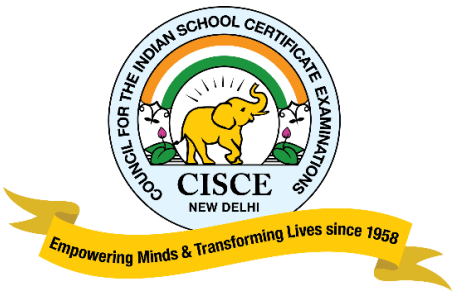
ISC

YEAR 2027

INDIAN SCHOOL CERTIFICATE EXAMINATION



BIOLOGY

(863)

February 2025

Council for the Indian School Certificate Examinations (CISCE)

MISSION STATEMENT

The Council for the Indian School Certificate Examinations is committed to serving the nation's children, through high quality educational endeavours, empowering them to contribute towards a humane, just and pluralistic society, promoting introspective living, by creating exciting learning opportunities, with a commitment to excellence.

ETHOS OF CISCE

- Trust and fair play.
- Minimum monitoring.
- Allowing schools to evolve their own niche.
- Catering to the needs of the children.
- Giving freedom to experiment with new ideas and practices.
- Diversity and plurality - the basic strength for evolution of ideas.
- Schools to motivate pupils towards the cultivation of:
  Excellence - The Indian and Global experience.
  Values - Spiritual and cultural - to be the bedrock of the educational experience.
- Schools to have an 'Indian Ethos', strong roots in the national psyche and be sensitive to national aspirations.

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 ... 15 marks*
Project Work ... 10 marks
Practical File ... 5 marks

PAPER 1- THEORY: 70 Marks

S.NO.	UNIT	TOTAL WEIGHTAGE
1.	Diversity of Living Organisms	09 Marks
2.	Structural Organisation in Animals and Plants	11 Marks
3.	Cell: Structure and Function	15 Marks
4.	Plant Physiology	17 Marks
5.	Human Physiology	18 Marks
TOTAL		**70 Marks**

PAPER I –THEORY – 70 Marks

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

1. Diversity of Living Organisms

(i) The Living World

Need for classification; taxonomy and systematics; concept of species and taxonomical hierarchy; binomial nomenclature.

Need for classification should be discussed. Definition and explanation of the terms taxonomy (numerical taxonomy, cytotaxonomy and chemotaxonomy) and systematics. Concept of species. Major taxonomical hierarchies (phylum, class, order, family, genus, species): definition and examples with reference to classification of man, house fly, mango and wheat. Rules of binomial nomenclature and advantages of using scientific names.

Three systems of classification – artificial, natural and phylogenetic.

(ii) Biological Classification

Three domains of life; Five kingdom classification; salient features and classification of Monera, Protista, Fungi, Plantae and Animalia. Lichens, Viruses, Viroids and Prions.

(a) Three domains of life – distinguishing features of (archaea, bacteria, eukarya). Five-kingdom system of classification and characteristics of different kingdoms with examples.

(b) Kingdom Monera: Bacteria - General structure of a typical bacterial cell; classification of bacteria according to shape, nutrition and mode of respiration; differences between gram +ve and gram –ve bacteria; types of reproduction – definition of fission, conjugation, transduction and transformation (details not required).

A brief idea of the role of different types of archaebacteria (methanogens, halophiles and thermoacidophiles in their extreme environments).

Mycoplasma – three distinctive features.

Economic importance with reference to role of bacteria in sewage treatment, antibiotics, energy production and house hold products (curd and cheese only).

(c) Kingdom Protista – only two general characteristics and two 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 including modes of locomotion and two examples of each).

(d) Kingdom Fungi: general characteristics and mode of reproduction of each (including types of spores and sexual reproduction – definition of isogamy, anisogamy, oogamy, plasmogamy, karyogamy and dikaryophase). Zygomycetes, Ascomycetes, Basidiomycetes, Deuteromycetes - characteristics with examples. Role of fungi in the field of medicine, bakery and environmental decomposition. Definition of lichens and mycorrhiza (ecto and endo).

Life cycles not required.

(e) Virus (characteristic features – link between living and non-living, structure of TMV and bacteriophage and contribution of the following scientists: D.J. Ivanowsky, M.W. Beijerinck, W.M. Stanley). Definitions of Viroid and Prions (examples of the diseases caused by prions – BSE and CJD).

(iii) Plant Kingdom

(a) Algae - characteristics (morphology, common name, major pigments, stored food, composition of cell wall, flagellar number and position of insertion, habitat, mode of sexual reproduction) and examples of Chlorophyceae, Phaeophyceae, Rhodophyceae; Economic importance of algae – any five.

(b) Bryophyta – general characteristics, distinctive features of liverworts and mosses; graphic outline of life cycle of Funaria with reference to alternation of

generations. Economic importance of bryophytes.

(c) Pteridophyta: characteristics; classification into classes: psilopsida (Psilotum), lycopsida (Selaginella, Lycopodium), sphenopsida (Equisetum) and pteropsida (Dryopteris, Pteris and Adiantum). Graphic outline of life cycle of a typical pteridophyte (fern). Definition of homospory and heterospory with relevant examples. Economic importance.

(d) Gymnosperms: general characteristics and graphic outline of life cycle of a typical gymnosperm (Pinus). Economic importance.

(iv) Animal Kingdom

Animal Kingdom: levels of organisation – (cellular level, tissue level, organ level, organ system level); body plan (cell aggregate plan, blind-sac plan and tube-within-tube plan), symmetry (spherical, radial and bilateral symmetry), (diploblastic and triploblastic organisation in animals, coelom development- (acoelomate, pseudocoelomate, coelomate and haemocoelomate), segmentation.

Non-chordata - five distinguishing characters with two examples of Porifera, Cnidaria, Ctenophora, Platyhelminthes, Nematoda (Aschelminthes), Annelida, Mollusca, Arthropoda, Echinodermata, Hemichordata.

Chordata – sub-classification of Chordata with reference to notochord - sub phyla Urochordata, Cephalochordata. Vertebrata (classes – cyclostomata, chondrichthyes, osteichthyes, amphibia, reptilia, aves and mammalia) – three distinguishing characters with two examples of each).

2. Structural Organisation in Animals and Plants

(i) Morphology of Flowering Plants

(a) Morphology and modifications of root, stem, leaf.

