. The technique of drawing floral diagrams with the mother axis in the right position should be taught. Floral formula should be correctly written. Identification of the correct family giving reasons, technique of cutting T.S. and L.S of ovary should be explained and accordingly correct labelled-diagram should be drawn.

Students should be taught the examples of plants (belonging to each family) which are of economic importance. The examples of common names of plants must be supported with correct scientific names as well.

2) Simple biochemical and physiological experiments -

(i) Demonstration of plasmolysis.

(ii) Demonstration of osmosis in living plant cells (potato osmoscope).

(iii) Demonstration of unequal transpiration in leaves.

(iv) To demonstrate the effect of different intensities of light on photosynthesis.

(v) To demonstrate that oxygen is evolved during photosynthesis.

(vi) Effect of different carbon dioxide concentrations on the rate of photosynthesis.

Students should be taught to set up and demonstrate the experiments with correct diagram of the set up and give conclusions. This will give a clear idea of the physiological processes.

3) Studies of the following with the help of models. (Students would be required to sketch, label and identify the various parts in the organ/system and know their role in the body).

(i) Human digestive system.

(ii) Human heart (V.S.).

(iii) Human eye (V.S.).

(iv) Human ear (V.S.).

(v) Human brain (external and V.S.).

(vi) Human kidney (V.S.).

Students should be taught to identify the parts in the organ / system either through a model or a diagram. The role of that part should be given. Diagrams are important.

4) Slide preparation -

(i) T.S. of dicot root.

(ii) T.S. of monocot root.

(iii) T.S. of dicot stem.

(iv) T.S. of monocot stem.

(v) Striated muscles of cockroach.

(vi) Nerve cells from spinal cord of a vertebrate (goat).

The technique of collecting the material from the correct location, teasing the material, staining and mounting neatly should be explained. Identification of the mount under the microscope should be taught. Students must know the use of low power and high power microscope. They should also know how to make labelled outline drawings.

(vii) Identification of human blood groups.

Blood group can be detected by noting the clumping behaviour of blood. Antisera A, B and D should be used.

5) Spotting: **(Three minutes to be given for each spot. Separate continuation sheets should be used which need to be collected at the end of spotting).**

(i) Identify and comment on permanent slides of:

a) T.S of monocot and dicot stem.

b) T.S. of monocot and dicot root.

c) T.S. of monocot and dicot leaf.

d) T.S. of spinal cord of mammal.

e) T.S. of bone of mammal.

f) T.S. of ovary of mammal.

g) T.S. of testis of mammal.

Students should be able to identify, giving reasons and draw a labelled diagram in the allotted time for each spot i.e. 3 minutes.

(ii) Comment on experimental set up studied in physiology.

Student should identify (aim of the experiment), draw the physiological set-up and write a brief description (observation, inference, precautions) of the experiment within the allotted time i.e., 3 minutes.

PROJECT WORK AND PRACTICAL FILE – 10 Marks

Project Work – 7 Marks

The project work is to be assessed by a Visiting Examiner appointed locally and approved by the Council.

The candidate is to creatively execute **one** project/assignment on an aspect of biology. Teachers may assign or students may choose any **one** project of their choice. Students can choose any other project besides the ones indicated in the list. Following is only a suggestive list of projects:

(i) Diabetes.

(ii) Endocrine glands.

(iii) Vegetarianism/non-vegetarianism.

(iv) Role of micro-organisms in industry.

(v) Drug addiction and community.

(vi) Balanced diet.

(vii) Human population.

(viii) Cancer.

(ix) AIDS/Hepatitis.

(x) Cell organelles.

Ecology

(i) Abiotic and biotic factors.

(ii) Food chains.

(iii) Ecological pyramids.

(iv) Ecosystems.

(v) Biomass and bionumber.

(vi) Carbon, nitrogen and mineral cycles.

(vii) Environmental resistance.

(viii) Ecological impact of pollution.

(ix) Acid rain.

(x) Ozone layer.

(xi) Conservation of natural resources.

(xii) Green house effect.

Practical File – 3 Marks

The Visiting Examiner is required to assess students on the basis of the Biology Practical file maintained by them during the academic year.