Latest Syllabus

BIOLOGY (863)
CLASS 12

*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 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) Reproduction in Organisms

Reproduction, a characteristic feature of all organisms for continuation of species; modes of reproduction - asexual and sexual reproduction; asexual reproduction - binary fission, sporulation, budding, gemmule formation, fragmentation; vegetative propagation in plants.

Definition of life span; life span of a few organisms (banana, rice, rose, banyan, butterfly, fruit fly, tortoise, crocodile, parrot, crow, elephant, dog, horse, and cow).

Asexual reproduction – definition, types (binary fission in Amoeba and Paramoecium, budding in yeast and Hydra, conidia in Penicillium, zoospores in Chlamydomonas, gemmules in sponges), definition of clone.

Vegetative propagation – definition, vegetative propagules (tuber of potato, rhizome of ginger, bulbil of Agave, leaf buds of Bryophyllum, offset of water hyacinth, runner of grass, sucker of pineapple, bulb of onion).

Sexual reproduction: Plants – definition, phases of life cycle (juvenile/vegetative, reproductive and senescence), unusual flowering phenomenon (bamboo and Strobilanthes kunthiana). Animals – continuous and seasonal breeders (definition, differences and examples).

Events in sexual reproduction – pre-fertilisation (gametogenesis and gamete transfer in plants and animals), chromosome number in the cells of house fly, fruit fly, butterfly, human beings, rat, dog, maize, apple, onion, cat, rice, Ophioglossum; fertilization (definition, types - external and internal), post-fertilisation (embryogenesis), definition and example of parthenogenesis, differences between asexual and sexual reproduction.

(ii) Sexual reproduction in flowering plants

Flower structure; development of male and female gametophytes; pollination - types, agencies and examples; outbreeding devices; pollen-pistil interaction; 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, definition of triple fusion and double fertilization, changes in the ovary and ovule for seed and fruit formation. Significance of double fertilization.

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.

(iii) 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. Parturition; lactation – hormonal control and importance.

(iv) 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 - IVF, ZIFT, GIFT (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, 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 (gonorrhoea, syphilis, genital herpes, chlamydiasis, genital warts, trichomoniasis, hepatitis- B, AIDS).

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; chromosomes and genes; sex determination - in humans, fruit fly, birds and honey bee; linkage and crossing over; mutation; sex linked inheritance - haemophilia, colour blindness; 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; 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) and co-dominance in human blood group, multiple alleles – e.g. blood groups, polygenic inheritance with one example of inheritance of skin colour in humans (students should be taught examples from human genetics through pedigree charts. They should be able to interpret the patterns of inheritance by analysis of pedigree chart). Biological importance of Mendelism. Pleiotropy with reference to the example of Phenylketonuria (PKU) in human beings and starch synthesis in pea seeds. Chromosomal theory of inheritance; autosomes and sex chromosomes (sex determination in humans, fruit fly, 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); chromosomal aberration: euploidy and aneuploidy; 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 and DNA as genetic material; structure of DNA and RNA; DNA

packaging; DNA replication; central dogma; transcription, genetic code, translation; gene expression and regulation - lac operon; human and rice genome projects; DNA fingerprinting.

Structure of eukaryotic chromosomes with reference to nucleosome; properties of genes 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 – concept only; reverse transcription (basic idea only), Meselson and Stahl's experiment, replication of DNA (role of enzymes, namely DNA polymerase and ligase), transcription, post-transcriptional processing in eukaryotes (splicing, capping and tailing). Intron, exon, cistron, (definitions only). Discovery and essential features of genetic code. Definition of codon. Protein synthesis - translation in prokaryotes. Gene expression in prokaryotes; 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. Rice Genome Project (salient features and applications).

