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BIOLOGY

RATIONALE

Biology arose in a two fold manner - firstly, as a practising art towards exploring and improving a variety of usable plant and animal products as well as towards maintaining good health; secondly, as an academic pursuit out of human curiosity to know about themselves and other living beings and to understand the position of humankind on the planet Earth. In other words, the storehouse of knowledge about living beings started building up only when humans were curious to know about life. In order to respect and appreciate the great diversity in living things at all levels of organisation, and to understand the impact of biological development on our life style, an attempt has been made in the present syllabus to bring out the different facts of Life. Hence, the themes that highlight the contribution of biology to the analysis and solution of problems of daily life like growth, health, nutrition, and environment, have been chosen as components of the content. The topics based on these themes will be dealt at the individual and community levels. Efforts have been made to reflect biology as not merely a correlational science but also as an experimental discipline by dealing with different tools and techniques used in biological studies. However, the vastness of knowledge has delimited the scope of each topic included in the syllabus. Besides integrating the content and the depth at which it could be dealt, modernity of the concepts as well as emerging areas like Biotechnology, Biochemistry and Immunology have also been introduced. The syllabus includes some optional modules to help the students to enrich in areas of their choice which should facilitate them to choose a career or pursue higher education.

The course would enable the learner to :-

(i) acquire knowledge of biological terms, facts, concepts, principles, and processes in order to understand the living world as a whole.

(ii) appreciate diversity in the living world as also inter-relationships of various living organisms, ecological balance in nature, and the role of biology in human welfare.

(iii) visualise the hazards of nuclear weapons and environmental pollution, and to create an awareness for ecological use of natural resources in the service of humankind.

(iv) develop insight into the role and impact of Biology in various allied professions such as medicine, agriculture forestry, biotechnology, veterinary sciences and pharmacology.

(v) develop interest in the living world with an aim to respect life.

As a part of this process, the syllabus also aims at developing the following abilities in the students to:

(i) apply knowledge and understanding of biology in situations which are novel and unfamiliar by developing abilities to analyse, hypothesise, draw conclusion and predict results.

(ii) develop skills in handling, improvising and manipulating scientific apparatus, and recording observations and data.

(iii) develop scientific attitude through the mode of curiosity and evidence for proof.

COURSE CONTENT

The syllabus contains 8 core modules and 4 optional modules which are as follows:-

CORE MODULES		Marks
1.	Diversity and evolution of life	6
2.	Cell, Cell functions and Tissues	10
3.	Functional morphology and Life processes in plants	11
4.	Functional morphology and Life processes in animals	11
5.	Reproduction and Development	10
6.	Heredity and Genetics	10
7.	Population Explosion and Family Planning	4
8.	Environmental Biology	8

OPTIONAL MODULES		Marks
1.	Tools and Techniques in Biology	10
2.	Economic Biology	10
3.	Health Science	10
4.	Emerging Areas in Biology-Biochemistry, Biotechnology and Immunobiology	10

DISTRIBUTION OF MARKS

The core modules are compulsory for all learners. From the list of optional modules the learner can take any 1 course of his/her choice. Thus, each learner takes 9 modules in all.

Core Modules	70
Optional Modules	10
Practical Examination	20
Grand Total	100

MODULE 1: DIVERSITY AND EVOLUTION OF LIFE

Study Time : 25 hours **Marks : 6**

Approach

This module is intended to enable the learner to visualize the origin of life on earth and the vast diversity in the living world from simple to more complex and to attempt to group them together at various levels of classification. In addition, it points out that studies of fossils and changes in population in time and space provide evidence that evolution has occured and is still occurring and provides an explanation for the mechanism of these changes.

Unit 1 Classification of organisms

- Principles of classification and taxonomic categories.
- Linnaeus and binomial nomenclature, general rule for naming, writing and printing of scientific names of organisms.
- Taxonomic categories (taxa) from, species upto phylum.

Unit 2 Viruses

- Characteristics of viruses, taking examples of TMV, Polio, HIV, bacteriophage T2.

