GENERAL CERTIFICATE OF EDUCATION

(ADVANCED LEVEL)

BIOLOGY

SYLLABUS (REVISITED)

For G.C.E. (A/L) Examinations to be held in 2012 and onwards

Department of Science, Health & Physical Education
Faculty of Science & Technology
National Institute of Education

1.0 Introduction

Biology as the scientific study of living organisms is essential for all individuals to co-exist successfully with biotic and abiotic environment.

Study of Biology is important in a number of aspects**;**

1 To have a broad overview of the concepts, principles and theories related to organisms.
2 To seek solutions and alternatives for the current issues faced by mankind such as HIV pandemic, cancers, reduced agricultural production, environmental degradation etc.
3 To develop awareness to foster values related to nature and to conserve the environment.

The Biology syllabus for G. C. E. (A/L) has also been developed on competency based, student centered and activity oriented approach with the intention of developing personal skills, interpersonal skills and thinking skills of the target student populations. This syllabus is in par with international syllabi of this subject at this level.

Revision of the Biology syllabus has been done taking in to consideration the requirements of students who enter tertiary level education as well as the majority which follow other carrier paths. Apart from that, the enhanced knowledge of biological principles and their applications are beneficial in day to day life pursuits and the needs of the society.

Major changes introduced under this syllabus revision are as follows;

- Classroom dissections on animals have been totally omitted in the new Biology curriculum, due to ethical concerns. Models, diagrams and virtual dissections are proposed to replace the teaching of relevant subject areas.
- The number of units in the Biology syllabus has been increased to 14 units from the present 9 units.
  The significant change in number of units is due to the fact that Functioning plant and Functioning animal units in the present syllabus have been divided into units, considering the main physiological functions of plants and animals. This will enable the student to develop an integral approach towards plant and animal physiological functions.

- The practical activities are expected to be incorporated with the theoretical components in the teaching learning process. Follow up practical sessions and activities could be done according to the requirement.
- Basic statistics unit has been omitted with the intention of reducing the subject content.
- Classification and nomenclature is covered under Diversity of organisms unit. Domain as a hierarchical level in classification of organisms has been introduced, keeping in par with the present system of classification.
- Details of reproductive structures in the life cycles of plants have been omitted and life cycles of Fungi have been totally omitted.
- Taxonomic classification in Kingdom Animalia has been demarcated clearly and classes in Kingdom Protozoa have been revised.
- Social problems of using genetically modified organisms and legal limits in releasing waste water according to Sri Lankan standards have been introduced to focus on the issues pertaining to developmental activities caused by man.
- Prions have been introduced as an important disease causing agent.
- Ecosystems in Sri Lanka have been elaborated with a view to familiarize the vast diversity of Sri-lankan ecosystems.
- Aquatic plants as cultured organisms have been introduced in Applied Biology unit. Some pests have been omitted and some others have been introduced considering the current prevalence.
- Plant diseases caused by microorganisms have been addressed in general, instead of emphasizing on important diseases of paddy as in the present syllabus.

The syllabus implemented from 2009 was revisited in 2011 and the following amendments were introduced.

- The total number of periods for the syllabus has been prescribed as 480.
- Competency level 5.1.1
    - Structure of tracheal systems of insects and gills of bony fish not necessary.
- Competency level 6.1.7
    - Blood tests as diagnostic tools (Methods and equipment not necessary)

- Competency level 8.1.2
  - Details of fine structure of excretory structures not necessary
- Competency level 9.1.4
  - Types of locomotary movement (Details of fine structure of the following not necessary)
    - Pseudopodial
    - Flagellar
    - Ciliary
- Competency level 9.1.6
  - Microscopic examination of root and stem (Practical) is omitted
  - Microscopic observation of leaf (Practical) is included under competency level 2.4.3
- Competency level 10.1.1
  - Following content has been omitted
    - Role of meiosis
    - Haploid and diploid stages in the life cycles
    - Genetic variations
- Competency level 10.1.2
  - Entire content has been removed
- Competency level 10.1.9
  - Isogamy,anisogamy and oogamy has been omitted
- Competency level 10.1.11
  - Experiments that led to discovery of auxins has been omitted
- Competency level 11.1.1
  - Study of some common Mendelian traits (Practical) has been omitted

- Competency level 11.2.1
  - Following content has been omitted.
    - DNA blotting
    - Methods of extraction of DNA
- Competency level 12.1.2
  - Study of a small eco system and finding out the organization levels of the environment (Practical) has been omitted.