(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 (mutation and recombination) 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 evolution to show that reducing atmosphere is essential for abiotic synthesis. Important views on the origin of life, modern concept of origin of life, Oparin Haldane theory, definition of protobionts, coacervates), vestigial organs; Miller and Urey experiment. Evidences of evolution: morphological evidences, definition and differences between homologous and analogous organs (two examples each from plants and animals). Embryological evidences – theory of recapitulation, definition and differences between ontogeny and phylogeny. Palaeontological evidence – definition of fossils. 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 (adaptive radiation).

Lamarckism: brief idea of Lamarck's theory, evidences in favour of Lamarckism such as evolution of long neck of giraffe to be discussed. Darwinism: salient features of Darwinism, contribution of Malthus, criticism of Darwinism. 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, Neo-Darwinism (Modern Synthetic Theory); Variation - causes of variation, Hugo de Vries theory of mutation - role of mutation in evolution; Hardy Weinberg's principle, factors affecting Hardy Weinberg equilibrium: gene migration or gene flow, genetic drift (Founder's effect, bottle-neck effect), mutation, genetic recombination and natural selection, types of natural selection (directional, disruptive and stabilizing). Evolution of man - three features of each of the ancestors Dryopithecus, Ramapithecus, Australopithecus, Homo habilis, Homo erectus, Homo neanderthalensis, Cro-magnon man and Homo sapiens leading to man of today.

3. Biology and Human Welfare

(i) Human Health and Diseases

Pathogens; parasites causing human diseases (common cold, dengue, chikungunya, typhoid, pneumonia, amoebiasis, malaria, filariasis, ascariasis, ring worm) and their control; Basic concepts of immunology - vaccines; cancer, HIV and AIDS; Adolescence - drug and alcohol abuse.

Communicable and non-communicable diseases; modes of transmission, causative agents, symptoms and prevention; viral diseases (common cold, chikungunya and dengue), bacterial diseases (typhoid, pneumonia, diphtheria and plague), protozoal diseases (amoebiasis, and malaria, graphic outline of life cycle of Plasmodium), helmintic diseases (ascariasis, and filariasis); fungal (ringworm); cancer - types of tumour (benign, malignant), causes, diagnosis and treatment, characteristics of cancer cells (loss of contact inhibition and metastasis).

Immunity (definition and types – innate 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, allergies and allergens – definition and general symptoms of allergies; 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) Strategies for enhancement in food production

Improvement in food production: green revolution, plant breeding, tissue culture, single cell protein, biofortification, apiculture and animal husbandry.

Measures for proper maintenance of dairy farms and poultry farms; apiculture and pisciculture – definition, brief idea and advantages of each.

Animal breeding - brief idea of inbreeding, out-breeding, cross-breeding and artificial insemination, Multiple Ovulation Embryo Transfer Technology (MOET). Advantages of artificial insemination.

Plant breeding – a brief reference to green revolution. Steps in plant breeding (germplasm collection, evaluation, selection, cross hybridisation or artificial hybridisation (concept of emasculation and bagging), selection and testing of superior recombinants, testing, release and commercialisation of new cultivars), advantages of mutation breeding, examples of some Indian hybrid crops like wheat, rice, maize, sugarcane, millet. Definition of heterosis and inbreeding depression.

Application of plant breeding for (i) disease resistance [examples of some disease- resistant varieties of crops for example wheat (Himgiri), Brassica (Pusa swarnim), cauliflower (Pusa shubhra, Pusa snowball K – 1), Cow pea (Pusa komal), chilli (Pusa sadabahar)],(ii) insect resistance [examples of some insect resistant varieties of crops – Brassica (Pusa Gaurav), flat bean (Pusa sem 2, Pusa sem 3), okra (Pusa sawani, Pusa A–4)], (iii) improved food quality (biofortification, e.g., wheat – Atlas 66, maize hybrids, iron fortified rice). Tissue culture (technique and application – micropropagation, somaclones, disease free plants and somatic hybridisation), single cell protein – source and significance.