Unit 3 Scheme of five kingdom classification of organisms.

Unit 4 Kingdom Prokaryotae (Monera)

- Chemical nature, general structure and characteristics of bacteria with common examples.
- Mention of useful and harmful bacteria like *Lactobacillus, Rhizobium, Mycobacterium tuberculosis, Clostridium tetani, Cornybacterium diphtheria*

Unit 5 Kingdom Protista

- General characteristics and classification upto phyla with examples of *Amoeba, Entamoeba, Plasmodium, Euglena* & Diatoms

Unit 6 Fungi

2|21 General characteristics of fungi, useful and harmful fungi, examples-*Rhizopus*

(Breadmould), Yeast, *Penicillium notatum, Puccinia graminis* (wheat rust)

Unit 7 Kingdom Plantae

Algae- *Chlamydomonas, Spirogyra*

Bryophyta (Liverworts and Mosses), Pteridophyta (Ferns), Spermatophyta (Gymnosperms and Angiosperms), General morphological features of flower and fruit and some common examples of the following families: Poaceae (Graminae), Brassicaceae (Cruciferae) and Leguminosae (only Papilionaceae).

Unit 8 Kingdom Animalia

Main characteristics, classification upto phylum and common examples of Porifera, Coelenterata, Platyhelminthes, Nemathelminthes, Annelida, Arthropoda, Mollusca and Echinodermata; Chordata upto classes, classification of Mammalia upto subclasses, with important examples for all.

Unit 9 Origin and Evolution of Life

a) Origin of life : Views, *spontaneous generation, experiments of Pasteur,* Abiogenesis hypothesis, Oparin's hypothesis of origin of life, Miller's experiment.

b) Organic evolution, progressive and retrogressive evolution, evidences of evolution.

Theories of evolution - Lamarckism, Darwinism, Mutation Theory, Neo Darwinism.

Suggested Teaching/Learning Hints While explaining taxonomic categories of classification examples should be given (in a tabular form, e.g. complete classification of the house of cat and man.) While discussing plant and animal groups, their characteristics, levels of organisation and other features should be given in a tabular form. The fact that evolution is a continuous process should be highlighted.

Suggested extended learning Find out what microbiology deals with. Read articles on the studies made by evolutionists regarding the history of development of mankind in magazines and newspapers. Read and see films on Civilization.

MODULE 2 : CELL, CELL FUNCTION AND TISSUES.

Study Time : 30 hours **Marks : 10**

Approach

This module is designed to get an insight into the entire living world as composed of basically the same kind of unit structure - the cell. All functions in the living body are ultimately the outcome of the activities of cells. The cells are composed of numerous organelles - each concerned with its specific function. Though fundamentally similar, the cells show a vast array of modification and specialization forming tissues to suit the need of different parts of the body and more so in the different kinds of organisms. The learner should be able to understand and appreciate that all organisms starts their life as a tiny single cell which, by repeated division and growth, may finally give rise to giants like elephant or banyan tree.

Unit 1 Cell Structure

Discovery of cell, cell theory, cell-its shape, size, physical and chemical composition, generalized cell structure as seen under compound and electron microscopes, differences between animal and plant cell.

Cell organelles - structure and functions of cell wall, plasma membrane, endoplasmic reticulum, ribosomes, Golgi bodies, micro bodies, Mitochondria, chloroplast, centrosome, cilia and flagella, nucleus (excluding chemical nature of chromosomes) and cell inclusions.

Unit 2 Cell Division

Mitosis and its significance. Meiosis and its significance.

Unit 3 Tissues

Plant Tissues-Meristems-Apical, Intercalary and Lateral: Parenchyma, Collenchyma, Sclerenchyma, Xylem and Phloem.

Animal Tissues-Epithelial, Connective, Muscular and Nervous.

Unit 4 Levels of Organisation (cell to organism)
A general idea about the ascending order of levels of organization-cell, tissues, organ, organ system and organism.

Suggested Teaching/Learning Hints Suitable examples from daily life should be taken in order to explain the levels of organisation, for example the root systems of a tree is one of its organ systems having root, root hairs etc.