Types of roots (tap, fibrous, adventitious), regions, modifications of roots for storage (Tuberous – e.g. Mirabilis and sweet potato; fusiform – e.g. radish; conical – e.g., carrot; napiform – e.g. turnip), respiration (pneumatophores) and support (stilt and prop).

Stems – features (nodes internodes, buds), modifications – underground (tuber, rhizome, corm) aerial (tendril, thorn, Phylloclade, cladode) and sub-aerial (runner, sucker, stolon, offset).

Leaves - parts of a simple leaf, venation, types of leaves (simple and compound – pinnate and palmate), phyllotaxy – alternate, opposite, whorled (with an example of each). Modifications for mechanical support (tendril), protection (spine), storage (bulb), reproduction (Bryophyllum); insectivorous plants (pitcher plant, Venus-fly-trap).

(b) Morphology of flower. Structure of a typical flower, types of inflorescence (racemose and cymose).

Structure of a typical flower, bracteates/ebracteate, [symmetry (actinomorphic, zygomorphic), trimerous/tetramerous/pentamerous complete/ incomplete, non-essential whorls (calyx: gamosepalous, polysepalous, corolla: gamopetalous, polysepalous, perianth, aestivation: valvate, twisted, imbricate, vexillary), essential whorls (androecium: cohesion - syngenesious, synandrous, monadelphous, diadelphous, polyadelphous; adhesion – epipetalous, epiphyllous; number of lobes – monothecous, dithecous; Gynoecium: position of ovary – epigynous, hypogynous, perigynous, cohesion – apocarpous, syncarpous, number of locules – unilocular, bilocular, multilocular, placentation – axile, marginal, parietal, free central, basal; types of inflorescence (racemose and cymose – definition, examples, and differences; subtypes not required).

(ii) Anatomy of Flowering Plants

Plant Tissues: types of plant tissues: Meristematic tissues: classification of meristematic tissue. Permanent Tissues: structure and function of simple tissues (parenchyma, collenchyma and sclerenchyma) and complex tissues (xylem and phloem), tissue system. Internal structure of root, stem, and leaf.

Characteristics of meristematic tissue; classification of meristems based on origin and location; structure, function and location of permanent tissues; simple and complex tissues; epidermal, ground and vascular tissue systems.

Cellular diagrams of T.S. of roots and stem and V.S. of monocot and dicot leaves are required.

(iii) Structural Organisation in Animals: Frog

Morphology, anatomy and functions of different systems (digestive, circulatory, respiratory, excretory, nervous and reproductive) of frog a brief account only.

3. Cell: Structure and Function

(i) Cell - the Unit of Life

Cell theory and cell as the basic unit of life: Structure of eukaryotic cells; Plant cell and animal cell; cell envelope; cell membrane, cell wall; cell organelles – ultrastructure and function; endomembrane system, mitochondria, ribosomes, plastids, microbodies; cytoskeleton, cilia, flagella, centrioles; nucleus.

Historical aspects, cell theory, size and shape of cells.

General structure of eukaryotic cell, ultra-structure and function of cell wall (including definition of plasmodesmata), cell membrane (description of fluid mosaic model; functions of the plasma membrane: active and passive transport, brief explanation of facilitated diffusion (uniport, symport and antiport) with one example]. Mitochondria, nucleus (nuclear membrane, chromatin, nucleolus, structure and types of chromosomes on the basis of the position of centromere, satellite), types of plastids, endomembrane system (endoplasmic reticulum, Golgi complex, lysosomes and vacuoles), ribosomes, microbodies, cytoskeleton (microfilaments, microtubules and intermediate filaments), cilia, flagella and centrioles; differences between prokaryotic cell and eukaryotic cell, plant cell and animal cell.

(ii) Biomolecules

Proteins, carbohydrates, lipids, enzymes, secondary metabolites.

Carbohydrates: general classification and functions of: monosaccharides (glucose, ribose and deoxyribose), disaccharides (maltose, lactose and sucrose), polysaccharides (glycogen, starch, cellulose, inulin, and chitin).

Proteins: amino acids – (structure: glycine, alanine, serine); amino acids as zwitter-ion; examples of acidic, basic, neutral, sulphur containing amino acids; essential and non-essential amino acids; levels of protein structure (primary, secondary, tertiary and quaternary); functions of proteins.

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

Enzymes: general properties, nomenclature and classification of enzymes according to type of reactions, co-factors (prosthetic groups, coenzymes and metal ions). Factors affecting enzyme activity - temperature, pH, substrate concentration. Competitive inhibitors.

Definition and examples of secondary metabolites.

(iii) Cell Cycle and Cell Division

Cell cycle, mitosis, meiosis and their significance.

Definition of C-value, different stages of cell cycle (G_o, G_1, S and G_2 and M).

Different stages of mitosis and meiosis (prophase – I) with diagrams. Significance of mitosis and meiosis. Differences between mitosis and meiosis.

4. Plant Physiology

(i) Photosynthesis in higher plants

Photosynthesis as a mean of autotrophic nutrition; site of photosynthesis, pigments involved in photosynthesis (elementary idea); photochemical and biosynthetic phases of photosynthesis; cyclic and non-cyclic photophosphorylation; chemiosmotic hypothesis; photorespiration; C_3 and C_4 pathways; factors affecting photosynthesis.

Differences between absorption and action spectra.

Brief idea of photosynthetic pigments (difference between chlorophyll 'a'&'b', carotenoids and xanthophyll), photochemical phase - pigment systems, cyclic and non-cyclic photophosphorylation, chemiosmotic hypothesis; biosynthetic phase - C_3 cycle – graphic representation in correct sequence (carboxylation, glycolytic reversal and regeneration of pentose); Kranz anatomy, graphic representation of C_4 cycle (Hatch and Slack pathway); Differences between C_3 and C_4 plants, C_3 and C_4 cycles, Photosystems I and II, Photorespiration pathway in brief; significance of photorespiration; explanation of how RuBP carboxylase acts as RuBP oxygenase. Blackman's Law of limiting factors, factors affecting photosynthesis (light, CO_2, temperature, and water).

(ii) Respiration in Plants

Exchange of gases; cellular respiration - glycolysis, fermentation (anaerobic), TCA cycle and electron transport system (aerobic); energy relations - number of ATP molecules generated; amphibolic pathways; respiratory quotient.

Types of respiration; mechanism of respiration: glycolysis, Krebs' cycle, ETS (only flowchart). Oxidative phosphorylation – definition; Brief idea of fermentation and Amphibolic pathway. Definition of respiratory quotient and RQ values of carbohydrates, proteins and fats.