(iii) 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, source (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) Microbes as biocontrol agents (ladybird, dragonfly, Bacillus thuringiensis Trichoderma, Nucleopolyhedrovirus (Baculovirus), and (vi) Microbes as biofertilisers (Rhizobium, Azospirillum, Azotobacter, 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: for production of 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, gene therapy - with reference to treatment of SCID, molecular diagnosis by PCR, ELISA and use of DNA/RNA probe.

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, biopatent; ethical issues.

5. Ecology and Environment

(i) Organisms and Populations

Organisms and environment: habitat and niche, population and ecological adaptations; population

interactions - mutualism, competition, predation, parasitism; population attributes - growth, birth rate and death rate, age distribution.

Definition of ecology; major biomes of India – Tropical rain forests, deciduous forests, deserts and sea coasts (their annual temperatures and precipitation). Definition of habitat and niche.

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 equation; growth models: exponential growth and logistic growth 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; nutrient cycles (carbon and phosphorous); ecological succession; ecological services - carbon fixation, pollination, seed dispersal, oxygen release (in brief).

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

Effects of abiotic factors (temperature, water, light, soil) on living organisms, definition of stenothermal, eurythermal, stenohaline and euryhaline), responses to abiotic factors (regulate, conform, migrate, suspend); ecological adaptations: morphological, physiological and behavioural in response to loss of water and extremes of temperature in plants and animals including humans. Allen's rule.

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 (iv) Nutrient cycle – definition of biogeochemical cycles – gaseous cycle (Carbon) and sedimentary cycle (Phosphorous).

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

Succession: definition to explain the meaning, kinds of succession (hydrarch, xerarch; primary and secondary succession with examples), definition of pioneer community, climax community and sere; significance of ecological succession.

Ecological services and their cost.

(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, 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).

(iv) Environmental Issues

Air pollution and its control; water pollution and its control; agrochemicals and their effects; solid waste management; radioactive waste management; greenhouse effect and climate change; ozone layer depletion; deforestation; any one case study as success story addressing environmental issue(s).

Definition of pollution and pollutant; environmental issues: air pollution and its control, major sources of gaseous and particulate pollutants, control devices for air pollution such as: scrubbers and electrostatic precipitators, catalytic converter, CNG, Bharat stages, noise pollution: harmful effects and control; Water pollution, major sources and its control, composition of waste water, thermal pollution, eutrophication - cultural or accelerated, BOD, effect of sewage discharge on BOD and dissolved oxygen content in river; case studies of waste water treatment (FOAM and EcoSan); Soil

pollution – sources, effects and control, agrochemicals and their harmful effects, integrated organic farming, contribution of Ramesh Chandra Dagar, biomagnification and bioconcentration; solid waste management, Radioactive waste management, e-waste.

A brief understanding of the concept of deforestation (slash and burn agriculture or jhum cultivation's contribution), greenhouse effect. Impact of global warming in terms of climatic changes, rise in sea levels, melting of ice caps, El Nino effect; impact on animals and plants due to climate changes. Ozone depletion – causes, ozone hole, Dobson unit, effects on plants and animals, methods to control ozone depletion, Montreal protocol. The following case studies as success stories addressing environmental issues: Chipko Movement, Joint Forest Management, contribution of Ahmed Khan of Bangalore.

Main provisions of Environmental Acts — Environmental Protection Act, Water (prevention and control of pollution), Air (prevention and control of pollution act).

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 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 10oC, optimum - 37oC and high – above 70oC) 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: <u>Spotting must be done on a separate answer sheet during examination, which should be handed over to the Examiner immediately after spotting.</u>

   (i) Identify and comment on the following:
   - (a) T.S. of ovary of mammal (Permanent slide).
   - (b) T.S. of testis of mammal (Permanent 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 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 investigatory projects. 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:

<u>Format of the Project:</u>

– 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.

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.