Suggested Extended Learning Find out about **'cancer'** cells which differ from normal cells in that they multiply rapidly and wildly and do not follow the normal rules of cellular conduct. Get to know about the tools involved in the investigation of cells.

MODULE 3: FUNCTIONAL MORPHOLOGY AND LIFE PROCESSES IN PLANTS

Study time : 35 hrs **Marks : 11**

Approach

This module intends to highlight the complex nature of the structure and function of the different organ-systems in plants with special emphasis on the life processes occuring in higher plants (e.g. in a flowering plant).

Pre-requisite knowledge Elementary idea about different types of root, stem and leaf and their functions.

Unit 1 :- Root
Primary growth, primary structure of dicot and monocot roots, mode of origin of lateral roots.

Secondary growth in dicot roots.

Special features of root for common functions of anchorage, growth in soil, absorption, conduction of water and mineral salts, as well as special functions of storage and respiration. Distribution of mechanical tissues to withstand pulling strain.

Unit 2 Stem

Primary growth, primary structure of dicot and monocot stem, mode of origin of lateral branches.

Secondary growth in dicot stem.

Growth rings (annual rings), sap wood and heart wood. Structural features for support, exposing leaves and flowers to favourable positions, conduction as well as special functions of storage and photosynthesis.

Distribution of mechanical tissues to withstand bending strain.

Unit 3 Absorption and Transport
Active and passive absorption, diffusion, osmosis, major theories on transport of water and organic substances.

Unit 4 Nutrition
Macronutrients and micronutrients. Deficiency symptoms.

Unit 5 Leaf
Internal structure of dicot and monocot leaf. Distribution of mechanical tissues, stomata, hairs and hydathodes, vascular tissues, air spaces etc.

Unit 6 Transpiration and Guttation
Processes, magnitude and significance of transpiration and guttation, and factors affecting them.

Unit 7 Photosynthesis
The process and its significance. Factors affecting photosynthesis.

Unit 8 Respiration
Aerobic, anaerobic, respiratory quotient, factors affecting respiration (excluding biochemical pathways), fermentation.

Unit 9 Flower and Inflorescence
Parts of a typical flower, flowers in dicots and monocots, arrangement and condition of various parts of flower. Placentation, major types of inflorescence.

Unit 10 Fruit
Definition, major categories, edible parts of common fruits,

Unit 11 Growth and Development
Definitions of growth and development, growth curve,

stages of plant growth, photoperiodism, vernalisation hormonal regulation of growth, measurement of growth. Different types of plant movement and responses; growth, turgor, hydration, tropic and nastic movements.

Suggested Teaching/Learning Hints Specimens of fresh plants should be observed by a learner while studying about its various parts. This should be highlighted in the instuction material. Activities which one can do at home should be given, for example : observing osmosis in a carrot.

Suggested Extended Learning Read about Hybrid Plants which give new varieties of flowers, fruits etc.

MODULE 4 : FUNCTIONAL MORPHOLOGY AND LIFE PROCESSES IN ANIMALS

Study Time : 35 hrs **Marks : 11**

Approach

The module brings out the relationship between the structure and function in animals with special reference to human so that the learner can appreciate the importance of intregration and co-ordination among processes in the functioning organism as a whole.

Pre-requisite knowledge Elementary idea about the human body.

Unit 1 Digestive System

Digestive organs, digestion, absorption, assimilation.

Unit 2 Respiratory System

Respiratory organs, breathing, gaseous transport and tissue respiration.

Unit 3 Circulatory System

Circulatory organs, blood circulation, histology and functions of blood, blood coagulation, blood transfusion, blood groups, blood pressure, lymph and lymph glands, spleen. Immune system (basic idea of immunocytes and immunity).

Unit 4 Excretory System

Excretory organs, finer structure of mammalian kidney, ultrafiltration and urine formation, an elementary idea of dialysis.

Unit 5 Nervous System

Central nervous system, peripheral nervous system, autonomous nervous system, sense organs, reflex action.