(iii) Plant Growth and Development

Seed germination; phases of plant growth; plant growth rate; differentiation, dedifferentiation and redifferentiation; sequence of developmental processes in a plant cell; growth regulators - auxin, gibberellin, cytokinin, ethylene, ABA.

Definition of hypogeal, epigeal and viviparous germination with two examples of each. A brief idea about differentiation, dedifferentiation and redifferentiation. Phases of growth in meristems, growth rate – definition; measurement of growth by direct method and use of auxanometer, factors affecting growth.

Discovery and physiological role of growth regulators in plants (such as auxins, gibberellins, cytokinins, ethylene and abscisic acid – four effects of each); application of growth regulators.

5. Human Physiology

(i) Breathing and exchange of gases.

Respiratory organs in animals (recall only); Respiratory system in humans; mechanism of breathing - exchange of gases, transport of gases and regulation of breathing, respiratory volumes; disorders related to respiration.

Organs involved in respiration; mechanism of pulmonary gas exchange; breathing process should be explained showing the action of diaphragm and intercostal muscles, regulation of breathing ; transport of oxygen in the blood, oxyhaemoglobin dissociation curve; transport of CO_2; chloride shift, pulmonary air volumes and lung capacities; disorders of respiratory system such as - asthma, emphysema, occupational respiratory disorders.

(ii) Body fluids and circulation.

Composition of blood, blood groups, coagulation of blood; composition of lymph and its functions; human circulatory system - structure of human heart and blood vessels; cardiac cycle, cardiac output, ECG; double circulation; regulation of cardiac activity; disorders of circulatory system.

Composition of blood plasma, functions of plasma proteins, blood corpuscles. Importance of ABO groups in blood transfusion, Rh factor and its importance in transfusion and pregnancy; clotting of blood to be taught briefly; lymphatic system – a brief idea of lymph (composition and function), Difference between closed and open vascular system; external and internal structure of heart; 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; definition of stroke volume and cardiac output, regulation of heart beat, ECG; arterial blood pressure (systolic and diastolic), double circulation.

The internal structure of artery, vein and capillary. Importance of ABO groups in blood transfusion, Rh factor and its importance in transfusion and pregnancy; clotting of blood to be taught briefly; lymphatic system – a brief idea of lymph (composition and function), lymphatic capillaries and lymph nodes; disorders of the circulatory system such as hypertension, coronary artery disease, angina pectoris and heart failure.

(iii) Excretory products and their elimination.

Modes of excretion - ammonotelism, ureotelism, uricotelism; human excretory system - structure and function; urine formation, osmoregulation; regulation of kidney function, renin - angiotensin, atrial natriuretic factor, ADH; role of erythropoietin; role of other organs in excretion; disorders of the excretory system - uraemia, renal failure, renal calculi, nephritis; dialysis and artificial kidney, kidney transplant.

Define, differentiate and explain the terms ammonotelism, ureotelism and uricotelism; external and internal structure of the kidney (L.S.); structure of nephron; physiology of urine formation - ultra filtration, selective reabsorption and active (tubular) secretion. Counter current system, regulation of urine formation, definition and regulation of micturition, renin-angiotensin-aldosterone system, role of atrial natriuretic factor, ADH and erythropoietin.

Role of skin, liver and lungs in excretion. Homeostasis – definition. Disorders of the excretory system - uraemia, renal failure, renal calculi, nephritis.

Haemodialysis; Kidney transplant.

(iv) Locomotion and Movement

Types of movement - ciliary, flagellar, muscular; skeletal muscles - contractile proteins and muscle contraction; skeletal system and its functions; joints; disorders of muscular and skeletal system.

Locomotion: Basic aspects of human skeleton (number and names of the bones of axial and appendicular skeleton).

Functions of human skeleton; different types of joints - their location and function; general properties of muscles; structure of skeletal muscle - sliding filament theory of muscle contraction; chemical events during muscle contraction; definition of summation, tetanus, rigor mortis, differences between red and white muscles.

Disorders of muscular and skeletal system: (i) Myasthenia gravis, (ii) Tetany, (iii Muscular dystrophy, (iv) Arthritis, (v) Osteoporosis, (vi) gout.

(v) Neural Control and Coordination

Neuron and nerves; nervous system in humans - central nervous system; peripheral nervous system and visceral nervous system; generation and conduction of nerve impulse.

Types of neurons – (unipolar, bipolar. Pseudounipolar and multipolar), Structure and functions of various parts of the brain and spinal cord; conduction of nerve impulses through nerve fibre (non- myelinated and myelinated) and through synapse.

(vi) Chemical Co-ordination and Integration

Human endocrine system - hypothalamus, pituitary, pineal, thymus, thyroid, parathyroid, adrenal, GI tract, pancreas, gonads; mechanism of hormone action (elementary idea); role of hormones as messengers and regulators, hypo - and hyperactivity and related disorders; dwarfism, acromegaly, cretinism, goiter, exophthalmic goiter, diabetes mellitus and diabetes insipidus, Grave's disease, Addison's disease.

Brief idea of location of endocrine glands; role of hypothalamus; hormones secreted by different lobes of pituitary and their functions; feedback control of tropic hormones to be discussed giving examples; hormones of pineal, thymus, thyroid, parathyroid, pancreas, adrenal glands, GI tract (gastrin, secretin, GIP, CCK-PZ) and gonads; mechanism of hormone action (through cAMP and steroid hormones only); effects of hypo secretion and hyper secretion of various hormones of the above mentioned glands.

Note: Diseases related to all the human physiological systems to be taught in brief.

Topics having numerical problems to be taught with illustrative examples.

PAPER II
PRACTICAL WORK – 15 Marks

1. Scientific Techniques

To study parts of a dissecting microscope and compound microscope.

The students should know all parts of dissecting and compound microscope and be able to handle the microscope independently.

2. Physiology

(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. Experiment on effect of alcohol on the permeability with regard to leaching.

(iii) Separation of plant pigments from leaves by chromatography.

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

(v) Demonstration of plasmolysis (using *Rhoeo* leaf / onion bulb).

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

3. Morphology

(i) Morphology and modification of roots, stems and leaves.

Teachers can show examples of roots, stems and leaves modified for mechanical support, storage, reproduction or perennation – students should learn to identify and draw the specimens.

