

## 9. BIOLOGY (Code No. 044)

The present syllabus reinforces the ideas introduced till the secondary classes. It provides the students with new concepts along with an extended exposure to contemporary areas of the subject. The syllabus also aims at emphasizing on the underlying principles that are common to both animals and plants as well as highlighting the relationship of biology with other areas of knowledge. The format of the syllabus allows a simple, clear, sequential flow of concepts without any jarring jumps. The syllabus also stresses on making better connections among biological concepts. It relates the study of biology to real life through the use of technology. It links the discoveries and innovations in biology to everyday life such as environment, industry, health and agriculture. The updated syllabus also focuses on reducing the curriculum load while ensuring that ample opportunities and scope for learning and appreciating basic concepts of the subject continue to be available within its framework.

The prescribed syllabus is expected to:

- promote understanding of basic principles of Biology
- encourage learning of emerging knowledge and its relevance to individual and society
- promote rational/scientific attitude to issues related to population, environment and development
- enhance awareness about environmental issues, problems and their appropriate solutions
- create awareness amongst the learners about diversity in the living organisms and developing respect for
- appreciate that the most complex biological phenomena are built on essentially simple processes.

It is expected that the students would get an exposure to various branches of Biology in the syllabus in a more contextual and friendly manner as they study its various units.

### COURSE STRUCTURE

#### CLASS XI (Theory)

One Paper	Time : 3 Hours	Max. Marks : 70 Marks
Unit	Title	Marks
1.	Diversity of Living Organisms	07
2.	Structural Organisation in plants and animals	12
3.	Cell: Structure and Function	15
4.	Plant Physiology	18
5.	Human Physiology	18
<b>Total</b>		<b>70</b>

**Unit I: Diversity of Living Organism (25 Periods)**

What is living? biodiversity; need for classification; three domains of life; taxonomy & systematics; concept of species and taxonomical hierarchy; binomial nomenclature; tools for study of taxonomy-museums, zoological parks, herbaria, botanical gardens.

Five kingdom classification; salient features and classification of Monera, Protista and Fungi into major groups: Lichens, Viruses and Viroids.

Salient features and classification of plants into major groups - Algae, Bryophyta, Pteridophyta, Gymnospermae and Angiospermae (three to five salient and distinguishing features and at least two examples of each category); Angiosperms - classification up to class, characteristic features and examples.

Salient features and classification of animals non chordates up to phyla level and chordates up to classes level (three to five salient features and at least two examples).

**Unit II: Structural Organisation in Animals and Plants (25 Periods)**

Morphology and modifications; tissues; anatomy and functions of different parts of flowering plants: root, stem, leaf, inflorescence; cymose and racemose, flower, fruit and seed (to be dealt along with the relevant practical of the Practical Syllabus).

Animal tissues; morphology, anatomy and functions of different systems (digestive, circulatory, respiratory, nervous and reproductive) of an insect (cockroach). (a brief account only)

**Unit III: Cell Structure and Function (40 Periods)**

Cell theory and cell as the basic unit of life; structure of prokaryotic and eukaryotic cells; Plant cell and animal cell; Cell envelope, cell membrane, cell wall; Cell organelles - structure and function; endomembrane system, endoplasmic reticulum, Golgi bodies, lysosomes, vacuoles; mitochondria, ribosomes, 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, lipids, nucleic acids, enzymes, types, properties, enzyme action.

Cell division : cell cycle, mitosis, meiosis and their significance.

**Unit IV: Plant Physiology (45 Periods)**

Transport in plants; movement 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 of water - Absorption, apoplast, symplast, transpiration pull, root pressure and guttation; transpiration, opening and closing of stomata; Uptake and translocation of mineral nutrients - Transport of food, phloem transport, mass flow hypothesis; diffusion of gases.

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.

Photosynthesis: photosynthesis as a means 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<sub>3</sub> and C<sub>4</sub> pathways; factors affecting photosynthesis.

Respiration: 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.

Plant growth and development: seed germination; phases of plant growth and plant growth rate; conditions of growth; differentiation, dedifferentiation and redifferentiation; sequence of developmental processes in a plant cell; growth regulators - auxin, gibberellin, cytokinin, ethylene, ABA; seed dormancy; vernalisation; photoperiodism.

## **Unit V: Human Physiology (45 Periods)**

Digestion and absorption: alimentary canal and digestive glands, role of digestive enzymes and gastrointestinal hormones; Peristalsis, digestion, absorption and assimilation of proteins, carbohydrates and fats; calorific values of proteins, carbohydrates and fats; egestion; nutritional and digestive disorders - PEM, indigestion, constipation, vomiting, jaundice, diarrhoea.

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, respiratory volume; 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 its 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, atrial natriuretic 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; joints; disorders of muscular and skeletal system - myasthenia gravis, tetany, muscular dystrophy, arthritis, osteoporosis, gout.

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; reflex action; sensory perception; sense organs; elementary structure and function of eye and ear.

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; dwarfism, acromegaly, cretinism, goit, exophthalmic goiter, diabetes, Addison's disease.

Note : Diseases related to all the human physiology systems (to be taught in brief).

## Practicals

**Maximum Marks : 30**

**60 Periods**

### A. List of Experiments

1. Study and describe three locally available common flowering plants, one from each of the 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).
3. Study of osmosis by potato osmometer.
4. Study of plasmolysis in epidermal peels (e.g. Rhoeo leaves)
5. Study of distribution of stomata in the upper and lower surface of leaves.
6. Comparative study of the rates of transpiration in the upper and lower surface of leaves.
7. Test for the presence of sugar, starch, proteins and fats. To detect these in suitable plant and animal materials.
8. Separation of plant pigments through paper chromatography.
9. To study the rate of respiration in flower buds/leaf tissue and germinating seeds.
10. To test the presence of urea in urine.
11. To detect the presence of sugar in urine.
12. To detect the presence of albumin in urine.
13. 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/slides/models 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/slides/models 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 sizes of plant and animal cells (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 tips cells and animals cells (grasshopper) from permanent slides.
6. Study of different modifications in root, stem and leaves.
7. Study and identification of different types of inflorescence (cymose and racemose)
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 cockroach through specimens/models.

**CLASS XII  
(THEORY)**

**(180 Periods)**

**Syllabus - Biology (XII)**

**One Paper**

**Time : 3 Hours**

**Max. Marks : 70 Marks**

Unit	Title	Marks
6.	Reproduction	14
7.	Genetics and Evolution	18
8.	Biology and Human Welfare	14
9.	Biotechnology and its Applications	10
10.	Ecology and Environment	14
<b>Total</b>		<b>70</b>

**1. Reproduction**

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

Sexual reproduction in flowering plant: 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