Unit 6 Skin and skeletal System

(a) Skin: Basic structure and functions of skin.

(b) Skeletal System: All major bones in human skeleton and their role in protection and/ or, movements, types of joints.

Unit 7 Endocrine system (Chemical Regulation)

Endocrine glands, nature and role of hormones, an elementary knowledge of Pheromones.

Unit 8 Reproductive System

Male and Female reproductive organs, histology of gonads, fertilisation, artificial insemination, ovarian cycle, fertility control, in vitro fertilisation and its prospects, Twins-monozygotic and dizygotic.

Suggested Teaching/Learning Hints Read about the concept organ transplant which is coming up as growing area in the field of human physiology.

MODULE 5 : REPRODUCTION AND DEVELOPMENT

Study Time : 30 hrs **Marks :- 10**

Approach

This module is designed to highlight the diverse methods of reproduction in living beings from very simple binary fission among unicellular organisms to complex sexual reproduction in plants and animals. It deals with both normal and abnormal development.

Pre-requisite knowledge An elementary understanding of the organs of reproduction in plants and animals.

Unit 1 Reproduction in non-flowering plants

Reproduction patterns in *Escherichia coli, chlamydomonas, Spirogyra, Rhizopus, Funaria, Dryopteris, Pinus.*

Unit 2 Reproduction in flowering plants

Juvenility, flowering, flower as a reproductive organ, flower formation and sex expression, pollen and ovule, pollination, fertilization, seed development, fruit development, pathenocarpy.

Unit 3 Vegetative reproduction in plants

Bulb, tuber, rhizome, bulbil, runner, sucker, etc. Special method culture (micropropagation).

Unit 4 Patterns of reproduction in animals

Asexual reproduction by fission, fragmentation and budding. Sexual (gametic) reproduction.

Unit 5 Basic features of embryonic development in animals

Gametogenesis, sperm and egg, general principles of fertilization, cleavage, blastulation, gastrulation organogenesis, morphogenesis and differentiation.

Unit 6 Embryonic nutrition in birds and mammals (human)

Structure of hen's egg, role of albumen, yolk and the extra embryonic membranes (amnion and allantois). Implantation and placenta in humans.

Unit 7 Some special aspects in Developmental Biology

Growth and regeneration, cancer, ageing (senescene).

SuggestedTeaching/Learning Hints Environmental influence on the embryo should be discussed while explaining embryonic development in order to highlight that a pregnant woman can help ensure the well being of the developing foetus.

Suggested Extended Learning : Read about articles on artificial insemination, in-vitro fertilization and other such areas in magazines and newspapers.

MODULE 6: HEREDITY AND GENETICS

Study Time : 30 hrs **Marks : 10**

Approach

This module describes the principles and mechanisms of heredity in determining the characteristics of organisms. It highlights the interaction of genetics and environment in the processes involved in the development of organisms, with special reference to humans. It also deals with Variation which is the result of genetic and/or environmental factors.

Pre-requisite knowledge Basic understanding of the cell structure and cell division.

Unit 1 Principles of Inheritance

Mendel's Law of Inheritance.

Linkage and crossing-over, criss-cross inheritance.

Unit 2 Gene expression and Interaction

One gene one enzyme hypothesis, Incomplete dominance, lethal genes, pleiotropic genes, Polygenic inheritance with example of skin colour in man.

Unit 3 Physical and Chemical basis of Heredity

Basic structure of DNA and RNA, nucleotides and nucleosides, Functions of nucleic acids, replication of DNA, transcription and translation.

Unit 4 Mutation

Definition of mutation, Mutagens-physical and chemical and their effects, Useful and harmful effects of mutation.

Unit 5 Human Genetics

Problems and modern approach to human genetics, human karyotypes, Autosomal and sex chromosomal abnormalities.

Abnormalities due to multiple sets of genomes. Colour blindness haemophilia disorders due to incompatibility of genes.

Rh-factor, ABO blood groups, Amniocentesis.

Unit 6 Genetics and Society

Improvement of plants and animals by selective breeding, gene pool, genetic counselling, genetic engineering and its importance, somatic hybridization and cloning.

