

CURRICULUM OF SENIOR SECONDARY COURSE IN BIOLOGY (314)

RATIONALE

Biology arose in a two fold manner - firstly, as a practicing 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 curiosity to know about humans and other living beings and to understand their position 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. The Course in biology helps us to respect and appreciate the great diversity in living things at all levels of organization and to understand the impact of development in biology on our life style.

Biology is not merely a correlational science but also an experimental discipline, which deals with different tools and techniques used in biological studies. In most of the activities that we perform, biology has a role to play. Therefore, the present course aims at imparting biological knowledge vis-a-vis the ever growing human needs. Besides integrating the content and the depth to which it could be dealt with, recent advancements in concepts as well as emerging areas like biotechnology and immunology have also been introduced.

OBJECTIVES

The course would enable the learner to,

- acquire knowledge of biological terms, facts, concepts, principles and processes in order to understand the living world as a whole;
- appreciate diversity in the living world as

also the interrelationships of various living organisms, ecological balance in nature, and the role of biology in human welfare;

- visualize the hazards of environmental pollution, and to create awareness for sustainable use of natural resources in the service of humankind;
- develop insight into the role and impact of Biology in various allied areas such as medicine, agriculture, forestry, biotechnology, veterinary sciences and pharmacology etc.;
- develop interest in the living world with an aim to respect life.

As a part of this process, the curriculum also aims at developing the following abilities in the learners such as to –

- apply knowledge and understanding of biology in situations which are novel and unfamiliar by developing abilities to analyze, hypothesize, draw conclusions and predict results;
- develop skills in handling and improvising scientific apparatus, and recording observations and data;
- inculcate scientific attitude and practice it in day to day life.

COURSE STRUCTURE

The present curriculum contains 5 Core modules and 2 Optional modules. The Core modules are compulsory for all learners, whereas, the learner

can choose any one of the two Optional modules. Thus, each learner learns six modules in all. Each module has been divided further into units

and then into lessons. The number of lessons, suggested study time and marks allotted for each unit is as follows:

Unit wise Distribution of Core Modules	Number of lessons	Study hours	Marks allotted	
			Unit	Modules
Module 1 : Diversity and Evolution of Life				
1.1 Origin and evolution of life and Introduction to Classification	3	30	8	12
1.2 Cell and Tissues	2	15	4	
Module 2 : Forms and Functions of Plants and Animals				
2.1 Plants - Morphology and Physiology	7	35	10	20
2.2 Animals - Morphology and Physiology	5	30	10	
Module 3 : Reproduction and Heredity				
3.1 Reproduction, Growth and Development	3	30	10	18
3.2 Principles and Applications of Genetics	3	25	8	
Module 4 : Environment and Health				
4.1 Environment and its Conservation	3	20	7	13
4.2 Healthy Living	2	15	6	
Module 5 : Emerging Areas in Biology	2	10	5	5
Optional module 6A				
Tools and Techniques in Biology	5	30	12	12
Or				
Optional module 6B : Economic Biology	5	30	12	
Theory examination		3 hr	1 paper	80
Practical Examination		3 hr	1 paper	20
Total				100

COURSE DESCRIPTION

Introduction to Biology (Non-Evaluative)

Biology and its branches, relationship with other sciences, scientific methodology, historical breakthroughs, recent advancements and careers in biology.

Module 1 Diversity and Evolution of Life

Time: 45 hr

Marks : 12

Approach

This module would enable the learner to visualize the origin of life on earth and the vast diversity in the living world, and also to group them together at various classification levels. It also intends to stimulate our learner to understand the concepts and theories of evolution. The module also highlights the cell as the basic unit of life and its organization into various forms of tissues.

Unit 1 Evolution and Classification of Organisms

Time: 30 hr

Marks : 8

1.1.1 Origin and Evolution of Life and Introduction to Classification

Characteristics of life, origin of life, spontaneous generation, Oparin-Haldane theory, Stanley Miller's experiment, organic evolution, evidence of evolution, sources of variation, natural selection, isolation and speciation.

Need for classification of organisms, principles of classification and taxonomic categories, Linnaeus and binomial nomenclature, position of virus, characteristics, structure and habit of virus, infective properties of viruses (general account of TMV, Polio, HIV, Influenza virus, Bacteriophage).

