



BIOLOGY

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SYLLABOUS

Class V

(A): The Circulatory System of Human Body

(B): The Skeletal System

(C): Food and Health

(D+E): Pollination Plant Reproduction

(F+G): Interdependence in Living Beings-Plants and Animals

(H): Cleanliness

(I): Hygiene

Class VI

(A) Plant Life: (The leaf), External structure, Kinds of leaves, Types of venation, Functions of leaf, Modifications, Insectivorous plants. Need for modification with an example, Vegetative propagation in leaf.

(B) The Flower: Parts, structure and function of each whorl; Pollination: An idea about agents of cross-pollination (wind, water and insects – their examples); Fertilization: process in simple terms; Formation of fruit – the fate of each part (whorl) of the flower after fertilization.

(C) Parts of fruits: dry and fleshy, examples of dry and fleshy parts; parts of the pericarp of fleshy fruits (pericarp, monocarp, endocarp) and function of each part; Seed – parts (cotyledon, embryo: Radicle, plumage) and types (monocot, dicot); Germination – conditions

required for germination (moisture, warmth), seed germination of different seeds.

(D) The Cell: Plant cell: Cell organelles and their functions; Animal cell: Cell organelles and their functions, Diagrams of plant and animal cell, Only the following are to be included: cell wall, cell membrane, plastids, nucleus, vacuole, and cytoplasm – their structure and functions; Differences between plant and animal cells.

(E) Human Body Digestive System: Organs of the digestive system; function of each organ, Process of digestion, particularly of carbohydrates, proteins and fats.

(F) Respiratory System: Main parts (nose, pharynx, larynx, trachea, bronchi, lungs); functions of each part of the respiratory system; Difference between respiration and breathing, Mechanism of breathing (physical process concerning diaphragm and ribs-inhalation and exhalation); Mention of common respiratory diseases: asthma, bronchitis, pneumonia, tuberculosis (T.B.).

(G) Circulatory System: Main parts of the circulatory system (blood, heart, blood vessels); Process of circulation in the body
Components of blood (plasma and blood cells – RBC, WBC, platelets with their functions only); Types of blood groups (A, B, AB, O): mention only; Blood pressure (concept only); heartbeat, pulse; Keeping the heart healthy through exercise and good food habits.

(H) Health and Hygiene: Types of diseases; Communicable diseases: bacterial, viral, and protozoal diseases caused by worms; Ways to prevent communicable diseases; Methods of safe disposal of garbage and healthy practices for hygiene; Modes of transmission of diseases.

(I) Habitat and adaptation: Habitat – definition; Adaptations of plants and animals to the following habitats, along with characteristics and examples; Aquatic habitat- floating, submerged and fixed plants; adaptations in fish; Desert – adaptations in cactus as desert plant and camel as a desert animal; Mountain – adaptations in trees like pine and fir; mountain goat; Air – adaptation for flight in birds and aerial plants.

Class: VII

(A) Tissues: Plant Tissues; Definition of tissue; Classification of plant tissues: Meristematic and permanent (simple and complex); Meristematic tissues: characteristics (any two), simple structure, location, function, examples; Simple permanent.

(B) Tissues: Parenchyma, collenchyma, sclerenchyma (simple structure, location and functions of each), examples; Complex permanent tissues: xylem, phloem- function only. (Elements of xylem and phloem not to be mentioned).

(C) Animal Tissues: Epithelial tissue: simple location, and function (types of epithelial tissue not to be mentioned); Connective tissue location and functions of bone, cartilage, blood, ligament, tendon.

Muscular tissue: location and one function of:

- striated (voluntary or skeletal muscle),
- untreated (involuntary/ smooth muscle),
- cardiac (specialized muscle).

Nerve tissue: parts of neuron (cell body, Dendron, axon).

