

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 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.

SECTION - A

1. The Living World

- (i) Tools of Biology: (Dissecting microscope, compound microscope, electron microscope); Methods of scientific research. Scope of Biology.
- (ii) Being alive: what does it mean? Life as an expression of energy; and homeostasis.

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.
- (ii) Kingdom Monera: Bacteria - forms of bacteria, reproduction, gram +ve and gram -ve bacteria; economic importance; cyanobacteria: characteristic features; archaebacter.
- (iii) General characteristics of Kingdom Protista - Characteristics and examples of subgroups:
 - (a) Chrysophytes
 - (b) Dinoflagellates,
 - (c) Euglenoids,
 - (d) Slime moulds,
 - (e) Protozoans.
- (iv) Kingdom Fungi: zygomycetes, ascomycetes, basidiomycetes, deuteromycetes - general characteristics. Brief idea of lichens and mycorrhizae.
- (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.

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

3. Organism and Environment

- (i) Species and Population: concept of species, interaction between members of a species (cooperation, communication and competition).
- (ii) Biotic community: intraspecific and interspecific relationship, commensalism, predation, scavenging, parasitism, symbiosis, biotic stability and biotic succession.
- (iii) Ecosystem: biotic and abiotic components, food chain, trophic levels, food webs, ecological pyramids, major ecosystems, man made ecosystem – agro ecosystem.

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.
- (ii) Enzymes: molecular structure, general properties, classification, mechanism of enzyme action, allosteric modulation, factors affecting enzyme activity.
- (iii) Cell membranes: unit membrane concept, fluid mosaic model, membrane transport, passive and active transport, exocytosis and endocytosis. Facilitated diffusion.

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

5. Continuity of Life

- (i) Cell reproduction: cell cycle, mitosis and meiosis.
- (ii) Fundamentals of Genetics: concept of alleles: dominant and recessive; phenotype and genotype, homozygous and heterozygous, mono and dihybrid crosses.
- (iii) Mendel's experiments with peas; Mendel's Principles of inheritance, incomplete dominance, co-dominance, multiple alleles and epistasis.
- (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.
- (v) Mutation: chromosomal and gene mutations, somatic and heritable mutations, spontaneous and induced mutations; role of mutations in speciation.
- (vi) Recombinant DNA technology and its applications.

6. Applications of Biology

- (i) Animal Husbandry: Dairy farm management, poultry farm management, bee keeping and fisheries.
- (ii) Plant diseases: rust and smut of wheat, blight of rice, late blight of potato, bean mosaic and root knot of vegetables.

PAPER II

PRACTICAL WORK – 20 Marks

1. Scientific Techniques

Study parts of a dissecting microscope and compound microscope.

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.
- (ii) To demonstrate the effect of thawing, heat and alcohol on permeability of beet root cells.
- (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.
- (iv) Demonstration of the effect of temperature on enzyme (diastase) action on starch solution.

3. Morphology

- (i) Study of different modifications in root, stem and leaves.
- (ii) Preparation of temporary slide of Mucor / Rhizopus.

4. Cytology

Preparation of -

- (i) Stages of Mitosis in onion root tips.
- (ii) Stages of Meiosis in grasshopper testes.

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) Paramecium
- (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

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.

SECTION - A

1. Multicellularity: Structure and Function - Plant Life

Forms and function

- (i) Tissues: types of plant tissues: Meristematic: Classification of Meristematic tissue, tunica-carpus 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.

- (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.
- (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.
- (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.
- (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.
- (vi) Differentiation and organ 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).
- (viii) Photomorphogenesis in plants including a brief account of phytochrome.

2. Multicellularity: Structure and Function - Animal Life

- (i) Tissues: epithelial; connective; muscular; nervous (location, structure and function).
- (ii) Nutrition (human): Organs of digestive system (histology not required), digestive process and disorders of the digestive system.
- (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.
- (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.
- (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.
- (vi) Endocrine System (human): hormones of pituitary, thyroid, parathyroid, thymus, pancreas, adrenal glands and gonads; effect of hyposecretion and hypersecretion, feedback mechanism.
- (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).
- (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.
- (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.
- (x) Growth, Ageing and Death: types of growth, growth curve, morphological and physiological changes during ageing, causes of death.

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.
- (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.

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.

- (ii) Crops today: Gene pool and genetic conservation, gene banks, cryopreservation.
- (iii) Biofertiliser: green manure, nitrogen fixation – symbiotic and non-symbiotic organisms.
- (iv) Pesticides: advantages and disadvantages of pesticides. Bioinsecticides and bioherbicides. Integrated Pest Management (IPM).
- (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, Klinefelter's syndrome, Turner syndrome). Rh factor incompatibility; amniocentesis. Genetic counselling; a brief idea of stem cells, organ transplants and immunosuppression.
- (vi) Mental Health and Community Health: types, causes and treatment of mental illness; causes of addiction; activities of community health services.
- (vii) Biomedical Engineering: (only basic concepts) Instruments – ECG, EEG, CT scan, ultrasound, MRI, pacemakers, implants, disposables, external prosthesis.
- (viii) Human population: population growth curves, causes of increase in 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.
- 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.
- 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.).

- 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).
 - (v) 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.

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.

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

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.