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		*… 3 marks*

PAPER I –THEORY – 70 Marks

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

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

Part II (50 marks) *will be divided into three Sections A, B and C. Candidates will be required to answer* ***two*** *out of* ***three*** *questions from Section A (each carrying 5 marks),* ***two*** *out of* ***three*** *questions from Section B (each carrying 10 marks) and* ***two*** *out of* ***three*** *questions from Section C (each carrying 10 marks). Therefore a* ***total of six*** *questions are to be answered in Part II.*

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

SECTION – A

1. Diversity of Life

(i) Taxonomy and phylogeny, three domains of life; taxonomical hierarchies, binomial nomenclature.

Need for classification should be discussed. Definition and explanation of the terms taxonomy and phylogeny should be given for a clear understanding; three domains of life – definition and features (archaea, bacteria, eukarya); major taxonomical hierarchies (phylum, class, order, family, genus, species); rules of binomial nomenclature, tools for study of taxonomy – museum and herbaria.

(ii) Five-kingdom classification: salient features, characteristics and examples.

Five-kingdom system of classification and characteristics of different kingdoms with examples.

(a) Kingdom Monera: Bacteria - forms of bacteria, reproduction (sexual and asexual), gram +ve and gram –ve bacteria – differences only; economic importance – special emphasis on role of bacteria in sewage treatment, antibiotics, energy production; cyanobacteria: characteristic features; archaebacter (A brief idea of the role of different types of archaebacteria (methanogens, halophiles and thermoacidophils in their extreme environments). Virus (characteristic features – link between living and non-living, structure and name of the discoverers) and Viroid (definition only).

(b) General characteristics of Kingdom Protista – Only general characteristics and examples of subgroups: (i) Chrysophytes (ii) Dinoflagellates, (iii) Euglenoids, (iv) Slime moulds,

(v) Protozoans (to be studied under rhizopods, flagellates, ciliates and sporozoans with two characteristics and two examples of each).

(c) Kingdom Fungi: general characteristics of each. Zygomycetes, Ascomycetes, Basidomycetes, Deuteromycetes - three characteristics with two examples Economic importance of fungi. Definition of lichens and mycorrhiza (ecto and endo).

Life cycles not required.

(d) Plant Kingdom: Algae – Characteristics and economic importance of Chlorophyceae, Phaeophyceae, Rhodophyceae.

Bryophyta – Characteristics, classification into liverworts and mosses; Life cycle of Funaria with reference to alternation of generations. ***(Emphasis should be laid on gametophyte and sporophyte stages).***

Pteridophyta and Gymnosperms – Characteristics and examples.

Angiosperms- monocot and dicot plants (comparison of external features only). Morphology and modification of roots, stems and leaves for storage, perennation, reproduction and mechanical support. Phyllotaxy.

(e) Animal Kingdom: animal construction - body plan (cell aggregate plan, blind-sac plan and tube-within-tube plan), symmetry (spherical, radial and bilateral symmetry), coelom development (diploblastic and triploblastic animals, acoelomate, pseudocoelomate, coelomate and haemocoelomate), segmentation.

Nonchordata - three to five distinguishing characters with two examples of Porifera, Coelenterata, Ctenophora, Platyhelminthes, Nematoda, Annelida, Mollusca, Arthropoda, Echinodermata.

Chordata – Sub-classification of Chordata with reference to notochord - Sub phyla Hemichordata, Urochordata, Cephalochordata and Vertebrata (classes - pisces, amphibia, reptilia, aves and mammalia).

(iii) Morphology and anatomy of different systems of cockroach (digestive, respiratory, circulatory, excretory, nervous and reproductive).

Only an ***elementary*** *knowledge the above systems is required.*

SECTION B

2. Plant Physiology

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

Criteria for essentiality of minerals, hydroponics, macro and micronutrients; role and deficiency symptoms (hunger signs) 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, nitrogen fixation and nitrogen-fixing organisms; importance of leghaemoglobin pigment.