Leaves: phyllotaxy – alternate, opposite whorled (with an example of each), shape, venation, simple and compound.

(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) Onion peel (to study the plant cell)

(ii) Stages of mitosis in onion root tips.

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.

(iii) T.S of monocot and dicot stem.

(iv) T.S. of monocot and dicot root.

After staining and mounting the tissue students should be able to draw the diagram and label all the parts as seen under the low power of microscope.

5. Spotting: (Three minutes to be given for each spot which includes identification, drawing a labelled diagram and writing at least two characteristics).

(a) Identification of stained preparations of the following:

(i) Stages of meiosis.

(ii) Identification of mammalian blood cells.

(iii) Bacteria

(iv) *Spirogyra*

(v) *Amoeba*

(vi) Yeast

(b) Identification of the following specimens -

(i) Liverworts

(ii) Moss

(iii) Fern
(iv) *Pinus*
(v) Mushroom
(vi) One monocot plant – bamboo
(vii) One dicot plant – *Petunia*
(viii) Sponge
(ix) *Hydra*
(x) Tape worm
(xi) Leech
(xii) Silk Worm
(xiii) Rohu fish

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

(c) 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 a labelled diagram of the physiological set-up and write observation and inference of the experiment within the allotted time i.e., 3 minutes.

PROJECT WORK AND PRACTICAL FILE – 15 Marks

Project Work – 10 Marks

Candidate is to creatively execute one project/assignment on any aspect of Biology. Preference is to be given to handwritten investigatory projects. Candidates are required to submit a hard copy of their computer-generated projects duly signed by the Internal Examiner (and the Head of the Institution) for physical verification and assessment. 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/animal life.
(ii) Project related to any aspect of environment.
(iii) Diabetes.
(iv) Endocrine disorders.
(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.

Suggested Evaluation Criteria for Project Work:

Format of the Project:

– Content
– Introduction
– Presentation (graphs, tables, charts, newspaper cuttings, diagrams, photographs, statistical analysis if relevant)
– Conclusion/ Summary
– Bibliography

Practical File – 5 Marks

The practical file should cover all the practical exercises outlined in the syllabus. Each practical done during the year, needs to be recorded by the student in the Practical file and the same must be checked, signed and dated by the teacher.

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

SCIENTISTS AND THEIR CONTRIBUTIONS

1. Beijerinck – *Contagium vivum fluidum*
2. Carl Woese – Three domains of life
3. Engelmann – Action spectrum of photosynthesis
4. Ernst Mayr – Biological species concept
5. F.F. Blackman – Law of limiting factor
6. F W Went – Isolated Auxins
7. Farmer and Moore – Discovered meiosis
8. G.N. Ramachandran – Analysis of Protein structure
9. George Palade – Discovered ribosomes
10. Huxley and Niedergerke – Sliding filament theory
11. Ivanowsky – Discovered Tobacco Mosaic Virus
12. Karl Landsteiner – ABO Blood group system
13. Katherine Esau – Anatomy of plants

14. Peter Mitchell – Chemiosmotic coupling hypothesis
15. Priestley – Plants restore oxygen in the air
16. Robert Brown – Discovered nucleus
17. Singer and Nicolson – Proposed fluid mosaic model of plasma membrane
18. Sutherland – cyclic AMP as second messenger
19. T. O. Diener – Discovered viroids
20. Thomas Addison – Father of endocrinology
21. Van Neil – Oxygen released during photosynthesis comes from water
22. W. M. Stanley – Crystallised TMV
23. Waldeyer – Coined the term chromosome
24. Whittaker – Five kingdoms of life
25. William Harvey – Discovered circulatory system

LIST OF ABBREVIATIONS TO BE STUDIED

1. 2,4-D – 2, 4-Dichlorophenoxy acetic acid
2. ABA – Abscisic Acid
3. ANF – Atrial Natriuretic Factor
4. CCK –Cholecystokinin
5. ECG – Electrocardiogram
6. ERV – Expiratory Reserve Volume
7. ETS – Electron Transport System
8. FAD – Flavin Adenine Dinucleotide
9. FRC – Functional Residual Capacity
10. GA – Gibberellic acid
11. GFR – Glomerular Filtration Rate
12. GIP – Gastric Inhibitory Peptide
13. IBA – Indole Butyric Acid
14. ICBN - International Code for Botanical Nomenclature
15. IRV – Inspiratory Reserve Volume
16. LHC – Light Harvesting Complex
17. NAA – Naphthalene Acetic Acid
18. NADPH – Nicotinamide Adenine Dinucleotide Phosphate (reduced)
19. OAA – Oxaloacetic Acid
20. PGA – Phosphoglyceric Acid
21. PGRs – Plant Growth Regulators
22. PPLO – Pleuro Pneumonia Like Organism
23. PZ – Pancreozymin
24. RQ – Respiratory Quotient
25. RUBISCO – Ribulose Bisphosphate Carboxylase Oxygenase
26. TMV – Tobacco Mosaic Virus

CLASS XII

There will be two papers in the subject:

Paper I: *Theory: 3 hours ... 70 marks*

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Paper II*: Practical: 3 hours ... 15 marks*

Project Work ... 10 marks

Practical File ... 5 marks

PAPER I- THEORY: 70 Marks

S. No.	UNIT	TOTAL WEIGHTAGE
1.	Reproduction	16 Marks
2.	Genetics and Evolution	15 Marks
3.	Biology and Human Welfare	14 Marks
4.	Biotechnology and its Applications	10 Marks
5.	Ecology and Environment	15 Marks
TOTAL		**70 Marks**

PAPER I –THEORY – 70 Marks

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

1. Reproduction

(i) Sexual reproduction in flowering plants

Flower structure; development of male and female gametophytes; pollination - types, agencies and examples; outbreeding devices; pollen-pistil interaction; artificial hybridisation, double fertilization; post fertilization events - development of endosperm and embryo, development of seed and formation of fruit; special modes - apomixis, parthenocarpy, polyembryony; Significance of seed dispersal and fruit formation.

Pre-fertilisation structures and events.

Structure of microsporangium, T.S. of anther microsporogenesis, structure and development of pollen grain, viability of pollen grain, economic importance of pollen grain. Pistil – structure of megasporangium (L.S. of anatropous ovule), megasporogenesis, structure and development of female gametophyte.