Scheme of five kingdom classification, merits and demerits of five-kingdom classification.

Supportive Video Programmes

- Origin and evolution of life

1.1.2 Kingdoms Monera, Protocista and Fungi

Kingdom Monera - General structure and characteristics of bacteria and cyanobacteria with examples.

Kingdom Protocista - General structure and characteristics of protozoa and algae with common examples.

Kingdom Fungi - General characteristics of fungi with common examples.

1.1.3 Kingdoms Plantae and Animalia

Classification and characteristics of Plantae up to division - Algae, Bryophyta, Pteridophyta, Spermatophyta, classification of Spermatophyta upto classes - Gymnospermae and Angiospermae, Dicotyledonae (Malvaceae and Fabaceae) and Monocotyledonae (Poaceae and Liliaceae).

Classification and characteristics of Kingdom Animalia upto phyla - Porifera, Cnidaria, Platyhelminthes, Aschelminthes, Annelida, Arthropoda, Mollusca, Echinodermata, Hemichordata, Chordata, Classification of Arthropoda and Chordata upto classes, class Mammalia upto major orders.

Supportive Video Programme

- Hierarchy in plant kingdom
- Hierarchy in animal world

Unit 2. Cell and Tissues

Times 15 hr

Marks: 4

1.2.1 Cell - the basic unit of life

Cell - Cell theory, prokaryotic and eukaryotic cells, animal and plant cells.

Cell organization - plasma membrane, cell wall, cytoskeleton, endoplasmic reticulum, cilia and flagella, nucleus, ribosomes, mitochondria, chloroplasts, golgi bodies, centrosome, peroxisomes, cell inclusions.

Cell molecules - water, mineral ions, carbohydrates, lipids, amino acids, proteins, nucleotides, nucleic acids, enzymes, vitamins, hormones, steroids and alkaloids.

Cell cycle - significance of mitosis and meiosis, karyotype analysis.

Supportive Video Programme

- The cell
- Cell cycle

1.2.2 Tissues

Plant Tissues - classification, structure and functions of meristematic and differentiated tissues.

Animal tissues - structure and functions of epithelial, connective, muscular and nervous tissues.

Supportive Video Programme

- The tissues

Module 2 Form and Functions of Plants and Animals

Time : 65 hr

Marks : 20

Approach

This module highlights the complex nature of the structure and function of the different organ systems in plants and animals with special emphasis on the life processes.

Unit 1. Plants - Morphology and Physiology

Time : 35 hr

Marks: 10

2.1.1 Root System

Characteristics and regions of root, primary structure of dicot and monocot roots, secondary growth in dicot roots, types and modifications of roots, common functions of roots.

2.2.2 Shoot System

Characteristics of stem, structure of monocot and dicot stems, difference between dicot and monocot stem, secondary growth in stem: wood, origin of lateral branches, types and modification of stem, functions of stem.

Structure and modifications of leaf, internal structure of a typical dicot and monocot leaf, stomata, hair and hydathodes, phyllotaxy.

Flower - Parts of flower, arrangement of various floral parts, placentation, inflorescence, major types of inflorescence.

Fruit - Definition, structure, major categories, edible parts of common fruits.

Supportive Video Programme

- Morphology of Plants

2.1.3 Absorption, Transport and Water Loss

Water relation - permeability, diffusion, osmosis, plasmolysis, active and passive absorption and movement, imbibition, water potential, Transpiration - The process and its significance, factors affecting rate of transpiration, opening

and closing mechanism of stomata (potassium ion theory), factors affecting stomatal movements, guttation and factors affecting rate of guttation, translocation of solutes.

Supportive Video Programme

- Transpiration in plants

2.1.4 Plant Nutrition

Mineral nutrition, functions of minerals (aeroponics and hydroponics), macro and micro nutrients, deficiency symptoms of elements, mode of nutrition in plants - autotrophic, heterotrophic, saprophytic, parasitic and insectivorous plants.

2.1.5 Nitrogen Metabolism

Molecular nitrogen, nitrogen fixation (biological and abiological both), nitrogen fixation by free living organisms and symbiotic nitrogen fixation, nitrate and ammonia assimilation by plants, amino acid synthesis by plants.