Suggested Teaching/Learning Hints Distinction between DNA and varieties of RNA should be discussed.

Social and ethical problems raised by artificial mutagens may be considered.

Suggested Extended Learning Read about 'Genetic drift' with changes in gene frequency by some events.

Read about the contributions of the Nobel Prize winner Hargobind singh Khurana.

MODULE 7 : POPULATION EXPLOSION AND FAMILY PLANNING

Study Time : 10 hrs **Marks : 4**

Approach

This module is designed to bring out the fact of the increase in human population all over the world through the prehistoric and historic times. It aims in providing awareness of the causes and dangers of population explosion in the more recent times. Also it provides adequate information about the methods of family planning and birth control and to remove misconceptions about human birth.

Unit 1 Concept and Definitions

Definitions of population, birth rate, death rate, growth rate.

Unit 2 Trends

Trends in world population and Indian population.

Unit 3 Reasons

Reasons for increased rate of population rise in India

Unit 4 Consequences of overpopulation

Unit 5 Control of Population growth

Importance, need for educating both male and famale adolescents, Higher age of marriage, need for use of contraception during the reproductive age.

Unit 6 Methods of Contraception

Reversible Spacing, Natural, Barrier, Hormonal (Pills and implants,) Devices, Devices plus Hormonal. **Irreversible** Tubectomy, Vasectomy, No-scalpel Vasectomy. Possibility of making reversible contraception.

Suggestion Extended/Learning Hints Find out about the methods and techniques adopted by a demographer in the population studies.

MODULE 8 : ENVIRONMENTAL BIOLOGY

Study Time : 15 hrs **Marks : 8**

Approach

This module emphasises the basic understanding of rules governing the interrelationships in a biotic community. It brings out the basic principle of conservation by pointing out that conservation of natural resources would brighten the prospect of future of mankind. The quality of human life should be improved without disturbing the natural ecosystems.

Unit 1 Ecological Principles

The biotic and abiotic factors in an ecosystem, dependence of plants and animals on their environment, inter-dependence of plants and animals; flow of energy through the biosphere, food chains and food webs, preservation of representative natural ecosystem. Man's place in environment (a general idea).

Unit 2 Spatial Distribution of plants and animals

Biomes General characteristics of the climate and the flora and fauna of the different biomes.

Unit 3 Conservation and use of Natural Resources

(a) Non-Renewable Resources: Primary energy resources and their consumption fossil fuels, minerals.

(b) Renewable Resources-water, wood, natural, pastures.

Conservation of Soil and Water Causes and methods of prevention of soil erosion, fertilizers and manures.

Water management and irrigation.

Conservation of Wild Life Forest and their conservation, endangered species, National parks in India.

Agencies dealing with conservation and wild life sanctaries.

Non conventional sources of Energy Hydropower, wind energy, nuclear power, solar energy, biogas, geothermal energy.

Unit 4 Pollution

Causes, prevention and remedy of different kinds of pollution-air, water, soil, thermal and noise.

Unit 5 Radiation in relation to human life

Kinds of radiation, harmful effects of non-ionising (ultraviolet) and ionising (X-rays, gamma rays and p-particles) radiations, their short term and long term effects, nuclear fall out, strontium-90 and its harmful effects.

Suggested Extended/Learning Hints Collect information about the recent legislation pertaining to conservation of natural resources from newspaper and magazines.

OPTIONAL MODULES

1. TOOLS AND TECHNIQUES IN BIOLOGY INCLUDING LABORATORY TECHNIQUES

Study Time : 30 hrs **Marks : 14**

Approach

This module is designed to enable the learner to familiarise herself/himself with the common laboratory techniques that may help him/her to maintain and look after a biological laboratory from the point of view of teaching as well as research. It includes maintenance of laboratory equipment and precautions necessary to be observed while working in a laboratory.

Unit 1 Short history of invention of simple and compound microscopes.