(ii) 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).

A brief idea about differentiation, dedifferentiation and redifferentiation. 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; role of auxins in phototropic responses.

(iii) Photomorphogenesis in plants including a brief account of phytochromes.

A brief idea of short day, long day and day neutral plants; critical day length, photoperiodic induction; brief idea of phytochromes; differences between photoperiodism and vernalisation.

3. Multicellularity: Structure and Functions of Animals

(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 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; diagram of the digestive system with correct position of the organs and the 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, PEM, vomiting and indigestion.

(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 the respiratory system.

Pulmonary gas exchange and organs involved; Diagram of the respiratory tract and the associated organs. 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 emphysema, 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 with the help of diagrams and adaptation), lymphatic system. ABO groups, coagulation of blood. Disorders of the Circulatory system.

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. Disorders of the Circulatory system such as hypertension, coronary artery disease, Angina pectoris and heart failure.

(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; homeostasis, 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). Counter current system, Regulation of urine formation, Renin-angiotensin, Atrial Natriuretic Factor.

Functions of the kidney. Role of skin and lungs in excretion. Homeostasis – definition with reference to open and closed systems. Brief idea of process of dialysis, haemodialysis and peritoneal dialysis. Disorders of the excretory system. (i) renal calculi, (ii) glomerulonephritis, (iii) uremia, (iv) renal failure.

(vi) Endocrine System (human): hormones of pituitary, pineal, 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 pineal, thyroid, parathyroid, pancreas, adrenal glands 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 with the help of diagrams; 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, 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; diagram of synovial joint; general properties of muscles; 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.

SECTION C

4. Units of Life

(i) Biomolecules: Carbohydrates – classification and functions. Proteins – classification – levels of structure and functions; Lipids – classification, structure and function. Structure of nucleic acids and their functions, differences between DNA and RNA.

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

Proteins: Structure and functions, levels of protein (simple (keratins, collagen) and conjugated (chromoprotein, glycoprotein, phosphoprotein, metalloprotein, lipoprotein and nucleoprotein).

Lipids – classification, structure and functions of fats and oils.

Nucleotides and Nucleic acids – Structure and function of DNA, types of RNA. Differences between DNA and RNA.

(ii) Enzymes: 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 – temperature, pH, substrate concentration, competitive and non competitive inhibitors. A brief idea of allosteric modulation 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) Cell theory – structure and functions of nucleus, mitochondria, plastids, endoplasmic reticulum, golgi complex, lysosomes, ribosomes, microfilaments, microtubules, cilia, flagella and centrioles (ultra structure and function);

Cell wall, vacuoles and cell inclusions. Prokaryotic cell and eukaryotic cell – a comparison.

Structure and functions of all the above to be taught with diagrams.

General structure of eukaryotic cell; differences and similarities between prokaryotic cell, eukaryotic cell, plant and animal cell.

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

Types of respiration; mechanism of respiration: glycolysis, oxidation of pyruvate, Krebs' cycle, ETS (only flowchart). Brief idea of fermentation and Amphibolic pathway.

(vi) 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.

5. Organisms and Environment

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

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. Definition of ecological adaptations, classification into hydrophytes, mesophytes, xerophytes, osmoregulators, osmoconformers with an example of each.

(ii) Ecosystem: biotic and abiotic components, Productivity and decomposition, food chain, trophic levels, food webs, ecological pyramids, niche, biogeochemical cycles.

Brief idea about biotic and abiotic components. Productivity - *Gross and net, primary productivity, secondary productivity. Decomposition – fragmentation, leaching, catabolism, humification and mineralization. Various types of food chains, food webs, trophic levels, ecological pyramids – energy, number and biomass. Niche – definition. Biogeochemical cycles – Carbon and Phosphorous.*

(iii) Pollution: Air, water and soil pollution and their control.