2.0 Aims of the syllabus

At the end of this course students will be able to;

1 develop an interest and desire to expand and deepen the knowledge in the field of Biology.
2 understand the concepts, phenomena, principles and processes in Biology through collaborative learning practices.
3 adjudicate our place in nature; understand our interactions and impact upon the natural and social environment.
4 develop the ability to plan investigative processes and to solve problems in the field of Biology.
5 develop a sense of belonging to the environment and identify the country's natural habitats, together with a positive attitude towards fauna and flora, in order to foster responsibility and involvement in preserving and protecting nature and the quality of the environment.
6 develop sensitivity to current practical problems of everyday life.
7 develop an awareness of good habits for maintaining hygiene, health and quality of life.

List of topics and allocated number of periods

	Topic	Number of periods
Unit 01	Introduction to Biology	07
Unit 02	Chemical & cellular basis of life	62
Unit 03	Diversity of organisms	40
Unit 04	Nutrition	14
Unit 05	Respiration	10
Unit 06	Transport	32
Unit 07	Coordination and homeostasis	45
Unit 08	Excretion	15
Unit 09	Support and movement	33
Unit 10	Reproduction, growth and development	60
Unit 11	Heredity	44
Unit 12	Environmental Biology	39
Unit 13	Microbiology	49
Unit 14	Applied Biology	30
	Total	**480**

Proposed term wise breakdown of the syllabus

Grade	Term	Competency levels	
Grade 12	First Term	From 1.1.1 to 3.1.5	(Competency levels 20)
	Second Term	From 3.1.6 to 7.1.3	(Competency levels 18)
	Third Term	From 7.1.4 to 9.1.6	(Competency levels 16)
Grade 13	First Term	From 10.1.1 to 11.1.4	(Competency levels 15)
	Second Term	From 11.1.5 to 13.1.2	(Competency levels 17)
	Third Term	From 13.1.3 to 14.1.6	(Competency levels 14)

3.0 Syllabus

3.1 - Grade 12

Unit 1 –Introduction to Biology

(7 Periods)

Competency	Competency Level	Content	No. of Periods
1.1.0 Conducts investigations from a biological perspective.	1.1.1 Elaborates on the nature, scope and importance of biology with reference to challenges faced by the man kind.	• Issues pertaining to biology. • Understanding biological diversity. • Understanding the human body and its functions. • Management of natural resources and environment. • Sustainable food production. • Understanding of diseases.	1
	1.1.2 Reviews the nature and the organizational patterns of the living world.	• Nature of living organisms – size, shape, form, distribution. • Characteristics of living organisms • Order and organization • Metabolism • Growth and development. • Irritability and coordination. • Adaptation • Reproduction • Heredity and evolution • Hierarchical levels of organization of life • Molecules • Organelles and cells. • Tissues • Organs	4

Competency	Competency Level	Content	No. of Periods
		• Organ systems • Organism • Population • Community • Ecosystems • Biosphere • Cell as the basic structural and functional unit of life	
	1.1.3 Uses the scientific method in solving biological problems.	• Importance of the use of scientific method for solving biological problems. • Steps in the scientific method. • Identification of the problem through observation. • Building up of hypothesis. • Testing hypothesis using experiments with control. • Selection of the most suitable hypothesis. • Formulation of theories.	2

Unit 2 – Chemical & cellular basis of life

(62 Periods)