(D) Kingdom Classification: Meaning and concept of classification

Need and advantages of Classification; Characteristics of each kingdom with suitable examples: (i) Moneta: bacteria – shape; useful bacteria, harmful bacteria (applications related to daily life to be discussed); (ii) Protista: Amoeba – basic structure and life processes (nutrition, locomotion, respiration, excretion and reproduction – by binary and multiple fission); (iii)Fungi: basic structure of mound, nutrition and respiration in mound, useful fungi, harmful fungi (applications related to daily life to be discussed); (iv)Plantae: Characteristics and examples (classification of plantae not to be discussed); (v) Animalia: (a)Vertebrates, (b)Invertebrates: 9 major Phyla, Peripheral, Cnidarian, Coelenterate, Platyhelminthes, nematode, Annelida, Arthropod, Mollusca, Echinodermata)

(E) Plant Life: Photosynthesis Definition, basic process, factors; affecting photosynthesis: (light, carbon dioxide, water, chlorophyll), significance of photosynthesis, setup; Experiment to demonstrate photosynthesis process; Respiration Basic process, word equation; respiration as a process which releases energy; respiration in plants: two types (aerobic and anaerobic: basic concept, word equations for both, examples); Respiration and photosynthesis in plants, difference in both processes.

(F) Human Body: Excretory System, Excretion: Definition; Organs and their excretory products (kidneys, sweat glands, lungs).

(G) Renal Excretory System: kidneys, ureter, urinary bladder, urethra (location and functions to be explained along with diagram); Role of kidneys infiltration of blood through millions of nephrons (details not required, structure of nephron not to be discussed); common disorders of the urinary system: Urinary Tract Infection, kidney stone.

(H) Nervous System: Main parts: brain, spinal cord, nerves.
Brain: cerebrum, cerebellum, medulla oblongata (location and function);
Spinal cord: location and function; Nerves: what are nerves; their general function.

(I) Health and Hygiene: Allergy, Concept of allergy; Allergens: Common allergens like dust, pollen grain, mites, strong sunlight, particular food items; Entry routes of allergens: mouth, nose, skin.
Symptoms of allergic reaction; Types of allergies: seasonal and perennial with examples.

Class VIII

(A) **Chapter 1:** Transport of Food and Minerals in Plants; Diffusion – its definition; Osmosis – its definition, examples, semi-permeable membrane; active transport; root pressure; Transpiration – its definition, importance and the factors affecting transpiration; Structure and the function of the Xylem and Phloem in detail; Importance of minerals: macro and micro-nutrients; three deficiency diseases caused by the lack of these essential nutrients.

(B) Reproduction in Plants: Sexual reproduction in the Plants: Binary fission, fragmentation, budding, spore formation, vegetative propagation, artificial propagation by the tissue culture (basic process along with the suitable example of each); Sexual reproduction in the Plants: Review of parts of a typical flower (its 4 whorls and their structure and functions) Pollination: self and cross; Agents of pollination: the three characteristics of plants pollinated by insects, wind and water (with examples). Characteristics of the flowers of each kind; Reproduction in Animals; Sexual reproduction in humans: Main organs of the male and female reproductive system.

(C) Ecosystems: Understanding ecosystems: definition, the interaction between biotic and abiotic factors; Biotic components consist of producers, consumers and decomposers. Meaning of food chain. Food web and pyramid of numbers; Interdependence between organisms: symbiosis, parasitism and predation; A brief account of the abiotic or non-living components such as air, water, soil and climatic factors such as sunlight, humidity temperature and wind; Only forest ecosystems with their flora and fauna are taught.

(D) Circulatory System:

- The internal structure of the heart in detail (including valves, septum, and pacemaker).
- Schematic diagram of the heart;
- Blood vessels – aorta, pulmonary trunk, coronary artery & vein, vena cava.
- Circulation of blood as double circulation.
- Blood Groups (A, B, AB and O): universal donor and universal acceptor.
- Conditions related to the functioning of the heart: palpitations, cardiac arrest and hypertension.

(E) Nervous System: Types of nerves: sensory, motor, mixed (function only). Cranial and spinal nerves (only definition and number); Structure of a motor neuron; Central nervous system (CNS) in detail with its parts and their functions; Reflex action: definition and basic terms used to describe reflex action stimulus, response, impulse, receptor, effector); common examples of reflex action.

(F) Disease and First-aid Diseases: A brief idea of communicable diseases (influenza, measles, malaria, dengue, chikungunya, HIV) – causative agents, symptoms, and prevention to be dealt with in a tabular form; The meaning of vectors; Method of preventing diseases in general; use of vaccines to be mentioned.

Vaccination and immunization: the concepts and differences between the two; Harmful effects of consuming tobacco, drinking alcohol and taking drugs; First Aid: First aid- meaning, first aid is given in the following cases burns, bleeding, fracture, object in the eye, unconsciousness, swallowing poison, snake bite, and stings.