2.1.6 Photosynthesis

The process and its significance, site of photosynthesis (functional aspect of chloroplast structure), photosynthetic pigments photochemical aspects of photosynthesis, photophosphorylation (cyclic and non-cyclic), C₃ and C₄ pathways, factors affecting photosynthesis, chemosynthesis.

Supportive Video Programme

- Food manufacturing and utilization by plants

2.1.6 Respiration

Aerobic and anaerobic respiration, respiratory quotient, glycolysis, Krebs cycle, pentose phosphate pathway, factors affecting respiration (excluding biochemical pathways), fermentation, photorespiration.

Unit 2. Animals -Morphology and Physiology

Time: 30 hr

Marks : 10

2.2.1 Nutrition and Digestion

Nutrition and its types, digestive system of invertebrate (Cockroach), digestive system and

process in humans (ingestion, digestion, absorption, assimilation, egestion), intracellular and intercellular digestion, role of enzymes and hormones in digestion.

Supportive Video Programme

- Nutrition and food utilization

2.2.2 Respiration and Nitrogenous Waste Elimination

Respiratory organs of humans, mechanism of breathing and its regulation, gaseous transport through blood and tissue respiration, gaseous exchange in animals (earthworm/cockroach), common respiratory disorders - prevention and cure.

Ammonotelism, ureotelism, uricotelism, urinary system in cockroach and humans, finer structure of mammalian kidney, ultrafiltration and urine formation, role of kidney in osmoregulation, kidney failure, dialysis, kidney transplantation, role of Antidiuretic Hormones (ADH), role of liver in excretion.

Supportive Video Programme

- Respiration in humans

2.2.3 Circulation of Body Fluids

Types of blood circulation, open circulatory system in cockroach, circulatory organs in humans, 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), blood related disorders - hypertension, atheroma and arteriosclerosis, ECG, pacemaker.

Supportive Video Programme

- Circulation of body fluid

2.2.4 Coordination and Control

Central and Peripheral Nervous System in humans, structure and function of brain and spinal cord, transmission of nerve impulse, reflex action, sensory receptors, sense organs - structure and functions.

Endocrine glands, nature and role of hormones, an elementary knowledge of pheromones, hormonal imbalance and diseases, role of hormones as messengers and regulators - hypothalamo-hypophyseal axis, feed-back mechanism.

Supportive Video Programmes

- Nervous system in humans
- Chemical regulation in humans

2.2.5 Homeostasis

Concept, regulation of body fluids, feedback mechanism - positive and negative, thermoregulation including skin.

Module 3 : Reproduction and Heredity

Time : 55 hr

Marks: 18

Approach

This module is designed to highlight the diverse methods of reproduction in living beings from unicellular organisms to complex forms including humans. This module highlights the increase in human population all over the world and also provides adequate information about the methods of family planning and birth control. The principles and mechanisms of heredity in determining the characteristics of organism has also been discussed in this module.

Unit 1. Reproduction, Growth and Development

Time : 30 hr

Marks: 10

3.1.1 Reproduction in Plants

Vegetative, asexual and sexual reproduction in lower plants (general account), reproduction in flowering plants - juvenility, flowering, factor affecting flowering (photoperiodism), flower as a reproductive organ, development of gametes in flowering plants, pollination - types and agencies, adaptation to promote cross pollination, fertilization and seed formation, seed - structure

of dicot and monocot seeds, seed germination, parthenocarpy.

Natural and artificial vegetative propagation, advantages and disadvantages of vegetative propagation, micropropagation, advantages of micropropagation.

Supportive Video Programmes

- The flower
- Pollination
- Vegetative Propagation
- Seed germination

3.1.2 Growth and Development in Plants

Definition of growth and development, growth curve, growth regulators (phytohormones) - Auxins, gibberellins, cytokinins, ethylene, abscissic acid; seed germination - mechanism and factors affecting germination, role of growth regulators in seed dormancy, vernalisation, senescence, abscission, stress factors (salt and water), measurement of growth, plant movements - geotropism, phototropism, turgor growth movements (tropic, nastic and turgor), phytohormones and their role in plant development.

3.1.3 Reproduction in Humans and Population Management

Female and male reproductive organs, histology of gonads, gametogenesis, fertilization, cleavage, blastulation, gastrulation, fate of germ layer (general account only), embryonic development and nutrition, childbirth, twins, growth, ageing and senescence, death, in-vitro fertilization.

