

BIOLOGY
CLASS: First Year PUC

Unit I: Diversity of Living Organisms

What is living?

- Concept of biodiversity

Classification of living organisms

- Need for classification.
- Three domains of life.
- Five kingdoms of life and basis of five kingdom classification.
- Lichens.
- Virus and Virioids.

Systematics and binomial nomenclature

- Taxonomy & Systematics.
- Concept of species and taxonomic hierarchy.
- Binomial nomenclature.
- Salient features and Classification of Monera, Protoctista (Protista) and Fungi into major groups
- Salient feature and classification of plants into major group – Algae, Bryophytes, Pteridophytes, Gymnosperms and features of each category and at least two examples of each.
- Angiosperms – Classification upto class, characterisation features and Examples.
- Salient feature and classification of animals – Major non chordate phyla and chordate classes. Three to five salient features and at least two examples.
- Tools for study of biodiversity – Museums, Zoos, Herbaria, botanical Gardens.

Unit II : Structural Organisation in Animal and Plants

- Tissues in animal and plants.
- Morphology including modifications, microscopic anatomy and functions of different parts of flowering Plants: Root, Stem, leaf, inflorescence, flower, fruit and seed. (To be dealt with along with the relevant Practicals of the Practical Syllabus)
- Morphology, anatomy and functions of different systems (digestive, circulatory, respiratory, nervous and reproductive) of insect (cockroach). (Brief account only)

Unit III : Cell Structure and function

Cell and its three major parts – Cell membrane, cytoplasm, nucleus

- Cell theory and cell as the basic unit of life.
- Structure of a prokaryotic and eukaryotic cell.
- Plant cell and animal cell. (brief)

- Cell organelles – Cell envelope, cell membrane, cell wall Structure and function: Mitochondria, golgi, endoplasmic reticulum, ribosomes, lysosomes, vacuoles, plastids, microbodies,
- Cytoskeleton, cilia, flagella, centrioles (Ultrastructure and function).
- Nucleus – nuclear membrane, chromatin, nucleolus.
- Chemical constituents of living cells.
- Biomolecules – Structure and function of proteins, carbohydrates, fats, nucleic acids.
- Enzymes – types, properties, enzyme action.
- Cell division – Cell cycle, significance of, and differences between mitosis and meiosis.

Unit IV : Plant Physiology

Movement of water, food, nutrients and gases

- Absorption of water, gases and nutrients.
- **Cell to cell transport**
- Diffusion, facilitated diffusion, active transport.
- **Plant – water relations**
- Imbibition, water potential, osmosis, plasmolysis.
- **Long distance transport**
- Apoplast, symplast, root pressure, transpiration pull.
- **Transpiration and Guttation**
- opening and closing of stomata.
- Role of K⁺ ions.
- **Uptake of mineral and their translocation**
- Transport through xylem and phloem.
- **Plants and mineral nutrition.**
- Essential minerals, macro- and micronutrients and their role
- Deficiency symptoms.
- Mineral toxicity.
- Elementary idea of Hydroponics as a Method to study mineral nutrition.
- Nitrogen metabolism – Nitrogen cycle, biological nitrogen fixation.
- **Plant Respiration**
- Exchange of gases.
- Cellular respiration – glycolysis, fermentation (anaerobic),
- TCA cycle and electron transport system (aerobic).
- Energy relation – Number of ATP molecules generated.
- Amphibiotic pathways.
- Respiratory quotient of nutrients.
- **Photosynthesis**
- Autotrophic nutrition.
- Site of photosynthesis.
- Photosynthetic pigments (Elementary idea).
- Photochemical and biosynthetic phases of photosynthesis.
- Cyclic and non-cyclic photophosphorylation.
- Chemiosmotic hypothesis.
- Photorespiration.
- C₃ and C₄ pathways.
- Factors affecting photosynthesis.
 - Law of limiting factors.