(G) Crop Production and Management: Agricultural practices, Preparation of soil; Sowing; Adding manures and fertilizers, Irrigation, Protection from weed, Harvesting and shortage, Food from animals.

(H) **Chapter** - Endocrine System: Two types of glands- exocrine and endocrine (the basic concept and difference); Hormone (its definition); Hormonal glands – (thyroid, pancreas, adrenal, pituitary); location and function of each. Adolescence and the accompanying changes.

(I) Microorganisms: Friends and Foe; Microorganisms; Microorganism and us: Friendly microorganisms; Disease causing microorganisms; Food preservation; Nitrogen fixation; Nitrogen Cycle.

Class IX

[A] (i) A brief outline of the five kingdom classification. (ii) Economic importance of Bacteria. (iii) Economic importance of Fungi.

[B] (i) Organic molecule and their features. (ii) The cell unit of life - Protoplasm, structure and function of different cell organelles. Difference between Prokaryotic and Eukaryotic cells. Difference of Plant and Animal cell. (iii) Tissues: Types of Plant and Animal tissues.

[C] Plants: (i) Flower: Structure of bisexual flower. Functions of various parts. Pollination- self and cross pollination. (ii) Fertilization (iii) Seeds - structure of dicot and monocot seeds. Germinations tubes. Condition for seed germination (iv) Transpiration - Aerobic and anaerobic respiration.

[D] (i) Physiological process of life: - Nutrition (class of food, balance diet. Digestive system. Digestive gland. Different enzymatic function, absorption, assimilation) (ii) Photosynthesis (light and dark phase. Significance) (iii) Respiration in animal - Respiratory system. Organs, mechanism of breathing, tissue respiration, heat production

[E] Circulation (Blood, Blood vessels, Heart, Circulatory system, Types of circulation) (v) Excretion - Plant excretion, Products, Importance, Nephron - structure, urine production, Liver, Skin - Excretory organs.

[F] Skeleton - Movement and Locomotion, Function of human skeleton, Axial and Appendicular skeleton, Types of Joints with reference to them. Location - structure and functions of skin.

[G] Biology and Human Welfare: - (i) Aids to Health: structure of Antibody, Active and Passive immunity. Humoral and cell mediated immunity, Concept of vaccine (ii) Pathogens and Parasites causing human disease. Bacterial, Viral, Protozoan, Helminthes diseases (iii) A brief introduction to Communicable, non-communicable, epidemic, Pandemic and sporadic disease (iv) Microbes in Human welfare (v) Health organization - Red cross, WHO.

[H] Environment and its resources: - Ecology and ecological organization, Population level, Community level, Ecosystem level, Structural aspect of ecosystem, Natural resources: - Forest, Food, Energy.

[I] Source of Waste: - Domestic, Industrial, Agricultural, Commercial and other establishments, Method of safe disposal of waste.

Class X

[A] (i) Control and co-ordination in living organism, Plant hormone (auxin, Gibberellin, Kinin), Endocrine system: - Pituitary glands, Thyroid glands, Adrenal, Pancreas, Endocrine vs Exocrine, Reproductive system, organs, Fertilization, Placenta Functions. Menstrual cycle.

[B] Nervous system - Types of nerve, neuron - structure, central, Autonomous and peripheral nervous system, Brain - Parts and function. Human eye - structure and function, Reflex action. Reflex arc - Structure, voluntary action - name of muscles and Joints - Spinal cord.

[C] Structure and chromosomes - chemical constituents, DNA, RNA, Gene, cell cycle, cell division, types of cell division, different phase of cell division. Significance of cell division. Continuity of life. Plant reproduction - Asexual, Vegetative, Sexual reproduction of Flowering plant. Alternation of Generation.

[D] Mendel's laws of inheritance. 1st law and 2nd law, Experiment, Sex linked inheritance of diseases. Genetic counselling.

[E] Absorption by Roots: Imbibition, Diffusion, Osmosis, Osmotic pressure, Root pressure, Turgidity and Flaccidity, Plasmolysis and De Plasmolysis, Absorption of water and Minerals, Active and Passive Transport.

[F] Rise of water in xylem and Forces responsible for Ascent of sap. Transpiration process, significance, factors affecting rate, Experiments, Guttation and Bleeding. Photosynthesis process, Importance Experiments, Carbon cycle, chemical co-ordination in plants. Plant growth, Regulator, Tropic and Nastic movement.