Environmental issues: Air pollution and its control; Water pollution and its control; Agrochemicals and their effects. Solid waste management; Radioactive waste management; Deforestation.

A brief understanding of the concept Greenhouse effect. Impact of global warming in terms of climatic changes, rise in sea levels, melting of ice caps, dramatic change in ice and permafrost in Arctic and Antarctic regions; impact on animals and plants due to climate changes. Ozone depletion.

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 study the effect of thawing, heat and alcohol on permeability of beet root cells.

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

(iii) To study 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 and compared after boiling and killing the cells.

(iv) To study the effect of different temperatures and three different pH on enzyme (amylase) action on starch solution.

Self-explanatory

(v) To study the rate of respiration in flower buds and germinating seeds.

Self-explanatory

3. Morphology

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

(ii) Preparation of temporary slides 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 and record observations.

4. Cytology

Preparation of temporary slides of -

(i) Stages of Mitosis in onion root tips.

(ii) Stages of Meiosis in grasshopper testes.

(iii) Striated muscles of cockroach.

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

Correct method of selecting the root tip, fixing, staining and mounting should be taught. 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 which includes identification, drawing a labelled diagram and writing two characteristics).

(a) Identification of stained preparations of the following:

(i) Stages of mitosis.
(ii) Stages of meiosis.
(iii) Identification of mammalian blood cells.
(iv) Bacteria
(v) Oscillatoria
(vi) Spirogyra
(vii) Amoeba
(viii) Entamoeba
(ix) Plasmodium
(x) Yeast

(b) Identification of the following specimens -

(i) Liverworts
(ii) Moss
(iii) Fern
(iv) Pinus
(v) Rhizopus
(vi) Mushroom
(vii) Lichen
(viii) One monocot plant – bamboo
(ix) One dicot plant – petunia
(x) A phyloclade - cactus
(xi) Hydra
(xii) Liver Fluke
(xiii) Ascaris
(xiv) Leech
(xv) Earthworm
(xvi) Prawn/Crab
(xvii) Honey Bee
(xviii) Cockroach
(xix) Silk Worm
(xx) Snail (Pila)
(xxi) Starfish
(xxii) Dogfish
(xxiii) Rohu fish
(xxiv) Frog
(xxv) Snake / Garden lizard
(xxvi) Sparrow / Pigeon
(xxvii) Rabbit/ Squirrel

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

(c) Comment on experimental set up in Physiology – Aerobic and Anaerobic Respiration.

Students should identify (aim of experiment), draw physiological set up and write a brief description (observation, inference and precautions) of the experiment in three minutes.

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 two parts.

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

Part II (50 marks) *will be divided into three Sections A, B and C. Candidates will be required to answer* ***two*** *out of* ***three*** *questions from Section A (each carrying 5 marks),* ***two*** *out of* ***three*** *questions from Section B (each carrying 10 marks) and* ***two*** *out of* ***three*** *questions from Section C (each carrying 10 marks). Therefore a* ***total of six*** *questions are to be answered in Part II.*

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

SECTION A

1. 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 evidences - homology and analogy, vestigial organs, atavism; 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 (two examples each from plants and animals), embryological evidences - theory of recapitulation, palaeontological evidence – definition and example of Archaeopteryx, biogeographical evidence - 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; Hardy Weinberg's principle; variations: causes of variation, mutation, selected examples and types of natural selection (DDT resistance in mosquito, sickle-cell anaemia); artificial selection; adaptations. 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, mutation – definition and its role in evolution (frameshift and substitution), examples of natural selection - resistance of mosquitoes to DDT, sickle cell anaemia, difference between natural and artificial selection, types of natural selection (directional, disruptive and stabilising) mechanism of speciation, definition of gene pool, gene flow, genetic drift and Hardy Weinberg's principle; evolution of man - brief idea of ancestors leading to man of today; comparison and homology in chromosomes of apes and man.