Demography - birth rate, death rate and population growth rate, position of India in world population, consequences of over population management of population growth, methods of contraception.

Unit 2. Principles and Applications of Genetics

Time: 25 hr

Marks: 8

3.2.1 Principles of Genetics

Heredity and variation, Mendel's laws of inheritance, incomplete dominance, lethal genes, pleiotropic genes, polygenic inheritance with examples, chromosomal basis of inheritance, linkage and crossing over, criss-cross inheritance, maternal inheritance.

Human karyotypes, autosome and sex chromosomes, abnormalities due to multiple sets of genome - colour blindness, haemophilia, Down syndrome (Mongolism), Turner syndrome, Klinefelter syndrome, Rh factor, ABO blood group, amniocentesis, human genome.

Supportive Video Programmes

- Aspects of Human Genetics
- Genetic Disorders

3.2.2 Molecular Inheritance and Gene Expression

One-gene-one enzyme hypothesis, discovery of DNA as genetic material, structure of DNA and RNA, types of RNA, functions of nucleic acids, DNA replication, protein synthesis, transcription and translation, house keeping genes, regulation of gene expression, positive and negative control systems, Operon model, mutations and their types, mutagens, useful and harmful effects of mutation.

3.2.3 Genetics and Society

Genetics through ages, recombinant DNA technology, gene cloning, gene bank, Polymerase Chain Reaction, DNA fingerprinting, genomics, genetic engineering and its importance, transgenic plants, animals and microbes, genetic counselling.

Supportive Video Programme

- Genetics and Society

Module 4 Environment and Health

Time: 45 hr

Marks: 13

Approach

This module emphasizes 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 humankind. This module aims to create an idea about healthy living. It also imparts knowledge regarding role of proper and balanced diet to prevent nutritional deficiency diseases. The types, causes and modes of transmission of human diseases are discussed in this module. This module also intends to make the learner understand various types of pollution and its control.

Unit 1. Environment and its Conservation

Time: 20 hr

Marks : 7

4.1.1 Ecological Principles

Biotic and abiotic factors in ecosystem, interrelationship between plants and animals, energy flow in the biosphere, food chain, food web, man's place in the environment, biomes, flora and fauna of different biomes.

Supportive Video Programmes

- Energy Flow in Biosphere

4.1.2 Conservation and use of Natural Resources

Types of natural resources – non-renewable and renewable with examples, need for conservation and restoration, Indian traditions of conservation of nature, conservation of soil, water and biodiversity, endangered and threatened species, wildlife reserves in India, agencies (national and international) dealing with conservation of wildlife, environmental legislation, sustainable development, conventional and non-conventional sources of energy (hydel, wind, tidal, nuclear, solar, geothermal, hydrogen energy, biogas and bio fuels), depleting energy resources, conservation of energy.

Supportive Video Programmes

- Our Biodiversity Richness
- Non-conventional Sources of Energy

4.1.3 Pollution

Causes, prevention and control of different kinds of pollution (air, water, thermal, soil, noise and radiation), entry and translocation of pollutants in our body, waste management.

Supportive Video Programmes

- Air pollution
- Water pollution
- Noise pollution
- Waste management

Unit 2. Healthy Living

Time: 15 hr

Marks: 6

4.2.1 Nutrition and Health

Health and nutrition, types of nutrients - macro and micronutrients, sources and functions of carbohydrates, fats, proteins, vitamins, minerals, water and roughage; energy requirement of the body, balanced diet, balanced diet for special needs growing children, persons in different occupations, pregnant and lactating mothers, deficiency diseases - Protein Energy Malnutrition (PEM), mineral deficiency and vitamin deficiency with examples - hypervitaminosis, obesity, food-fads.

Supportive Video Programme

- Nutritional Deficiency Disorders

4.2.2 Diseases

Definition, types and transmission of diseases, define - parasite, pathogens, infection, infestation, vector; causes, symptoms, prevention and control of some common communicable diseases - influenza, measles, polio, hepatitis, tuberculosis, diphtheria, leprosy, malaria, filariasis and dengue; cardiovascular diseases - diabetes, osteoporosis, cancer, allergy, syphilis, gonorrhoea and AIDS (awareness, symptoms and prevention), drug abuse.