Unit 2 Basic principle of electron microscope, phase contrast microscope, cytochemistry, autoradiography, paper chromatography, tissue culture, centrifugation.

The historical resume to bring out the origin and growth of biology should be discussed briefly.

Unit 3 General laboratory equipments :-

Thermostats, pH meter, autoclave, calorimeter, distillation units, centrifuge, weighing balance, microtomes, blood pressure instrument, Kymograph.

Unit 4 Preparation of common stains and reagents

Types of stains and reagents, materials required, steps involved.

Unit 5 Maintenance of Botanical garden and Zoological museum aquarium, Herbarium and Green house.

Unit 6 Some techniques

Collection and Methods of culturing organisms for class work, Laboratory care of animals.

Suggested Extended Learning :- Maintenance of laboratory equipments should be discussed.

Precautions that are necessary to be observed while working in a laboratory should also be stressed.

2. ECONOMY BIOLOGY

Study Time : 30 hrs **Marks : 14**

Approach

This module highlights human dependence on agriculture to provide cereals, pulses, beverages, fruits and vegetables for food, fibres of different kinds for clothing and medicine to treat different diseases. The importance of forests and different products obtained from forest plants is also highlighted. Some of the common principles and practices in raising and rearing a variety of animals for their commercial products such as milk, fishes, pearls, silk, lac etc. are discussed. The concept of using vermiculture as a means of biodegradation leading to production of good manure is described.

Unit 1 Agriculture : Human dependence on agriculture:- Different kinds of Crops; cereals, oil seeds, sugarcane, fibres (cotton, flax, jute, leaf fibres coconut fibres,) cotton and jute, vegetables pulses and fruits-Green revolution, farm management including irrigation, storage, marketing of the product kitchen gardening.

Beverages :- Sources, processing and nutritional value of coffee, tea, coco, soya milk.

Unit 2 Mushroom culture, Floriculture and Hydroponics:- Brief information about each of these methods.

U**nit 3 Medicinal Plants** Concept of general value of - Amla, Mahua *Cinchona, Atropa belladona, Pinus, Pterocarpus, Opium, Datura, Ocimum, Eucalyptus, Rauvolfia, Neem.*

Unit 4 Forest Wealth Importance of forest, different products-paper, plywood, rubbergums, resin.

Unit 5 Animal Husbandry General principles of raising and caring of animals useful for human, proper management for their products like milk, butter, ghee, meat, hides, wool, leather. Poultry farming.

Unit 6 Fisheries An elementary idea of fresh water and marine fisheries. Different kinds of common edible fish-their rearing and breeding. Pearl fisheries.

Unit 7 Apiculture and Lac Culture General acquaintance with bee keeping and honey extraction, uses of honey and wax. An elementary idea of lac insect and lac production.

Unit 8 Sericulture and Vermiculture:- A general idea about sericulture, different kinds of silk moths, their rearing and silk reeling. Types of silks. Idea of rearing of economically useful worms like earthworm.

3. HEALTH SCIENCES

Study Time : 30 hrs **Marks : 14**

Approach

This module aims at creating awareness regarding the need of proper hygiene for maintenance of individual health. It also imparts knowledge regarding the need for a healthy social environment around a person. The role of proper and balanced nutrition to prevent nutritional deficiency diseases is also highlighted. The types, causes and modes of transmission of human diseases, the common symptoms, prevention and methods of control of some common communicable diseases are discussed. Non-Communicable diseases and their causes are also highlighted. It also attempts to create awareness about the symptoms and prevention of sexually-transmitted diseases.

Unit 1 Concept of Health and Hygiene Definiation and meaning of health, need for good health/concept of ill health, concept and importance of hygiene for maintenance of good health.

Unit 2 Nutrition and Health Nutrition, macro and micro nutrients, sources of nutrients need for balanced diet, calorific needs of persons in various occupations; nutrition during pregnancy and lactation.

Unit 3 Nutriotional disorders Kwashiorkor, Marasmus, disorders due to mineral deficiency namely iron, iodine and calcium; disorders due to vitamin deficiency; overeating-obesity; risk of intake of overdoses of iron and vitamin.