Types of pollination (autogamy, chasmogamy, cleistogamy, geitonogamy, xenogamy), adaptations in flowers pollinated by wind, water and insects. Advantages of self and cross-pollination. Contrivances for prevention of self-pollination. Pollen-pistil interaction in terms of incompatibility/compatibility, events leading to fertilisation, artificial hybridisation: procedure (emasculation and bagging), and its significance in plant breeding); definition of triple fusion and double fertilization, significance of double fertilisation, changes in the ovary and ovule for seed and fruit formation; apomixis, polyembryony, parthenocarpy to be explained briefly. Fruits to be classified into true and false, structure (L.S) of a typical fruit (mango and coconut); Internal structure of dicot (bean) and monocot (maize) seeds; definition, differences and examples of albuminous and non-albuminous seeds. Significance of seed and fruit formation. Significance of dispersal of seeds.

Post-fertilisation events - embryo formation (monocot and dicot); types of endosperm (cellular, nuclear and helobial); definition of perisperm.

(ii) Human Reproduction

Male and female reproductive systems; microscopic anatomy of testis and ovary; gametogenesis - spermatogenesis and oogenesis; menstrual cycle; fertilisation, embryo development upto blastocyst formation, implantation; pregnancy and placenta formation (elementary idea); parturition (elementary idea); lactation (elementary idea).

Organs of male and female reproductive system and their functions; internal structure of testis and ovary to be taught with the help of diagrams; gametogenesis-spermatogenesis (including spermiogenesis and spermiation) oogenesis; hormonal control of gametogenesis, structure of sperm and mature ovum, menstrual cycle - different phases and hormone action, differences between oestrous and menstrual cycle, menarche and menopause, physico-chemical events during fertilisation, implantation, embryonic development up to blastocyst formation, important features of human embryonic development (formation of heart, limbs, digits, appearance of hair on head, eyelashes, separation of eye lids, external genital organs and first movement of foetus with reference to time period) placenta and its functions (structure and the types of placenta not required). Parturition; lactation – hormonal control and importance.

(iii) Reproductive Health

Need for reproductive health and prevention of Sexually Transmitted Diseases (STDs); birth control - need and methods, contraception and medical termination of pregnancy (MTP); amniocentesis; infertility and assisted reproductive technologies (elementary idea for general awareness).

Definition of reproductive health, programs of reproductive health (family planning, RCH),

population explosion - role of government in controlling the population, contraceptives methods and their methods of action (natural- periodic abstinence, withdrawal or coitus interruptus, lactational amenorrhea; artificial – barriers, IUDs, oral pills, spermicidal agents, implants and surgical methods, definition of medical termination of pregnancy (MTP) and reasons for it; causes of infertility. Amniocentesis and its role in detecting genetic defects. Assisted reproductive technologies: IVF, IUT, ZIFT, ICSI, GIFT, AI, IUI. - definition and application only. Causes, symptoms and methods of prevention of sexually transmitted diseases (genital warts, genital herpes, hepatitis- B, AIDS gonorrhoea, syphilis, chlamydiasis, trichomoniasis).

2. Genetics and Evolution

(i) Principles of inheritance and variation

Heredity and variation: Mendelian inheritance; deviations from Mendelism - incomplete dominance, co-dominance, multiple alleles and inheritance of blood groups, pleiotropy; elementary idea of polygenic inheritance; chromosomal theory of inheritance; sex determination; linkage and crossing over; mutation; sex linked inheritance; Mendelian disorders in humans; chromosomal disorders in humans.

Explanation of the terms heredity and variation; Mendel's Principles of inheritance; reasons for Mendel's success; Biological importance of Mendelism; definition of 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 using Punnett square. Incomplete dominance with examples from plants (snapdragon - Antirrhinum). Co-dominance and multiple allelism – (pattern of inheritance of ABO blood group in humans), polygenic inheritance with an example of inheritance of skin colour in humans (students should be taught examples from human genetics through pedigree charts. They should be able to create a pedigree chart and interpret the patterns of inheritance by analysis of pedigree chart). Pleiotropy with reference to the example of Phenylketonuria (PKU) in human beings and starch synthesis in pea seeds. Chromosomal theory of inheritance; sex determination in humans, birds, honey bees and grasshopper, sex-linked inheritance - with reference to Drosophila (colour of body-yellow and brown; and colour of eyes-red and white), and man (haemophilia and colour blindness), definition and significance of linkage and crossing over. Mutation: spontaneous, induced, gene (point – transition, transversion and frame-shift); human genetic disorders: phenylketonuria, thalassaemia, colour blindness, sickle cell anaemia; chromosomal disorders: Down's syndrome, Klinefelter's syndrome, Turner's syndrome.

(ii) Molecular basis of Inheritance

Search for genetic material; structure of DNA and RNA; DNA packaging; DNA replication; central dogma; transcription, genetic code, translation; regulation of gene expression - lac operon; human genome project; DNA fingerprinting.

Structure of eukaryotic chromosomes with reference to nucleosome; properties of ideal genetic material such as ability to replicate, chemical stability, mutability and inheritability. Search for DNA as genetic material - Griffith's experiment, Hershey and Chase's experiment, Avery, McLeod and McCarty's experiment; double helical model of DNA (contributions of Miescher, Watson and Crick, Wilkins, Franklin and Chargaff); Differences between DNA and RNA; types of RNA (tRNA, mRNA and rRNA, snRNA, hnRNA); central dogma; reverse transcription (basic idea only), replication of DNA (role of enzymes, namely DNA polymerase and ligase), Meselson and Stahl's experiment, and Taylor's experiment. transcription, post-transcriptional processing in eukaryotes (splicing, capping and tailing). Intron, exon, cistron, recon, muton, monocistronic and polycistronic transcription unit (definitions only). Discovery and essential features of genetic code. Definition of codon. Protein synthesis - translation

in prokaryotes. Gene expression; lac operon in E. coli.

Human Genome Project: goal; methodologies [Expressed Sequence Tags (EST), Sequence Annotation], salient features and applications. DNA finger printing – technique, application and ethical issues to be discussed briefly.

(iii) Evolution

Origin of life; biological evolution and evidences for biological evolution (palaeontology, comparative anatomy, embryology and molecular evidences); Darwin's contribution, modern synthetic theory of evolution; mechanism of evolution - variation and natural selection with examples, types of natural selection; gene flow and genetic drift; Hardy - Weinberg's principle; adaptive radiation; human evolution.