SECTION B

2. Multicellularity

A. Plants

(i) Tissues: types of plant tissues: Meristematic: Classification of Meristematic tissue.

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 in stem: brief idea of formation of secondary xylem and secondary phloem by cambium ring formation, annual rings.

Characteristics of meristematic tissue; classification of meristems based on origin and location; 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 in stems and formation of annual rings.

(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; apoplastic and symplastic movements, 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) Photosynthesis: ultra structure of chloroplast, photochemical and biosynthetic phases, absorption and action spectra, factors affecting photosynthesis, photophosphorylation; photorespiration, transport of solutes.

Photosynthesis and 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 factors, factors affecting 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.

(iv) Reproduction and development in angiosperms: vegetative reproduction, sexual reproduction: development of male and female gametophytes, placentation, pollination, fertilisation (Amphimixis) and formation of endosperm, embryo, seed and fruits (broadly classified). Apomixes, Polyembryony, Parthenocarpy. Significance of seed and fruit formation.

Natural and artificial vegetative propagation, advantages and disadvantages of vegetative reproduction. 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, Parthenocarpy to be explained briefly. Significance of seed and fruit formation.

(v) Differentiation and organ formation.

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

B. Animals

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. Amniocentesis. Assisted reproductive technologies.

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; lactation – hormonal control and importance; brief knowledge about medical termination of pregnancy and causes of infertility. Amniocentesis – role in detecting genetic defects. Assisted reproductive technologies — IVF, ZIFT, GIFT (Definition and application only).

SECTION C

3. Genetics

(i) 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.

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

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.

(iii) Genes: packaging of hereditary material in chromosomes. Linkage and crossing over; linkage maps, sex determination and sex linkage, search for DNA as genetic material, central dogma; genetic code, protein synthesis. Human genome project. DNA finger printing.

Chromosomal theory of inheritance; chromosomes in eukaryotic organisms, autosomes and sex chromosomes (sex determination in humans, birds and honey bees), sex-linked inheritance, complete and incomplete linkage and crossing over, chromosomal mapping and its significance; replication of genetic material, functions of genes - expression of genetic information, gene expression in prokaryotes, search for DNA as genetic material - Griffith's experiment, Hershey and Chase's experiment; central dogma; Lac Operon; genetic code. Transcription, translation and protein synthesis.

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

(iv) 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 crops. Biosafety issues: biopiracy and patents.

4. Applications of Biology

(i) Crop improvement: methods of crop improvement: selection, hybridisation, plant breeding, plant introduction, tissue culture; single cell protein; biofortification; biopesticides.

A reference to green revolution only. 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; single cell protein – source and significance; biofortification: meaning and its role in improving food production. Biopesticides: definition, importance and two examples (Bioinsecticides e.g. Bacillus thuringiensis, Bioherbicides e.g. Cochineal insect).

(ii) Biodiversity today: importance of biodiversity, types of biodiversity, genetic conservation, gene banks and cryopreservation. Loss of biodiversity - threatened, endangered and extinct species. Strategies for conservation of biodiversity – in-situ and ex-situ.

Importance of biodiversity, Few examples of each type of biodiversity - species, ecosystem and genetic. A general idea that species share a common gene pool and represent the lowest taxonomic group. Definition of genetic conservation, genetic erosion, gene bank and cryopreservation; factors affecting genetic erosion.

Only a brief understating of the following is required:

Implications of loss of biodiversity. Categorizing species in different groups like - threatened, endangered and extinct. Examples of plants and animals. Looking at various in-situ and ex-situ strategies for their efficacy and viability. In-situ - protected areas (biosphere reserves, national parks, wildlife sanctuaries). Hotspots and red data book. Ex-situ - captive breeding, zoo, botanical garden.

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

Green manures – definition and types; reasons for preference of biofertilisers over chemical fertilisers should be discussed. Role of bacteria in improving soil fertility.