Competency	Competency Level	Content	No. of Periods

2.1.0 Investigates the chemical basis of life.	2.1.1 Inquires into the elemental composition of living bodies.	• Elemental composition of living matter.
		  • Macroelements.
		  • Trace elements
		• Functions of macroelements and trace elements
			2

	2.1.2 Investigates the physical and chemical properties of water important for life.	• Importance of water for life • Importance of physical and chemical properties of water for life.	2

	2.1.3 Examines the chemical nature and functions of main organic compounds of organisms.	• Structure and function of the four main types of organic compounds found in organisms.
		  • Carbohydrates, lipids , proteins,and nucleic acids.
		  • Carbohydrates
		  • Monosaccharides, disaccharides and polysaccharides.
		  • Functions of carbohydrates
		  • Lipids
		  • Fats and oils, phospholipids and steroids
		  • Functions of lipids
		  • Proteins
		  • Amino acids and peptide bonds.
		  • Primary, secondary, tertiary and quaternary structures of proteins.
		  • Functions of proteins
			8

Competency	Competency Level	Content	No. of Periods

		• Nucleic acids
		  • Nucleotides and polynucleotides
		  • Structure of DNA & RNA
		  • Double helical structure of DNA
		  • Self replication of DNA
		  • Functions of DNA & RNA
		• **Simple laboratory tests for the identification of reducing and non-reducing sugars, starch, proteins, fats and oils**	

2.2.0 Examines how cells and tissues contribute to the functioning of organisms.	2.2.1 Elaborates on the contribution of microscopes to the expansion of knowledge on cells and celluar organization.	• Microscope as a tool in biology.
		  • Light microscope
		  • Electron microscope
		• Cell theory
		• Organization of cells
		  • Prokaryotic
		  • Eukaryotic .
		• **Parts and functions of microscope and using microscope to observe specimens**
		• **Use of electron micrographs to understand the structure of cellular components.**
			4

Competency	Competency Level	Content	No. of Periods
	2.2.2 Analyses the structure and functions of the subcellular units.	• Structure of a typical plant cell and an animal cell as seen in electron micrographs • Structure and functions of organelles and sub cellular components • Cell wall • Plasma membrane • Nucleus • Ribosomes • Endoplasmic reticulum (Rough and Smooth) • Golgi bodies • Lysosomes • Micro bodies (Peroxisomes, glyoxysomes) • Mitochondria • Chloroplasts • Micro tubules • Cytoskeleton • Vacuoles • Cell junctions • Flagella and cilia • Centriole	7

Competency	Competency Level	Content	No. of Periods
	2.2.3 Relates the structure of plant tissues to their functions	• Tissues of multicellular organisms • Types of plant tissues, their structure & functions • Parenchyma • Collenchyma • Sclerenchyma • Xylem • Phloem • **Microscopic observation and identification of different types of plant tissues**	5
	2.2.4 Relates the structure of animal tissues to their functions	• Types of animal tissues, their structure & functions • Epithelial tissues • Connective tissues • Muscle tissue • Nervous tissue • **Microscopic observation and identification of different types of animal tissues**	5
2.3.0 Investigates the importance of cell division.	2.3.1 Analyses the process of cell division	• Cell cycle • Mitosis • Behaviour of chromosomes and other parts of a cell during mitosis.	6

Competency	Competency Level	Content	No. of Periods
		• Importance of mitosis. • Meiosis • Behaviour of chromosomes and other parts of a cell during meiosis. • Importance of meiosis • **Identification of different stages of mitosis and meiosis using microscopic slides**	
2.4.0 Investigates energy relationships in metabolic processes of organisms.	2.4.1 Analyses the energy relationships in metabolic processes.	• Need of energy for living systems. • Anabolic and catabolic reactions, • Importance of ATP as an energy carrier. • Cellular processes involving energy	1
	2.4.2 Investigates the role of enzymes in regulating metabolic reactions.	• Enzymes • General characteristics of enzymes • Cofactors • Co enzymes • Prosthetic groups • Inorganic ions • Mechanism of reaction • Reducing activation energy • Lock and key mechanism • Induced fit mechanism	6