Origin of life - abiogenesis and biogenesis, effect of oxygen on origin of life to show that reducing atmosphere is essential for abiotic synthesis. Important views on the origin of life (panspermia, spontaneous generation), modern concept of origin of life, Oparin Haldane theory (definition of protobionts, coacervates); Miller and Urey experiment. Evidences of evolution: morphological evidences, definition and differences between homologous and analogous organs (two examples each from plants and animals), convergent evolution and divergent evolution, vestigial organs; Embryological evidences – theory of recapitulation, definition and differences between ontogeny and phylogeny. Palaeontological evidence – definition of fossils and radioactive carbon-dating. Geological time scale (with reference to dominant flora and fauna) Biogeographical evidence – definition of biogeography, molecular (genetic) evidences -for example genome similarity, universal genetic code; Darwin's finches and marsupials (adaptive radiation).

Darwinism: salient features of Darwinism, contribution of Malthus. Examples of natural selection – Long neck of giraffe, industrial melanism, resistance of mosquitoes to DDT and resistance of bacteria to antibiotics, Lederberg's replica plating experiment, criticism of Darwinism. Neo-Darwinism (Modern Synthetic Theory); gene migration or gene flow, genetic drift (Founder's effect, bottle-neck effect), mutation, genetic recombination and natural selection, Hugo de Vries theory of mutation - role of mutation in evolution; Hardy Weinberg's principle, factors affecting Hardy Weinberg equilibrium (numericals on Hardy Weinberg equilibrium), Variation - causes of variation (mutation and recombination), types of natural selection (directional, disruptive and stabilizing). Evolution of man - three features (for example cranial capacity, height, posture, dentition, social behaviour, etc.) of each of the ancestors Dryopithecus, Ramapithecus, Australopithecus, Homo habilis, Homo erectus, Homo neanderthalensis, Cro-magnon man leading to man of today (Homo sapiens sapiens).

3. Biology and Human Welfare

(i) Human Health and Diseases

Pathogens; parasites causing human diseases (viruses, bacteria, protozoans, helminths, and fungi);Basic concepts of immunology - vaccines; cancer, HIV and AIDS; Adolescence - drug and alcohol abuse.

Communicable diseases; modes of transmission, causative agents, symptoms and prevention; viral diseases (common cold, chikungunya and dengue), bacterial diseases (typhoid- diagnosed by Widal test, pneumonia, diphtheria and plague), protozoal diseases (amoebiasis, and malaria, graphic outline of life cycle of Plasmodium), helmintic diseases (ascariasis, and filariasis); fungal (ringworms); cancer - types of tumour (benign, malignant), causes, diagnosis and treatment (surgery, immunotherapy, and radiotherapy), characteristics of cancer cells (loss of contact inhibition and metastasis); allergies and allergens – definition and general symptoms of allergies.

Immunity (definition and types – innate immunity - role of physical barriers,

physiological barriers, cellular barriers, and cytokine barriers; and acquired, active and passive, humoral and cell-mediated), Interferons – definition, source and function; structure of a typical antibody molecule, types of antibodies - IgG, IgA, IgM, IgD and IgE (function and occurrence, e,g. in serum, saliva, colostrum); vaccination and immunisation; autoimmunity, primary and secondary lymphoid organs and tissues, brief idea of AIDS – causative agent (HIV), modes of transmission, diagnosis (ELISA), symptoms, replication of retrovirus in the infected human cell (including diagram) and prevention.

Alcoholism and smoking - effects on health.

Drugs: effects and sources of opioids, cannabinoids, cocaine and barbiturates.

Reasons for addiction; prevention and control of alcohol and drug abuse.

(ii) Microbes in Human Welfare

In household food processing, industrial production, sewage treatment, energy generation and microbes as biocontrol agents and biofertilisers. Antibiotics.

Use of microbes in: (i) Household products: Lactobacillus (curd), Saccharomyces (bread), Propionibacterium (Swiss cheese); (ii) Industrial products: beverages (with and without distillation), antibiotics (Penicillin – discovery and use); sources (microbes) and uses of organic acids, alcohols and enzymes (lipase, pectinase, protease, streptokinase) in industry, sources (microbes) and applications of Cyclosporin-A, Statins. (iii) Sewage treatment – primary and secondary treatment; (iv) Production of biogas (methanogens, biogas plant, composition of biogas and process of production); (v)Biocontrol agents (ladybird, dragonfly, Bacillus thuringiensis Trichoderma, Nucleopolyhedrovirus (Baculovirus), and (vi) Microbes as biofertilisers (Rhizobium, Azospirillum, Azotobacter, Glomus, Mycorrhiza, Cyanobacteria), IPM, harmful effects of chemical pesticides.

4. Biotechnology and its Applications

(i) Biotechnology - Principles and processes

Genetic Engineering (recombinant DNA technology).

Definition and principles of biotechnology; isolation of genomic (chromosomal) DNA (from bacteria/plant cell/animal cell, by cell lysis), isolation of gene of interest (by electrophoresis), steps of formation of recombinant DNA, discovery, nomenclature, features and role of restriction enzymes (EcoRI, HindII) and role of ligase; cloning vectors (features of a good cloning vector, examples of cloning vectors like pBR322, Agrobacterium, retroviruses, bacterial artificial chromosome (BAC), yeast artificial chromosome (YAC)), methods of transfer of rDNA into a competent host, e.g. by direct-method (temperature shock), microinjection, gene gun, methods of selection of recombinants (antibiotic resistance, insertional inactivation/blue-white selection), cloning of recombinants, i.e., gene amplification (by in vivo or in vitro method - using PCR technique), bioreactor (basic features and uses of stirred tank and sparged tank bioreactors), downstream processing.

(ii) Biotechnology and its applications

Applications of biotechnology in health and agriculture: human insulin and vaccine production, stem cell technology, gene therapy; genetically modified organisms - Bt crops; transgenic animals; biosafety issues, biopiracy and biopatents.

In agriculture: Micropropagation and somatic hybridisation techniques for production of GM crops tolerant to abiotic stresses (cold, drought, salt, heat); pest-resistant crops (Bt-crops, RNAi with reference to Meloidogyne incognita); crops with enhanced nutritional value (golden rice).

In medicine: insulin, vaccine production, definition of stem cells and application of stem cell technology; gene therapy - with reference to treatment of SCID, molecular diagnosis by PCR, ELISA (the details of the technique of ELISA are not required), and use of DNA/RNA probes.