SCIENTISTS AND THEIR CONTRIBUTIONS:

1. Oparin: Coacervates, Conditions on primitive earth were favourable for chemical evolution
2. Stanley Miller & Harold Urey: Recreated probable conditions on primitive earth
3. Ernst Haeckel: Proposed the recapitulation theory
4. Charles Darwin: Natural Selection
5. Lamarck: Inheritance of acquired characters
6. Hugo de Vries: Mutation
7. T. R. Malthus: Theory of Human Population Growth/ Essays on population

Syllabus

8. Alec Jeffrey: DNA finger printing
9. Temin and Baltimore: Reverse transcription.
10. Jacob, Monad and Lwoff: proposed Lac operon.
11. Watson and Crick: Structure of DNA
12. Nirenberg and Khorana: Genetic code
13. Benzer: Cistron, recon, muton
14. Gregor Mendel: Father of genetics
15. Sutton and Boveri: Chromosomal theory of inheritance
16. Hugo de Vries, Correns and Tschermack: Rediscovered Mendelism
17. T H Morgan: Linkage
18. P Maheshwari: Plant tissue culture
19. Henking: Discovered X-chromosome
20. F. Meischer: Isolated nucleic acid from pus cells, called Nuclein
21. Chargaff: Rule of equivalence in DNA structure
22. F. Griffith: Transformation in bacteria
23. Avery, MacLeod and McCarty: DNA is the genetic material
24. Hershey and Chase: DNA is the genetic material
25. Meselson and Stahl: Semi-conservative replication of DNA
26. G. Gamow: Triplet nature of codons
27. S Ochoa: discovered polynucleotide phosphorylase
28. Wallace: divided the Earth into biogeographical regions
29. M S Swaminathan: Green revolution in India
30. H Boyer: discovered Restriction Enzyme
31. S Cohen: method to transfer plasmid DNA in host cells
32. R. Mishra: Father of Indian Ecology
33. E. Wilson: coined the term Biodiversity
34. P Ehrlich: Rivet Popper Hypothesis
35. Sanger: DNA/Protein sequencing

LIST OF ABBREVIATIONS TO BE STUDIED

1. ADA- Adenosine Deaminase
2. CMI- Cell Mediated Immunity
3. CNG- Compressed Natural Gas
4. CPCB- Central Pollution Control Board
5. DDT – Dichloro diphenyl trichloro ethane
6. DFC- Detritus Food Chain
7. EFB- European Federation of Biotechnology
8. EST- Expressed Sequence Tags
9. ET- Embryo Transfer
10. GFC- Grazing Food Chain
11. GMO- Genetically Modified Organism
12. GPP- Gross Primary Productivity
13. hnRNA - Heterogeneous Nuclear Ribo Nucleic Acid
14. IARI- Indian Agricultural Research Institute
15. IMR- Infant Mortality Rate
16. IRRI- International Rice Research Institute
17. ICSI - Intra Cytoplasmic Sperm Injection
18. IUCD/IUD – Intra uterine contraceptive device
19. IUCN- International Union for Conservation of Nature and Natural Resources
20. IUI- Intra Uterine Insemination
21. IUT- Intra Uterine Transfer
22. JFM- Joint Forest Management
23. LAB- Lactic Acid Bacteria
24. MALT- Mucosal Associated Lymphoid Tissue
25. MMR- Maternal Mortality Rate
26. MOET- Multiple Ovulation Embryo Transfer Technology
27. NACO- National AIDS Control Organisation
28. NPP- Net Primary Productivity
29. PID- Pelvic Inflammatory Diseases
30. PKU- Phenyl ketonuria
31. RCH- Reproductive and Child Health Care Programmes
32. SCID – Severe Combined Immuno Deficiency
33. SNPs - Single Nucleotide Polymorphisms
34. snRNA- Small Nuclear Ribo Nucleic Acid
35. sRNA - Soluble Ribo Nucleic Acid
36. SSBP – Single Strand Binding Protein
37. UTR - Untranslated Region
38. VNTRs - Variable Number of Tandem Repeat

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