[G] Circulatory system: - Blood lymph, heart structure and function. Blood vessels, Circulation. Lymphatic system, Excretory system: Introduction, urinary system, Kidney structure and function Nephron.

[H] Basic introduction of Human Evolution. Lamarck's and Darwin theories of Evolution. Evidence of Evolution, Adaptation of Cactus, Fish, Camel,

Sundori, Pigeon. Behavioral adaptive features with example (Bee, Chimpanzees). Population: Population explosion in India, The need of Population control.

[I] N₂ cycle, Types and sources of Pollution, Effect of soil, Air, water and noise pollution. Major pollutants. Biodegradable and non-Biodegradable wastes. Environment and human population, Biodiversity and conservation. Ex-situ and in situ conservation, JFM and PBR.

Class XI

(A) (DIVERSITY IN LIVING WORLD):

1. Biological classification - Five kingdom classification with characteristics and example of each group.

2. Plant kingdom -

All non-flowering and flowering plants, with characteristics, examples and evolutionary relationship.

3. Animal Kingdom -

Characteristics used for classification, all phylum's starting from non-chordates to Chordates with unique characteristics, examples and evolutionary relationship.

(B) (STRUCTURAL ORGANISATION IN PLANTS AND ANIMALS): 1.

Morphology of flowering plants-

a. Root - Different parts and types of tap root and its modification with example; Different types of adventitious roots including fibrous root with modification and example.

b. Stem - Definition, general characteristics of stem, Different parts and modifications of stem with characteristics, functions and examples.

c. Leaf- Definition, Different parts of a typical leaf, Types of leaf (Simple leaf and compound leaf) characteristics and example, venation and phyllotaxy.

d. Inflorescence - definition, Types and sub types of Racemose and Cymosely inflorescence with characteristics and example.

e. Flower - Definition, characteristics, different parts of a typical flower, position of parts of flower, Adhesion and cohesion of stamen, Aestivation, placentation with types, characteristics and examples, floral formula and floral diagrams.

f. Fruit - Definition, types, characteristics and examples.

g. Seed - definition, structure of a typical dicot and monocot seeds with examples.

h. Description of some important families in angiosperms.

i. Salicaceae, Fabaceae, Liliaceae, Brassicaceae, Malvaceae, characteristics, floral formula and floral diagrams.

(C) 2. Anatomy of flowering plants:

a. Plant tissue - Characteristics of meristematic and permanent tissue (simple and complex permanent tissue) their position and types and characteristics. Tissue system, characteristics, some modifications, examples. Types of vascular bundles with examples. Detail study of anatomical features of dicot and monocot stem, root and leaf, their similarities and dissimilarities. Secondary growth in dicot stem and root.

3. Structural organization in Animals- Tissue in Animals, types, characteristics of each with examples and occurrence

Frog-Morphology, Digestive system, Respiratory system, Circulatory system, Excretory system, Reproductive system.

(D) (Structure and function): 1. Cell: The unit of life -

a. Definition, occurrence, detail structure and functions of all the cellular organelles and cytological structures, their organization and functions. Detail analysis of a prokaryotic and eukaryotic cell (plant and animal cell), nucleus, cell inclusion, and chromosomes.

2. Cell cycle and cell division - Amitosis, Mitosis and Meiosis. Definition, characteristics of individual phases, reason for cell to undergo division, functions. Regulation of cell cycle.

3. Biomolecules - Definition, Analysis, comparison of biomolecules of earth and organisms, Carbohydrates, Amino acids, protein, lipid, Nucleic acid, enzymes definition, special characters, types, structures, properties, comparison between Macro and micro molecules. Living state.

(E) (PLANT PHYSIOLOGY):

1. Photosynthesis - Related Experiments, reaction, Site of occurrence, structure of chloroplast, pigments and their distribution and characteristics in high plants and algae. Detail Mechanism with redox potential concept of Light Reaction - Cyclic and Non - Cyclic (Z scheme), Difference between Cyclic and non-cyclic photophosphorylation. Down Hill and Up Hill reactions. Dark reaction C₃, C₄, CAM pathway, All stoichiometry of ATP, NADP⁺ etc.

Photorespiration, Factors controlling photosynthesis. Black man's law of limiting factors and associated graphs.