- **Plant growth and development**
- Phases of plant growth and plant growth rate.
- Condition of growth.
- Differentiation, dedifferentiation and redifferentiation.
- Sequence of developmental process in a plant cell.
- Growth regulators-auxin, gibberellin, cytokinin, ethylene, ABA.
- Photomorphogenesis including brief account of phytochromes.
(Elementary Idea)
- Seed germination.
- Seed dormancy.
- Vernalisation.
- Photoperiodism.

Unit V : Human physiology

- **Digestion and Absorption**
- Human alimentary canal and Digestive glands.
- Role of digestive enzymes and gastrointestinal hormones
- Peristalsis.
- Digestion, absorption and assimilation of proteins, carbohydrates and fats.
- Calorific value of proteins, carbohydrates and fats.
- Egestion.
- Nutritional and digestive disorders – P E M, indigestion, constipation, vomiting, jaundice.
- **Breathing and Respiration**
- Respiratory organs in animals. (Recall only)
- Respiratory system in humans.
- Mechanism of Breathing and its regulation in humans.
- Exchange of gases, transport of gases and regulation of respiration in humans.
- Respiratory volumes.
- Disorders related to respiration – Asthma, Emphysema, Occupational Respiratory disorders.
- **Body fluids and Circulation**
- Composition of blood, Blood groups, Coagulation of blood.
- Composition of Lymph and function.
- 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 – Hypertension, Coronary artery disease, Angina pectoris, heart failure.
- **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, Antinatriuretic factor, ADH and Diabetes insipidus.

- Role of other organs in excretion.
- Disorders – Uraemia, Renal failure, Renal calculi, Nephritis.
- Dialysis and artificial kidney.

- **Locomotion and Movement**
- Types of movement – ciliary, flagellar, muscular.
- Skeletal muscle _ contractile proteins and muscle contraction.
- Skeletal system and its functions. (to be dealt with the relevant practical of practical syllabus)
- Joints.
- Disorders of muscular and skeletal system – Myasthenia gravis, Tetany, Muscular dystrophy, Arthritis, Osteoporosis Gout.
- **Neural control and coordination**
- Neural and nerves.
- Nervous system in humans.
- Central Nervous system, Peripheral Nervous system and Visceral Nervous system.
- Generation and conduction of nerve impulse.
- Reflex action.
- Sensory Perception.
- Elementary structure and function of eye and ear and general idea of other sense organs.
- **Chemical coordination and regulation**
- Endocrine glands and hormones.
- Human endocrine system – Hypothalamus, Pituitary, Pineal, Thyroid, Parathyroid, Adrenal, Pancreas, Gonads.
- Mechanism of hormone action (Elementary Idea).
- Role of hormones as messengers and regulators.
- Hypo- and hyperactivity and related disorders, (Common disorders eg. Dwarfism, Acromegaly, Cretinism, goiter, exophthalmic goiter, diabetes, Addison's disease).

IMP: Diseases related to all the human physiology systems to be taught in brief.

Practicals

A. List of Experiments

1. Study and describe three locally available common flowering plants from each of the following families (Solanaceae, Fabaceae and Liliaceae) including dissection and display of floral whorls and anther and ovary to show number of chambers. Types of root (Tap and Adventitious); Stem (Herbaceous and woody); Leaf (arrangement, Shape, Venation, Simple and Compound).
2. preparation and study of T.S. of dicot and monocot roots and stems (primary).
 1. Study of osmosis by potato osmometer.
 2. Study of plasmolysis in epidermal peels (e.g. Rhoeo leaves).
 3. Study of distribution of stomata in the upper and lower surface of leaves.
 4. Comparative study of the rates of transpiration in the upper and lower surface of leaves.

5. Test for the presence of sugar, starch, proteins and fats. To detect them in suitable plant and animal materials.
6. Separation of plant pigments through paper chromatography.
7. To study the rate of respiration in flower buds/leaf tissue and germinating seeds.
8. To test the presence of urea in urine.
9. To detect the presence of sugar in urine/blood sample.
10. To detect the presence of albumin in urine.
11. To detect the presence of bile salts in urine.