Transgenic animals for bioactive products like alpha-1-antitrypsin for emphysema, alpha-lactalbumin; vaccine safety testing, chemical safety testing; study of diseases.

Role of GEAC, definition and two examples of biopiracy (for example Basmati rice and turmeric), biopatent; ethical issues.

5. Ecology and Environment

(i) Organisms and Populations

Population; population interactions - population attributes - growth, birth rate and death rate, age distribution.

Definition of population; population attributes: sex ratio, types of age distribution pyramids for human population; definition of population density, natality, mortality, emigration, immigration, carrying capacity. Ways to measure population density. Calculation of natality and mortality.

Population growth: factors affecting population growth and population growth models: exponential growth and logistic growth models along with equations, graph and examples of the same; life history variations: definition of reproductive fitness and examples.

Population interactions – definition of mutualism, competition (interspecific, interference, competitive release and Gause's Principle of Competitive Exclusion), predation (adaptations in organisms to avoid predation), parasitism (ecto-, endo-, and brood parasites), commensalism, amensalism.

(ii) Ecosystem

Ecosystems: patterns, components; productivity and decomposition; energy flow; pyramids of number, biomass, energy.

Definition and types of ecosystems; structure of ecosystem (brief idea about biotic and abiotic components).

Structure and function of pond ecosystem; ecosystem functions: (i) Productivity – gross primary productivity (GPP), net primary productivity (NPP) and secondary productivity (ii) Decomposition (fragmentation, leaching, catabolism, humification and mineralization), factors affecting rate of decomposition (iii) Energy flow. Various types of food chains – grazing and detritus, food webs, trophic levels, ecological pyramids – energy, number and biomass.

Definition of PAR, 10% Law, standing crop and standing state.

(iii) Biodiversity and its Conservation

Concept of biodiversity; patterns of biodiversity; importance of biodiversity; loss of biodiversity; biodiversity conservation; hotspots, endangered organisms, extinction, Red Data Book, biosphere reserves, national parks, sanctuaries and Ramsar sites

Definition of biodiversity, few examples of each type of biodiversity - species, ecosystem and genetic. Global biodiversity and proportionate number of species of major taxa of plants, invertebrates and vertebrates; patterns of biodiversity (latitudinal gradients, species-area relationship – graph and equation), "rivet popper hypothesis", importance of species diversity to the ecosystem (narrowly utilitarian, broadly utilitarian, ethical terms).

Examples of some recently extinct organisms (dodo, quagga, Steller's Sea cow, thylacine and the three sub-species of tiger – Bali, Caspian and Javan), causes of loss of biodiversity (habitat loss and fragmentation, over-exploitation, alien species invasion, co-extinction).

Biodiversity conservation: In-situ methods - protected areas: biosphere reserves, national parks, wildlife sanctuaries, sacred groves; ex-situ methods - captive breeding, zoo, botanical gardens, cryopreservation, wild life safari, seed banks, tissue culture. Definitions and examples of each of the above. Hotspots, Ramsar sites and Red Data Book.

The place, year and main agenda of historic conventions on biological diversity (the Earth Summit and the World Summit).

Note: Topics having numerical problems to be taught with illustrative examples.

PAPER II
PRACTICAL WORK – 15 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) Leguminosae: subfamily – Papilionaceae – type – Sweet pea/ Pea/ Bean/ *Sesbania*/ *Clitoria* (single flower).

(iii) Solanaceae: type – *Petunia* / *Datura* / Brinjal Flower / *Solanum nigrum*.

(iv) Liliaceae: type – Onion or Amaryllidaceae – type – Lily/Spider lily/ Tiger lily/ Tube rose/ *Gladiolus*.

(v) Cruciferae: type – mustard, candytuft (*Iberis* sp)

(vi) Compositae (Asteraceae): type sunflower, *Chrysanthemum*, *Cosmos*, *Dahlia*, Marigold.

(vii) Gramineae (Poaceae): type – wheat, corn, rice

Floral characteristics should be explained by dissection of flowers. Students should be taught how to cut vertical section of the flower and draw accurately labelled diagrams. The technique of drawing floral diagrams with the ***mother axis in the right position is necessary.*** *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 know 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.

NOTE: In the examination, candidates will be tested on <u>any one</u> of the above families.

(2) Simple biochemical and physiological experiments

(i) Study of arrangement/distribution of stomata in dicot and monocot leaves.

(ii) Study of soils from ***two different sites***.

Collect soil samples from two different areas and make a comparative study of their texture, moisture content, humus content, water holding capacity and pH.

Guidelines for collection of soil samples:

- *Texture - loamy, sandy and clayey soil.*
- *Moisture content – Soil samples are to be collected from a dry place and a wet place. Alternatively, samples of soil can be dried to different degrees in oven/by keeping in sun.*
- *Humus Content – Collect one sample from roadside/barren land and one sample from garden/cultivated field.*
- *Water holding capacity – Pour given amount of water in known weight of soil sample and record the volume of water retained by the soil sample.*
- *pH – Add distilled water to the soil sample and test with pH paper.*

Students should be taught to set up and demonstrate the experiments with correct diagram of the setup, record their observations methodically and give conclusions. This will give a clear idea of the physiological processes. Questions can be asked based on the above physiological processes studied.

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

Effect of enzyme (amylase/ diastase) action at three different temperatures (low- below 10°C, optimum - 37°C and high – above 70°C) and pH (acidic, neutral and basic) on starch solution.

(iv) To isolate DNA from available plant material.

Isolation of DNA from spinach leaves, green pea seeds, pulp of banana and papaya.

Take half a ripe and peeled banana into a beaker and add 50 ml of extraction fluid (1.5gm table salt +10 ml liquid detergent +90 ml distilled water). Place the beaker in a water bath set at 60 °C for 15 minutes. Stir gently with a glass rod. Filter 5ml of cooled content into a clean test tube and add 5ml of cold 90%

ethanol. DNA molecules separate out and appear as white fibres.

(3) Slide preparation

(i) Germination of pollen grain in a nutrient medium.

(ii) T.S. of ovary of any locally available flower, to show marginal / axile placentation.

(iii) T.S. of a hydrophyte stem.

(iv) T.S. of a xerophytic leaf (*Nerium).*

(v) L.S. of monocot and dicot seed (soaked seeds of maize/wheat, pea/ bean.)

