

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-corporis 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 corporis 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 CO₂ 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 receptors.

- (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, capacitation, 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, Klinefelter'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, Klinefelter'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 -
- T.S. of dicot root.
 - T.S. of monocot root.
 - T.S. of dicot stem.
 - T.S. of monocot stem.
 - Striated muscles of cockroach.
 - 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.

- 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).**

- Identify and comment on permanent slides of:
 - T.S. of monocot and dicot stem.
 - T.S. of monocot and dicot root.
 - T.S. of monocot and dicot leaf.
 - T.S. of spinal cord of mammal.
 - T.S. of bone of mammal.
 - T.S. of ovary of mammal.
 - 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.

- 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:

- Diabetes.
- Endocrine glands.
- Vegetarianism/non-vegetarianism.
- Role of micro-organisms in industry.
- Drug addiction and community.
- Balanced diet.
- Human population.
- Cancer.
- AIDS/Hepatitis.
- Cell organelles.

Ecology

- Abiotic and biotic factors.
- Food chains.
- Ecological pyramids.
- Ecosystems.
- Biomass and bionumber.
- Carbon, nitrogen and mineral cycles.
- Environmental resistance.
- Ecological impact of pollution.
- Acid rain.
- Ozone layer.
- Conservation of natural resources.
- 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.