Supportive video Programmes

- Mosquito- the flying menace
- Housefly- the enemy no-1

Module 5 Emerging areas in Biology

Time: 10 hr

Marks: 5

Approach

This module has been included in the Biology course to familiarize the learners with the importance of the new emerging areas of biology like Biotechnology and Immunology which have an impact on human lifestyles.

5.1.1 Biotechnology

Introduction, industrial biotechnology (alcohol, beverages, yoghurt, cheese, vinegar, antibiotics), general idea of genetic engineering, importance of transgenic organisms, gene therapy, bioremediation, biopesticides.

Supportive Video Programme

- Biotechnology and Human welfare

5.1.2 Immunology

Types of defense mechanisms of body, cells of immune system (T-cells, B-cells, macrophages), antigens and antibodies humoral and cell mediated immune response, types of immunity, immunization.

Supportive Video Programme

- Biology in Industry

OPTIONAL MODULE I

Tools and Techniques in Biology

Time: 30 hr

Marks : 12

Approach

This module is designed to enable the learners to familiarize themselves with the common laboratory techniques that may help them to maintain and look after a biological laboratory equipment and take precautions necessary to be observed while working in a laboratory.

6.1 General Laboratory Equipment

Incubator, pH meter, autoclave, colorimeter, water distillation unit, spectrophotometer,

centrifuge, weighing balance, microtome, sphygmomanometer (blood pressure instrument), kymograph, haemocytometer.

Supportive Video Programme

- General Laboratory Equipments and Their Uses

6.2 Common Tools and Techniques

Microscopy - Simple, compound, electron and phase contrast microscopes, histochemistry, autoradiography, paper-chromatography, tissue culture, centrifugation.

Supportive Video Programme

- The Biology Laboratory

6.3 Some Common Preservatives, Stains and Reagents

Types of stains, reagents and preservatives, materials required, procedure involved, organization of typical biology laboratory.

6.4 Culturing Organisms for Laboratory Work

Preparation for culturing organisms, common organisms cultured in the lab - E. coli, Paramecium, Amoeba, Hydra, Rhizopus, Drosophila, Yeast, onion root tip, rearing animals in animal house, cage management, equipment required for collection of flora and fauna - vasculum, plant press and nets.

Supportive Video Programme

- Culturing Organisms for Biology Laboratory

6.5 Some Aids in Biology

Maintenance of botanical garden and zoological museum, aquarium, herbarium and greenhouse.

Supportive Video Programme

- The Zoological Museums

OPTIONAL MODULE II

Economic Biology

Time : 30 hr

Marks: 12

Approach

This module highlights human dependence on agriculture to provide cereals, pulses, fruits and vegetables for food, different kinds of fibres for textiles etc. and medicines to treat different diseases. The importance of forests and different forest products is also highlighted. Some common practices in raising and rearing a variety of animals through animal husbandry are also dealt with in this module.

6.1 Agriculture, Forestry and Medicinal Plants

Role of agriculture in sustenance of human life, agriculture importance of cereals, pulse crops, vegetable crops, fruit crops, oil seed crops, sugarcane and fibre crops; green revolution, farm management, kitchen garden, forest and its importance and different products- paper, plywood, rubber, gums, resins; medicinal plant products [general value of *Emblica officinalis* (amla), *Madhyca indica* (mahua), *Cinchona officinalis* (Quinine), *Atropa belladonna* (Belladonna), *Pinus sylvestris* (Pinus), *Papaver somnifera* (Opium), *Datura stramonium* (Dhatura), *Occinum sanctum* (Tulsi), *Eucalyptus globula* (Safeda), *Rauwolfra scelpenlinzi* (Sarpagandha), *Azadirachta indica* (Neem), *Chilophera indica*, *Aloevira*, *Phyllanthus*, *Catharanthus roseus* (Periwinkle or Sadabahar), *Taxus*].

Supportive Video Programme

- Medicinal plants in India
- Silviculture

6.2 Floriculture, Mushroom Culture and Hydroponics

Floriculture, ornamental plants, herbs, shrubs, trees, climbers, bulbous plants, indoor plants,

terrariums, designing a home garden, mushroom culture, hydroponics.

Supportive Video Programme

- Floriculture
- Mushroom culture
- Hydroponics

6.3 Animal Husbandry

General principles of raising and caring of animals useful for human, proper management of their products like milk, butter, ghee, meat, hide, wool, leather, poultry farming.