B. Study / observation of the following (spotting)

1. Study parts of a compound microscope.
2. Study of the specimens and identification with reasons-Bacteria, Oscillatoria, Spirogyra, Rhizopus, mushroom, Yeast, liverwort, moss, fern, pine, one monocotyledonous plant and one dicotyledonous plant and one lichen.
3. Study of specimens and identification with reasons-Amoeba, Hydra, Liverfluke, Ascaris, leech, earthworm, prawn, silkworm, honeybee, snail, starfish, shark, Rohu, frog, lizard, pigeon and rabbit.
4. Study of tissues, and diversity in shapes and size of plant and animal cells (e.g. palisade cells, guard cells, parenchyma, collenchyma, sclerenchyma, Xylem, phloem, Squamous epithelium, muscle fibers and mammalian blood smear) through temporary/permanent slides.
5. Study of mitosis in onion root tip cell animals cells (grasshopper) from permanent slides.
6. Study of different modification in root, stem and leaves.
7. Study and identification of different types of inflorescence.
8. Study of imbibition in seeds/raisins.
9. Observation and comments on the experimental set up for showing:
 - a. Anaerobic respiration
 - b. Phototropism
 - c. Apical bud removal
 - d. Suction due to transpiration
10. Study of human skeleton and different types of joints.
11. Study of external morphology of earthworm, cockroach and frog through models.

BIOLOGY
CLASS: Second Year PUC

UNIT 1 REPRODUCTION

Reproduction in Organisms

Reproduction a characteristic feature of all organisms for continuation of species.

Modes of reproduction- Asexual and sexual.

- **Asexual reproduction**
 - Uniparental
 - Modes – Binary fission, sporulation, budding, gemmule, fragmentation, regeneration.
 - Vegetative Propagation in plants.
 - Micropropagation.
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- **Sexual reproduction in flowering plants**
 - Flower structure.
 - Development of male and female gametophytes.
 - Pollination-type-agencies and examples.
 - Outbreeding devices.
 - Pollen-Pistil interaction.
 - Double fertilization
 - Post fertilization events
 - Development of endosperm & embryo
 - Development of seed and formation of fruit.
 - Seed development
 - Fruit formation.
 - Special modes – apomixes, parthenocarpy, Polyembryony.
 - Significance of seed and fruit formation.
- **Human Reproduction**
 - Male and female reproductive systems.
 - Microscopic anatomy of testis and ovary
 - Gametogenesis – spermatogenesis & oogenesis.
 - Menstrual cycle
 - Fertilization, embryo development upto blastocyst formation implantation.
 - Pregnancy and placenta formation (Elementary idea).

- Parturition (Elementary idea).
- Lactation (Elementary idea).
- **Reproductive health**
 - Need for reproductive health and prevention of Sexually Transmitted Diseases (STD)
 - Birth Control – Need and Methods.
 - Contraception & Medical Termination of Pregnancy (MTP).
 - Amniocentesis.
 - Infertility and assisted reproductive technologies – IVF, ZIFT, GIFT (Elementary idea for general awareness).

Unit II GENETICS AND EVOLUTION

Heredity and variation

- Mendelian Inheritance
- Deviations from Mendelism, incomplete dominance Co-dominance, Multiple alleles and Inheritance of blood group, pleiotropy.
- Elementary idea of Polygenic Inheritance
- Chromosome theory of inheritance
- Chromosomes and genes.
- **Sex determination**
 - In humans, birds, honey bee.
 - Linkage and crossing over.
 - Sex linked inheritance-Haemophilia, Colour blindness.
- **Medellin disorders in humans**
 - Chromosomal disorders in humans.
 - Down's syndrome, Turner's and Klinefelter's syndromes.
- **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.
 - Genome and human genome project.
 - DNA finger printing.