Competency	Competency Level	Content	No. of Periods

		• Factors affecting enzymatic reactions.
		  • pH
		  • Temperature
		  • Substrate concentration
		  • Enzyme concentration
		  • Inhibitors
		• **Laboratory experiment to demonstrate enzyme activity and to determine rate of enzymatic reaction (starch-amylase)**	

	2.4.3 Examines photosynthesis as an energy fixing mechanism.	• Importance of photosynthesis
		• Light reaction of photosynthesis
		  • Photosystem I
		  • Photosystem II
		  • Photolysis of water
		  • Synthesis of NADPH and ATP
		• Dark reaction of photosynthesis
		  • Carboxylation – function of RuBP carboxylase.
		  • Reduction – Reduction of PGA and synthesis of carbohydrates.
		  • Regeneration of RuBP
		• C4 pathway of photosynthesis
			8

Competency	Competency Level	Content	No. of Periods

		• Factors affecting photosynthesis
		  • Carbondioxide
		  • Water
		  • Light
		  • Temperature
		• Principle of limiting factors
		• **Determination of rate of photosynthesis by amount of O_2 released.**
		• **Microscopic observation of a cross section of a leaf with special reference to adaptations for photosynthesis.**	

	2.4.4 Examines cellular respiration as a process of obtaining energy	• Cellular respiration
		  • Importance of cellular respiration
		  • Aerobic and anerobic processes
		  • Aerobic respiration- process of glucose oxidation
		  • Glycolysis
		  • Location of glycolysis
		  • Substrate phosphorylation
		  • Formation of pyruvate
		  • NADH and ATP synthesis
		  • Conversion of pyruvate to acetyl -co A (2C)
		  • Krebs cycle
		  • Location of Krebs cycle
		  • Formation of citrate
			8

Competency	Competency Level	Content	No. of Periods
		• Regeneration of oxaloacetate from citrate by a cycle of reactions • Decarboxylation and dehydrogenation with the synthesis of ATP and reduced co-enzymes • Metabolic significance of Krebs cycle • Use of lipids (fats and oils) and proteins in respiration • Use of intermediate components of respiration for synthesis of amino acids. • Electron transport chain • Location • Oxidative phosphorylation • Synthesis of 38 ATP molecules in aerobic respiration. • Anaerobic respiration • Production of ethyl alcohol /Ethanol fermentation in plant cells • Production of Lactic acid in animal cells / Lactic acid fementation in bacteria • Respiratory quotient • **Determination of rate of respiration using germinating seeds**	

Unit 3 – Diversity of organisms

(40 Periods)

Competency	Competency Level	Content	No. of Periods

3.1.0 Explores the diversity of organisms	3.1.1 Constructs hierarchy of taxa on scientific basis	• Identification of organisms, classification and nomenclature
		  • Binomial nomenclature
		  • Methods of natural & artificial classification
		  • Use of keys
		  • Systems of classification
		  • Hierarchy of taxa from domains to species
		• Present system of classification and its basis
		• Domains
		  • Bacteria
		  • Archaea
		  • Eukarya
		• Viruses
		• Kingdoms of Eukarya
		  • Protista
		  • Fungi
		  • Plantae
		  • Animalia
			8

	3.1.2 Explores the diversity of organisms within Domain Bacteria.	• Domain - Bacteria • Characteristic features of Bacteria and Cyanobacteria • **Observation of the characteristic features of typical Bacteria and Cyanobacteria**	2

Competency	Competency Level	Content	No. of Periods

	3.1.3 Explores the diversity of organisms within the kingdom Protista.	• Characteristic features of the following phyla
		  • Phylum – Ciliophora
		  • Phylum – Rhizopoda
		  • Phylum – Chyrysophyta
		  • Phylum – Phaeophyta
		  • Phylum – Rhodophyta
		  • Phylum – Chlorophyta
		• **Observation of characteristic features of typical organisms of the above phyla**
			4