The technique of staining and mounting neatly should be explained. Students should also know how to make labelled outline diagrams. They should also be taught to identify the mount under low/ high power of microscope. ***Two*** *identifying features of the above need to be mentioned.*

(4) Spotting: (three minutes to be given for each spot which includes identification, drawing a labelled diagram and writing at least two identifying characteristics).

NOTE: 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 the following:

(a) T.S. of ovary of mammal (chart/slide).

(b) T.S. of testis of mammal (chart/slide).

(c) Germinating pollen grain (slide/chart).

(d) T.S. of ovary to show the type of placentation (marginal, axile, basal (LS), parietal).

(e) T.S. of blastula / blastocyst of a mammal (chart/ slide).

(f) Whole mount of *Plasmodium* sporozoite (slide /chart).

(g) Whole mount of *Entamoeba histolytica* trophozoite (slide/chart).

(h) Preserved specimen/ chart/ model of *Ascaris.*

(ii) Comment upon ecological adaptations of plants and animals.

Models/ virtual images/ charts of one plant and one animal found in xeric and aquatic habitats. Examples: Hydrilla, cactus, fish and camel.

(iii) Flowers adapted to pollination by different agencies – insect, water 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. Example: Hibiscus and grass.*

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. 'T.S.', 'model', 'whole mount', 'chart', 'image' of the specimen should be mentioned as a part of identification.

PROJECT WORK AND PRACTICAL FILE – 15 Marks

Project Work – 10 Marks

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

The candidate is to creatively execute **one** project/assignment on an aspect of biology. Preference is to be given to handwritten original investigatory projects, no plagiarism allowed. Candidates are required to submit a **hard copy** of their computer-generated projects duly signed by the Internal Examiner (and the Head of the Institution) for physical verification and assessment. 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) Genetic disorders
(ii) Gene therapy
(iii) Human Genome Project
(iv) DNA fingerprinting
(v) Bio-piracy
(vi) Cancer.
(vii) AIDS/Hepatitis.
(viii) Drug addiction and community.
(ix) Role of micro-organisms in industry.
(x) Human population.
(xi) Mendelian Inheritance
(xii) Environmental resistance.

(xiii) 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.

(xiv) Role of agrochemicals in increasing food production.

Suggested Evaluation Criteria for Project Work:

Format of the Project:

– Content
– Introduction
– Presentation (graphs, tables, charts, newspaper cuttings, diagrams, photographs, statistical analysis if relevant)
– Conclusion/ Summary
– Bibliography

Practical File – 5 Marks

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

The practical file should cover all the practical exercises outlined in the syllabus. Each practical done during the year, needs to be recorded date wise by the student in the Practical file and the same must be checked, signed and dated by the teacher.

SCIENTISTS AND THEIR CONTRIBUTIONS:

1. Oparin: Coacervates, Conditions on primitive earth were favourable for chemical evolution
2. Stanley Miller & Harold Urey: Conducted experiment to validate Oparin's theory.
3. Ernst Haeckel: Proposed the recapitulation theory
4. Charles Darwin: Natural Selection
5. Hugo de Vries: Mutation
6. T. R. Malthus: Theory of Human Population Growth/ Essays on population
7. Alec Jeffreys: DNA finger printing
8. Temin and Baltimore: Reverse transcription.
9. Jacob, Monod and Lwoff: proposed Lac operon.
10. Watson and Crick: Structure of DNA
11. Nirenberg and Khorana: Genetic code
12. Benzer: Cistron, recon, muton
13. Gregor Mendel: Father of genetics
14. Sutton and Boveri: Chromosomal theory of inheritance
15. Hugo de Vries, Correns and Tschermack: Rediscovered Mendelism
16. T H Morgan: Linkage
17. P Maheshwari: Plant tissue culture
18. Henking: Discovered X-chromosome
19. F. Miescher: Isolated nucleic acid from pus cells, called Nuclein
20. Chargaff: Rule of equivalence in DNA structure
21. F. Griffith: Transformation in bacteria
22. Avery, MacLeod and McCarty: DNA is the genetic material
23. Hershey and Chase: DNA is the genetic material
24. Meselson and Stahl: Semi-conservative replication of DNA
25. G. Gamow: Triplet nature of codons
26. S Ochoa: Discovered polynucleotide phosphorylase
27. Wallace: Divided the Earth into biogeographical regions
28. M S Swaminathan: Green revolution in India
29. H Boyer: Discovered Restriction Enzyme
30. S Cohen: Developed the method to transfer plasmid DNA in host cells
31. R. Mishra: Father of Indian Ecology
32. E. Wilson: Coined the term Biodiversity
33. P Ehrlich: Rivet Popper Hypothesis
34. Sanger: DNA/Protein sequencing
35. Ernest Chain and Howard Florey – Use of Penicillin as a lifesaving antibiotic

LIST OF ABBREVIATIONS TO BE STUDIED

1. ADA- Adenosine Deaminase
2. CMI- Cell Mediated Immunity
3. DFC- Detritus Food Chain
4. EFB- European Federation of Biotechnology

5. EST- Expressed Sequence Tags
6. ET- Embryo Transfer
7. GFC- Grazing Food Chain
8. GMO- Genetically Modified Organism
9. GPP- Gross Primary Productivity
10. hnRNA - Heterogeneous Nuclear Ribo Nucleic Acid
11. IARI- Indian Agricultural Research Institute
12. IMR- Infant Mortality Rate
13. IRRI- International Rice Research Institute
14. ICSI - Intra Cytoplasmic Sperm Injection
15. IUCD/IUD – Intra uterine contraceptive device
16. IUCN- International Union for Conservation of Nature and Natural Resources
17. IUI- Intra Uterine Insemination
18. IUT- Intra Uterine Transfer
19. KVIC- Khadi and Village Industries Commission
20. LAB- Lactic Acid Bacteria
21. MALT- Mucosa Associated Lymphoid Tissue
22. MMR- Maternal Mortality Rate
23. NACO- National AIDS Control Organisation
24. NPP- Net Primary Productivity
25. PID- Pelvic Inflammatory Diseases
26. PKU- Phenyl ketonuria
27. RCH- Reproductive and Child Health Care Programmes
28. SCID – Severe Combined Immuno Deficiency
29. SNPs - Single Nucleotide Polymorphisms
30. snRNA- Small Nuclear Ribo Nucleic Acid
31. sRNA - Soluble Ribo Nucleic Acid
32. SSBP – Single Strand Binding Protein
33. UTR - Untranslated Region
34. VNTRs - Variable Number of Tandem Repeats