2. Respiration in Plants - Definition, Types of respiration, Mechanism of Aerobic and Anaerobic respiration (Glycolysis, Krebs cycle and ETC) Amphipolis pathway. Efficiency of Aerobic respiration, Beta peroxidation. Respiratory balance sheet for ATP, NAD⁺, FADH, Water, oxygen.

(F) 3. Plant Growth and Development - Definition, properties, Arithmetic, Geometric, Absolute growth and Relative growth, Plant hormones Auxin, Gibberellins, cytokine, ABA, Ethylene. details. Photoperiodic, Verbalization.

4. Mineral nutrition - Only nodule formation mechanism.

5. Transport in plants - Diffusion, Osmosis, Active transport (primary and secondary), Water potential, DPD all detail concepts WP., TP, OP. Short distance transport and long distance transport, Simplistic and Apo plastic transport through Roots. Translocation of food, theories and mechanisms.

(G) (HUMAN PHYSIOLOGY):

1. Digestion and Absorption - Extent of alimentary canal with detail morphology, anatomy, histology, ontogeny and functions of each and every organs forming the digestive system, list of enzymes, name of respective ducts and hormones secreted from different digestive glands and their functions. Absorption mechanism of carbohydrates, amino acids, lipids, nucleic acid.

2. Breathing and exchange of Gases - Definition of inspiration and expiration, pathway of gaseous exchange, morph anatomy, histology and cytological features of trachea, voice box, lungs, scheme of ramified pathway from nostril to lung, different capacities of lungs, Respiratory surface, Detail concept of hemoglobin and features related to gaseous exchange, Gaseous exchange with respect to different partial pressure of gasses, their numerical values involving lung, blood and tissues. Mechanism of Oxygen transport and Carbon -di-oxide transport, Chloride Shift, Haldane effect and Boor's effect with explanatory graphs, Oxygen- Hemoglobin dissociation curve. Neural and chemical regulation of respiration, Respiratory diseases.

(H) 3. Body fluids and Circulation - Definition, organs involved and their history anatomy, composition of blood and its nature, composition of

lymph, its formation and functions, Detail description of human Heart, cardiac cycle, ECG, Junctional tissues, Cardiac disorders.

4. Excretory products and their elimination - Definition, organs associated their history anatomy. Types of organisms on the basis of excretory materials. Detail history anatomy of kidney and nephron, Urine formation mechanism, RAAS Mechanism, Osmoregulation, disorders.

5. Locomotion and Movement - Differences, contractile proteins components of muscle. Muscle contraction mechanism, physiological functioning of these muscles, Skeletal system history anatomy of all the 260 bones in our body. Analysis of morphology and anatomy of each bones.

(I) 6. Neural control and coordination - Definition, Structure and functions of CNS in details, PNS brief idea, detail structure and functions of brain. Nerve impulses transmission, synaptic transmission, Reflex Action, types, Cranial nerve and Spinal nerve

7. Chemical control and coordination - List of different hormones present in our body, source of secretion, chemical. Nature, Anomaly.

Class XII

(A) Reproduction -(a). Definition, Significance, types, comparison, between them, (b). Different types of vegetative reproductions, and their significance. (c). Sexual reproduction in flowering plants - Pre Fertilization, (sporogenesis, Gametogenesis), pollination and types and examples, Outbreeding Devices, pollen pistil interaction (both biochemical and genetic basis), Artificial hybridization techniques. Fertilization (Syphon gamy and Double Fertilization process) and Post Fertilization events (Embryogenesis in dicot and monocot, diagrams and process, formation of endosperm and their types), Seed ad fruit (rudimentary ideas NCERT concepts), Apomixes and polyembryony (proper idea, types, significance and application) Hybrid seeds preparation by farmers every year,

(d). Human Reproduction - Basic concepts of the reproductive structures of Male and female (external genitalia and internal reproductive organs, accessory reproductive structures, Spermatogenesis and oogenesis process, histology of reproductive organs, structure of sperm and ovum, ovary , testis and Gratian follicles, Menstrual cycle detail concepts, Steps of fertilization in details, post fertilization embryogenic (zygote to fetus formation with details of morula, blastula and gastrulation in details with concept of primitive

streak), reproductive hormones, functions, pregnancy, gestation, parturition, lactation; Reproductive health. (e). Problems and strategies, RCH awareness programmer, amniocentesis, Population explosion and birth control (Natural and artificial method of birth control including physical methods and IUD, pills, their role, Sahel (nature and uses), surgical methods). Medical termination of pregnancy (MIP), STDs, Infertility, concepts of ZIFT, GIFT, IUT, IVF-ET, ICSI, AI, IUI.