Unit 4 Dangers of Drug Addiction Harmful effects of addictive drugs and beverages; rehabilitation of a drug addict.

Unit 5 Hygiene Types of hygiene - personal, domestic, community with emphasis on social nuisances like spitting, nose-picking, urination, defaecation, throwing garbage and other common insanitary habits.

Unit 6 Disease Disease, its definition, types, transmission of disease, parasite, pathogen, infection, infestation, vector, carrier, host.

Unit 7 Communicable Disease Categories, communicable diseases with examples; causes and common symptoms prevention and control of some common communicable diseases-Chicken pox, Measles, Polimyelitis, Hepatitis, Rabies, Bacterial Dysentery, Diphtheria, Cholera, Tuberculosis, Leprosy, Malaria, Typhoid, Amoebiasis, Filariasis, Transmission of disease (e.g. German Measles) during pregnancy.

Unit 8 Non-Communicable disease Heart disease, Hypertension, Diabetes, Arthritis, Osteoporosis, Cancer and Allergy.

Unit 9 Sexually Transmitted Diseases Syphilis, Gonorrhoea, AIDS - awareness, symptoms and prevention.

4. EMMERGING AREAS IN BIOLOGY - BIOCHEMISTRY, BIOTECHNOLOGY AND IMMUNOLOGY

Study Time : 30 hrs **Marks : 14**

PART A Biochemistry

Approach

This module is intended to make the learner understand that all living beings are the outcome of chemical activities. It describes the nature of various biologically important molecules such as water, amino acids as well as the structure and function of the macromolecules such as the proteins, lipids and nucleic acids.

Unit 1 Introduction to Biochemistry:- Elements found in living organisms.

Unit 2 Simple biologically important Molecules water, amino acids, sugars, (pentoses and hexoses), fatty acids, aromatic bases.

Unit 3 Macromolecules Structure and function of carbohydrates, proteins and lipids.

Conjugated proteins (e.g. glycoprotein, phospholipids)

Unit 4 Metabolism of carbohydrates, proteins and lipids Regulation of metabolism

Unit 5 Translation and Transcription

PART B : Biotechnology

Approach

Biotechnology is emerging as an exciting endeavour of human technological excellence in Biology. This module provides ideas about the manipulation of genetic makeup (genetic engineering) in order to harvest important biological products, useful transgenic organisms and normal genes for gene therapy.

Unit 1 Uses of biological processes in industry Use of fermenting yeast to produce alcohol used as beverages and in industry, yoghurt production, use of micro-organisms in production of antibiotics.

Unit 2 General idea of Genetic Engineering Manipulation of genetic make-up to produce cheaply and on a large scale proteins and hormones (insulin, blood serum, proteins etc.) and other products of commercial and medical importance.

Unit 3 General idea of Transgenic Organisms Basic concept of transgenic organisms, Transgenic animals (with one example), Importance of transgenic organisms.

Unit 4 Biogas Production Use of microbes in producing biogas.

Unit 5 Gene therapy in humans:- Insertion of good genes into humans to counteract harmful mutation and treat disorder such as diabetes, sickle-cell anemia, etc.

PART C : Immunobiology

Approach

Immunobiology is a fast growing field in Biology. The humans are constantly faceing various kinds of infections. Such infections most often are counteracted and not allow to flourished inside the body by an efficient immune system. Whenever the immmune system for one reason or the other reason get weakened then the particular disease appear. In this way the importance of immune system is being realised. In this module you will be able to gain an insight into this immune system and learn about its intricacy.

UNIT 1 Introduction Types of defence mechanisms in the body

(i) Skin, mucous membrane of eyes, nose etc.

(ii) Immune system.

Unit 2 Tissues and organs involved in the immune system Cell types involved (T cells, B cells, macrophages)

Unit 3 Definition of antigen, antibody General account of humoral and cell mediated immune response

Unit 4 Types of immunity:-

Natural

Acquired : active and passive

Unit 5 Active Immunization (vaccines):- List of vaccines available against diseases.