(iv) 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 (typhoid and pneumonia), viral diseases (common cold, swine flu and dengue), protozoa (malaria, and amoebiasis), helminthes (ascariasis, ringworm, and filariasis); sexually transmitted diseases (STD); non-communicable diseases: cancer (types, causes, diagnosis and treatment); human genetic disorders: (haemophilia, thalassaemia, albinism, Down's syndrome, Klinefelter's syndrome, Turner syndrome). Rh factor incompatibility – during transfusion and pregnancy. 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; sexually transmitted diseases (STD), diseases should be discussed on basis of causative agent, symptoms and prevention; cancer (types, causes, diagnosis and treatment); human genetic disorders: (haemophilia, thalassaemia, albinism, Down's syndrome, Klinefelter's syndrome, Turner syndrome). Rh factor incompatibility – role of Rh factor in blood transfusion and pregnancy; 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.

(v) Adolescent issues: alcoholism and drugs.

Adolescent issues (alcoholism and drugs – reasons for addiction and its effects on health).

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

Students should know one application of each of the instruments mentioned above. Details are not required.

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

Terms biotic potential, environmental resistance and carrying capacity; population: birth rate, death rate, age distribution; types of growth curves; causes and measures to control population (natural and artificial).

(viii) Animal Husbandry: Dairy farm management, poultry farm management, apiculture, pisiculture.

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

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)/ Dahlia/ Zinnia.
   (iii) Leguminosae: subfamily – Papilionaceae – type – Sweet pea/ Pea/ Bean/ Sesbania/ Clitoria (single flower).
   (iv) Solanaceae: type – Petunia / Datura / Brinjal Flower / *Solanum nigrum*.
   (v) Liliaceae: type – Onion or Amarallydaceae –type – Lily/Spider lily/ Tiger lily/ Tube rose/ Gladiolus.

   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) Study of imbibition in raisins/seeds.
   (ii) Demonstration of plasmolysis (using rheo leaf and onion bulb).
   (iii) Demonstration of osmosis in living plant cells (potato osmoscope).
   (iv) Demonstration of unequal transpiration in leaves.
   (v) Study of arrangement/distribution of stomata on isobilateral and dorsiventral leaves.
   (vi) To demonstrate the effect of different intensities of light on photosynthesis.
   (vii) To demonstrate that oxygen is evolved during photosynthesis.
   (viii) 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) **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) Germination of pollen grain.

   The technique of collecting the material from the correct location, 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.

4) **Spotting: (Three minutes to be given for each spot which includes identification, drawing a labelled diagram and writing two characteristics). Spotting must be done on a separate answer sheet during examination, which should be handed over to the Examiner immediately after 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 ovary of mammal.
      (e) T.S. of testis of mammal.

(f) Germinating pollen grain.

(g) T.S. of morula

(h) T.S. of blastula.

(i) T.S. of gastrula.

(j) Plasmodium.

(k) Entamoeba histolytica.

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

(ii) Students should identify, draw and comment on:

(a) Different types of inflorescence – basic racemose, basic cymose and capitulum.

Students should be able to identify the type of inflorescence, draw its diagram and write two characteristics of the specimen.

(b) Flowers adapted to pollination by different agencies – insect and wind.

Students should be able to identify the type of pollination of the given flower, draw the diagram of the flower and give two reasons for the type of pollination.

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

(a) Osmosis

(b) Transpiration

(c) Photosynthesis

(d) Transpiration pull.

Students 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 topics:

(i) Diabetes.

(ii) Cancer.

(iii) AIDS/Hepatitis.

(iv) Drug addiction and community.

(v) Endocrine glands.

(vi) Role of micro-organisms in industry.

(vii) Human population.

(viii) Mendelian Inheritance

(ix) Environmental resistance.

(x) Traditional and modern methods: Study of a few traditional methods of pest deterrence vis-a-vis modern methods of pest control - viability of traditional methods in today's scenario and limitations and dangers of modern methods.

(xi) Role of agrochemicals in increasing food production.

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.