(B) Principal of Inheritance - (a). Concept of different terminologies related (Genetics, inheritance, heredity, Allele, phenotype, genotype, Homologous chromosomes, Dominance, pseudo dominance, Trait , etc.), Mendelian genetics, laws formulated with concepts of Monohybrid cross, Dihybrid cross, Back cross, Test cross, Reason for selection of garden pea plant, Post Mendelian concept - incomplete dominance, codominance, multiple allele, polygenic inheritance or multiple factors, Epistasis (Dominant and Recessive), Hypostasis, complementary factor, supplementary factor, Additive effect, Chromosomal theory of Inheritance (parallelism between gene and chromosomes), Concepts of thoughts collaboration of Mendel, Sutton and Boeri, Morgan and Alfred Sturtevant, Concept of linkage, sex linked inheritance, Sex determination (Human, Honey bee, Drosophila, Birds, butterfly, cockroaches), pedigree analysis, genetic disorders (sickle cell anemia, hemophilia, color blindness, thalassemia, cystic fibrosis, phenyl ketone urea, Mutation (Definition, types in details) Chromosomal aberration - Ploidy, Aneuploidy, Down syndrome, Klinefelter's syndrome, Turner's syndrome, Artaud's syndrome, Edward' s Syndrome.

(C) Molecular Basic of Inheritance - History of discovery of Nucleic acid, it's physical arrangement, chemical nature of B-DNA and RNA (in details), Watson and Crick model of DNA structure, Chargaff's rule, mathematical and problems associated, Packaging of DNA from chromatin to chromosome with special reference to Nucleosome model. Physical and chemical structure of chromosome, Experiments performed to discover the genetic material characteristics of molecule that can act as genetic material, RNA world, DNA replication mechanism in both prokaryote and eukaryotes (features , enzymes, detail mechanism, rolling circle model or theta model), Transcription (features, Transcription unit, Enzymes and detail mechanism in both prokaryotes and eukaryotes), RNA types, Why is it more primitive than DNA , why RNA is more prone to alkali hydrolysis, post translational RNA processing or RNA modification in eukaryotes, Genetic code.

(definition , all properties, respective codons with its respectively coded amino acids), structure of t-RNA, Translation in both prokaryotes and eukaryotes (definition, features, detail mechanism), Regulation of gene expression (both Catabolic and anabolic operon , Lac operon and Tryptophan operon , Mechanism of negative and positive regulation of Lac operon, Human genome project (History, features and useful data's , concepts of Repetitive DNA , Bulk DNA, sequence , Satellite DNA , DNA, annotations, Expressed sequence tag , DNA Polymorphism (SNP) , BAC , YAC, etc.).

(D) Evolution – (a). Origin of Life (With special reference to Theories of Operon and Haldane , Urey and Miller's experiment), Evolution of life forms, Adaptation as a root cause of evolution, Factors influencing evolution (Crossing over and recombination, Genetic drift {founder effect, bottle neck effect}, Gene flow or gene migration Natural Selection, Mutation). Evidences of Evolution (Anatomical evidence {Homologous and Analogous organs, definition and examples from both plants and animal source, features and significance}, embryological evidences, paleontological evidences, Concept of Adaptive radiation and convergent evolution with reference to Australian Marsupials and placental mammals, Biological evolution involving the concept of Branching descent and Natural Selection. Theories of Evolution (Lamarckism, Darwinism, de Varies mutation theory - statements, Merits and Demerits), Directional, Stabilizing and Disruptive Natural Selection with graph and explanation Brief account of evolution of plants and animals with respect to geological time scale, Hardy Weinberg equilibrium (concepts of ale frequency and genotypic frequency, problems related to population genetics), Details of Hominid evolution (Human evolution).