Supportive Video Programme

- Animal Husbandry

6.4 Fisheries and Aquaculture

Fisheries, common edible fish found in India, economic importance of fish, effect of environmental pollution on fish, fishing technology, fish migration, aquaculture.

Supportive Video Programme

- Fisheries
- Aquaculture

6.5 Apiculture, Lac Culture and Sericulture

Apiculture, Indian species of honey bees, bee colony, commercial production of honey and other products from a bee hive, brief account of lac culture; sericulture history and sources of silk, rearing of silkworm, reeling of silk.

Supportive Video Programme

- Lac culture
- Sericulture

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 identifying 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) collecting, mounting and preserving skills.
- (iv) drawing, labelling and reporting experimental results thereby interpreting them.

List of Practicals

A. For Core Modules

1. To study parts of a compound microscope.
2. To prepare temporary stained glycerine mounts of
 - (i) epidermal peel of onion
 - (ii) cheek cells of humans
 - (iii) epidermal peel of leaf to observe stomata
 - (iv) T.S. of stem to observe xylem and phloem
 - (v) striated muscles from cockroach leg.
3. To study the various modifications in root, stem and leaf
 - (a) Root
 - (i) Storage (carrot/beet root/radish)
 - (ii) Support -Prop root, stilt root
 - (b) Stem
 - (i) Underground - Rhizome, tuber, corm, bulb
 - (ii) Aerial - Tendril, thorn, phylloclade, cladode
 - (c) Leaf
 - (i) Tendril
 - (ii) Spine
 - (iii) Phyllode
4. To observe and study the T.S. of dicot and monocot root and stem from permanent slides.
5. To study the microscopic structure of human cartilage, bone, blood, testis and ovary from permanent slides.
6. To study the structure and function of different parts of the following flowers : China rose, Petunia
7. To identify the characteristic features of the following animals and classify upto class sponge, earthworm, butterfly, snail, starfish, bony fish, cartilaginous fish, toad, house lizard, pigeon and bat.
8. To study the stages of mitosis from temporary stained mount of onion root tips.
9. To study the morphological adaptations of (a) plants living in xeric and aquatic habitats e.g. cactus and water hyacinth. (b) animals to parasitic mode of life e.g. tapeworm.
10. To study the (a) texture and (b) water holding capacity of two different types of soils.
11. To study osmosis by potato osmometer.
12. To study the rate of photosynthesis in aquatic plants.
13. To study the structure and germination in gram and bean seeds.
14. To demonstrate respiration in germinating seeds.
15. To study the action of salivary amylase on starch.

B. Optimal module - Three sample projects are mentioned below. A project carries 3 marks. You may choose one of these or devise a project of your choice from the optional module.

- (i) Make a herbarium with 10 to 15 plants. Collect press and stick them on the herbarium sheets. Write their names and classification and present the herbarium at the time of the examination.
- (ii) Take water in an old bulb or jam bottle. Grow a small piece of money plant (*Pothos*) with one or two leaves in the bottle. Observe

and record time taken for (i) new roots and (ii) leaves to come (iii) increase in length of stem.

- (iii) Culture *Drosophila* by collecting them from the fruit market on an overripe banana in a clean jam bottle. Identify the red eyed *Drosophila*. They would lay eggs on the banana. From the second day onwards observe and record the time taken for larval life, pupal life and emergence of adult of new generations. Record your observations and present in the form of a project.

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

(i) Performing an experiment	4 marks
(ii) Submitting a project	3 marks
(iii) Identification of given samples (4 sample)	4 marks
(iv) Preparing mounts	3 marks
(v) Maintenance of record book	3 marks
(vi) Viva-voce	3 marks
Total	20 marks

SCHEME OF EVALUATION

The learners will be evaluated through Public Examination and through continuous and comprehensive evaluation in the form of Tutor Marked Assignments (TMAs).

Mode of evaluation	Duration	Marks	Paper
Public examination	3 hrs	80	1
Practical examination	3 hrs	20	1
TMA-I and TMA-II	Self-paced	25	
TMA-III (Compulsory)	Self-paced	25	

The awards/grades of TMA will be reflected in the mark sheet separately. The award will not be considered for inclusion in overall grading in the Public Examination.