Unit 6 Effect of HIV on immune system.

Unit 7 Definition of Allergens

PRACTICAL WORK

Purpose

The purpose of teaching biology is not only to acquaint the learners with biological terms, facts, concepts and principles but also to develop practical skills. Development of practical skills leads to better understanding through first hand experience and mutual reinforcement. It takes into account the development of psychomotor skills. Since this is an important aspect of development, the present biology course considers practical work as an integral part of the theory.

The skills which the present course intends to develop are :-

(i) observational skills in the form of identifyig relevant details in given specimens, locating the desired parts in a dissection or specimen.

(ii) manipulative skills in the form of arranging, handling and reading apparatus and instruments.

(iii) dissectional skills.

(iv) collecting, mounting and preserving skills.

(v) drawing, labelling and reporting experimental results and thereby interpreting it.

List of Practicals

A) For Core Modules

1. Preparing stained glycerine mounts of
   i) Epidermal peel of onion, squamous epithelium of frog, squash preparations of root tip of onion to show mitotic stages.
   ii) Collenchyma, sclerenchyma, parenchyma from transverse sections of petiole (preferably Datura)
   iii) Xylem and phloem from a cucurbit stem by cutting transverse section
   iv) Striated and non-striated muscle (cockroach)
2. Demonstration of the structure of root, stem, leaf (of both dicot and monocot) with the help of prepared slides.
3. Study of cartilage, bone (mammalian long bone), blood (frog and man) and sections of liver, kidney, testis, ovary and skin of mammal (from prepared slides).

4. To perform experiments to demonstrate and/ or determine
   - i) Osmosis in potato/carrot
   - ii) Plasmolysis in *Rhoeo/Tradescantia* leaf
   - iii) Stomatal count and its correlation with transpiration from the two surfaces in a bifacial leaf using cobalt chloride paper.
   - iv) Rate of photosynthesis in *Hydrilla* (or any other aquatic plant) in normal, green and red lights (by counting the number of bubbles liberated per minute).
   - v) Evolution of CO_2 during germination of seeds;
   - vi) Action of salivary amylase on starch;
   - vii) Chemical test of abnormalities in urine (sugar and albumin)
5. Examination of prepared slides/specimens to study the life history of the following
   - i) *Chalmydomonas* (vegetative)
   - ii) *Spirogyra* (vegetative and conjugation)
   - iii) Mucor/*Rhizopus* (all stages)
   - iv) Moss *(Funaria)* Gametophyte and Sporophyte
   - v) Fern *(Pteris/Dryopteris)*-Prothallus, Sporophyte, Sporangium
   - vi) *Pinus*-Long and Dwarf Shoots, Male and Female Cones, Slide of Pollen Grains.
   - vii) Flowering plant-study of floral parts of China Rose/Holly Hock and petunia, their floral formulae and floral diagram.
6. Identification with distinguishing features and classification upto classes, of the following:-

   Paramecium, Sponge, *Hydra,* Tapeworm, Liverfluke, Leech, Butterfly/Moth, Housefly, Scorpion, *Pila,* Starfish, Dogfish, Rohu, Toad, Wall-Lizard, Snake, Pigeon, Bat.
7. Identification of life history stages of silk moth.
8. Identification of frog-egg, cleavage, blastula, gastrula, neurula (whole mount or section from prepared slides), tadpole.
9. Demonstration of live sperm from rat.
10. Dissection/Demonstration of the general viscera of rat to expose and flag label the following parts:

    Stomach, appendix, liver, spleen, pancreas, diaphragm, heart, dorsal aorta, kidney, adrenals, testis/ovary.

PRACTICAL EXAMINATION

There will be a practical examination of 3 hours duration and Maximum marks 20, apart from the theoretical examination. The distribution of marks is as follows:-

		MARKS
(i)	Performing an experiment	4
(ii)	Submitting a project	2
(iii)	Identification of given samples (4 samples)	3
(iv)	Preparing mounts	3
(v)	Maintenance of Record Book	3
(vi)	Viva Voce	5
		..... 20 .....