- **EVOLUTION**
- **Origin of life**
- **Biological evolution and evidences for biological evolution** (Paleontological from comparative anatomy and embryology and molecular evidence)
 - Darwin's contribution /Modern Synthetic theory of Evolution
 - Hardy – Weinberg's principle.
- Mechanism of evolution – Variation (Mutation & Recombination) and Natural Selection with examples drift types of natural selection
 - Gene flow and genetic
 - Adaptive Radiation
- Human evolution

Unit III BIOLOGY AND HUMAN WELFARE

- **Health and Disease**
 - Basic concepts of immunology – vaccines
 - Pathogens, parasites causing human diseases (Malaria, Filariasis, Ascariasis, Typhoid, Pneumonia, common cold, amoebiasis, ring worm).
 - Cancer, HIV and AIDS.
 - Adolescence drug and alcohol abuse.
- **Insects and human welfare**
 - Silk, Honey, Lac
- **Improvement in food production**
 - Plant breeding, tissue culture, single cell protein.
 - Biofortification, Animal husbandary.
- **Microbes in human welfare**
 - In household food processing, industrial production, sewage treatment, energy generation and as biocontrol agents and biofertilizers.

UNIT IV BIOTECHNOLOGY AND ITS APPLICATIONS

- **Principles and process of Biotechnology**
 - Genetic engineering (Recombination DNA technology).
- **Application of Biotechnology in health and agriculture**
 - Human insulin and vaccine production, gene therapy.

- Genetically modified organisms – B+ crops.
- Biosafety issues.
- Biopiracy and patents.

Unit V ECOLOGY AND ENVIRONMENT

- **Meaning of ecology, environment, habitat and niche**
 - Organisms and environment.
- **Population and ecological adaptations**
 - Population Interactions – mutualism, competition, predation, parasitism.
 - Population attributes – growth, birth rate and death rate,
 - Age distribution.
- **Ecosystems**
- **Patterns, components, energy flow, nutrient cycling (carbon and phosphorous), decomposition and productivity**
 - Pyramids of number, biomass, energy.
 - Ecological succession
 - Ecological Services: Carbon fixation, Pollination, Oxygen release
- **Biodiversity and its conservation**
 - Threats to and need for biodiversity conservation.
 - Hotspots, endangered organisms, extinction, Red Data Book.
 - Biodiversity conservation- biosphere reserves, national parks and sanctuaries.
- **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 global warming
 - Ozone depletion, deforestation.
 - Any three case studies as success stories addressing environmental issues.

List of Experiments

1. Study pollen germination on a slide.
2. Collect and study soil from at least two different sites and study them for texture, moisture content, pH and water holding capacity of soil. Correlate with the kinds of plants found in them.

3. Collect water from two different Water bodies around you and study them for pH, clarity and presence of any living organisms.
4. Study of presence of suspended particulate matter in air at the two widely different sites.
5. Study of plant population density by quadrat method.
6. Study of plant population frequency by quadrat method.
7. Prepare of temporary mount of onion root tip to study mitosis.
8. To study the effect of the different temperatures and three different pH on the activity of salivary amylase on starch.

Study/observation of the following (Spotting)

1. Flowers adapted to pollination by different agencies (wind, insect)
2. Pollen germination on stigma through a permanent slide.
3. Identification of stages of gamete development i.e. T.S. testis and T.S. ovary through permanent slides. (from any mammal)
4. Meiosis in onion bud cell or grass hopper testis through permanent slides.
5. T.S of blastula through permanent slides.
6. Mendelian inheritance using seeds of different colour/size of any plant.
7. Prepared pedigree charts of genetic traits such as rolling of tongue, blood groups, widow's peak, colour blindness.
8. Exercise on controlled pollination-Emasculation, tagging and bagging.
9. Identification of common disease causing organisms like Ascaris, Entamoeba, Plasmodium, ringworm through permanent slides or specimens. Comment on symptoms of diseases that they cause.
10. Two plants and two animals found in xerophytic conditions. Comment upon their morphological adaptations.
11. Plants and animals found in aquatic conditions. Comment upon their morphological adaptations.