(E) Human Health and Disease – (a). Concept of Health, disease (definition), factors affecting health, Classification of disease on the basis of pathogen and spreading out of disease, contingency, host pathogen interaction, Detail account of some disease Pneumonia, Typhoid, Cancer, common cold, Malaria, Amoeboid dysentery, Ascariasis, Filariasis, Venereal disease (AIDS, Syphilis, Gonorrhoea, Genital warts), Ringworm; Immunity (Innate immunity - features, barriers), Acquired Immunity - Humoral immunity (B- cell mediated and Cellular immunity (T- cell mediated) - detail account of both types with proper definition, mechanism of action, anamnestic response, Active and Passive immunity, Vaccination and Immunization, Allergies, Auto

Immunity, Immune system in the body (Lymphoid organs, concept of MALT), Drugs and Alcohol detail account (opioid, cannabinoids, cocaine etc.) Adolescence and Drug and alcohol Abuse, Addiction and Dependence (withdrawal syndrome), Effect of Drug and alcohol Abuse (liver cirrhosis) , prevention and control.

(F) Strategies for Enhancement in Food Production – (a). Animal Husbandry (Dairy farm management, poultry farm management, Animal breeding - detail concepts {in breeding, out crossing, cross breeding, interspecific hybridization}, controlled breeding experiments - Insemination, MOET, Apiculture, viticulture, Plant breeding (detail concepts, steps of plant breeding, Mutation breeding) concept of SCP, Tissue culture (Tot potency, micro propagation, Soma clone, somatic hybridization).

(G) Microbes in Human welfare - Use of microbe's in Household products, Industrial products, Sewage treatment, production of biogas, Microbes as biocontrol agents, As bio fertilizers. All the names of microbes, substrate on which they act and product they produce, Detail concepts of Sewage treatment.

(H) Biotechnology – (a). Definition, principles, Some relevant examples of its area of significance, Conceptual development of genetic engineering, Important application, Recombinant DNA technology (Definition, Tools, Different enzymes involved and their properties, Stepwise detail account of the process, application), concepts of genetic engineering, gene cloning , Gel electrophoresis and its use, Restriction enzymes and types, Cloning vector (definition, properties, Details idea of vector pBR322, vector for cloning genes in plants and animals, concepts of Microinjection, Gene gun or biolistic, transfection, electroporation, how to make a cell competent, PCR (definition, enzyme required, opposite DNA primer requirement, process, application), Isolation of genetic material, blue white selection, concept of staggered cut and blunt cut, palindromic sequence, Insertion of R-DNA into host cell, selectable marker, obtaining the foreign gene product, large scale production by using bio fermenter, Downstream processing, critical research area of biotechnology are, Biotechnological application in Agriculture (Green revolution, GMO { But- cotton , pest resistance in Tobacco plant by RNA interference, Genetically engineered insulin } , Gene therapy definition, detail mechanism with example, Molecular Diagnostic (PCR, ELISA, Use of

radioactive probe to determine genetic defect), Transgenic animals (normal Physiology and development, study of disease, Biological products, vaccine safety, chemical safety testing, Ethical issues (contribution of GEAC), Bio piracy , Amendment of the Indian Patents Bill.

(I) Ecology: A. Organism and population – (a). Organism and its environment b. Major abiotic factors -Temperature (euro thermal and steno thermal organisms definition, examples), Water (euryhaline and stenohaline organisms definition and examples), light, soil, Responses to abiotic factors (confirmers, partial regulators Regulators and suspend - definition, explanation, examples , graph), Adaptations , population attributes with special reference to Age pyramids , some calculations , population density , Population growth (Nasality , Mortality , Immigration , emigration, equations , Growth Models (Exponential growth, mathematical expression, Logistic growth curve , mathematical expression , growth) , life history variation, Population interactions all in details , pre zygotic barrier, pre zygotic isolation, temporal isolation.

B. Ecosystem - Definition, Terrestrial, aquatic ecosystems, Temporal and permanent ecosystem, Anthropogenic ecosystem, Structure of Ecosystem, Productivity, Decomposition, Energy flow, Nutrient cycle, production and productivity (Gross, Net, primary and secondary productivity), Decomposition, Energy flow, Detritus food chain, standing crop, standing state, ecological pyramids, Ecological succession, Plant ecological succession, Nutrient cycling, Ecosystem succession.

C. Biodiversity and Conservation – (a). Biodiversity (definition, types, Representing global biodiversity, Species area relationship curve detail mathematical analysis with graph and related information, Significance of biodiversity, Loss of Biodiversity (discussion of all points), In Situ conservation and Ex situ conservation, sacred groves.

D. Air pollution and its control, Water pollution, eutrophication, solid waste, Agro chemical and their effect, Radioactive Waste, Greenhouse effect, Ozone Depletion, Hum cultivation, Amrita Devi Bishop Wild life protection, Joint Forest Management.