	3.1.4 Explores the diversity of organisms within the kingdom Fungi.	• Kingdom – Fungi
		• Characteristic features of the following phyla
		  • Phylum – Chytridiomycota
		  • Phylum – Zygomycota
		  • Phylum – Ascomycota
		  • Phylum – Basidiomycota
		• **Observation of characteristic features of typical organisms of the above phyla**
			4

	3.1.5 Explores the diversity of organisms within the kingdom Plantae	• Kingdom – Plantae
		• Characteristic features of the following phyla and classes
		  • Phylum – Bryophyta
		  • Phylum – Lycophyta
		  • Phylum – Pterophyta
		  • Phylum – Cycadophyta
		  • Phylum – Coniferophyta
		  • Phylum – Anthophyta
		  • Class – Monocotyledoneae
		  • Class - Dicotyledoneae
		• **Observation of characteristic features of typical organisms of the above phyla and classes**
			6

Competency	Competency Level	Content	No. of Periods

	3.1.6 Explores the diversity of organisms within the kingdom Animalia	• Kingdom – Animalia
		• Characteristic features of the following phyla (Details of feeding, osmo regulation, excretion, nervous & hormonal regulations, respiration, reproduction and life cycles are not necessary.)
		  • Coelenterata(Cnidaria)
		  • Platyhelminthes
		  • Nematoda
		  • Annelida
		  • Mollusca
		  • Arthropoda
		  • Echinodermata
		  • Chordata
		• **Observation of characteristic features of typical organisms of the above phyla**
			5

	3.1.7 Uses the external features of organisms to identify their classes.	• Identification of following major classes using external features
		  • Coelenterata
		  • Hydrozoa
		  • Scyphozoa
		  • Anthozoa
		  • Platyhelminthes
		  • Turbellaria
		  • Trematoda
		  • Cestoda
		  • Annelida
		  • Polychaeta
		  • Oligochaeta
		  • Hirudinea
			6

Competency	Competency Level	Content	No. of Periods

		• Mollusca
		  • Gastropoda
		  • Bivalvia
		  • Cephalopoda
		  • Polyplacophora
		• Arthropoda
		  • Crustacea
		  • Insecta
		  • Chilopoda
		  • Diplopoda
		  • Arachnida
		• Echinodermata
		  • Asteroidea
		  • Ophiuroidea
		  • Echinoidea
		  • Holothuroidea
		  • Crinoidea
		• **Observation of characteristic features(external) of typical organisms of the classes of above phyla**	

	3.1.8 Uses the characteristic features to study organisms belonging to phylum Chordata	• Characteristic features of classes of phylum Chordata
		  • Chondrichthyes
		  • Osteichthyes
		  • Amphibia
		  • Reptilia
		  • Aves
		  • Mammalia
		• **Observation of characteristic features of typical organisms of the above classes**
			5

Unit 4 - Nutrition

(14 Periods)

Competency	Competency Level	Content	No. of Periods

4.1.0 Explores the diversity of nutritional processes.	4.1.1 Investigates the modes of nutrition in organisms .	• Nutrition and its need.
		• Autotrophic nutrition
		  • Photoautotrophic
		  • Chemoautotrophic
		• Heterotrophic nutrition
		  • Process of heterotrophic nutrition
		  • Modes of heterotrophic nutrition
		  • Saprotrophic nutrition
		  • Holozoic nutrition
		  • Symbiosis
		  • Mutualism
		  • Parasitism
		  • Commensalism
		• Insectivorous plants.
			6

	4.1.2 Analyses the nutritional requirements for the optimum growth of plants.	• Macro and trace elements required for plants.
		  • Forms of absorption
		  • Functions and deficiency symptoms.
			1

	4.1.3 Relates the structure of the human digestive system to its functions.	• Structure and functioning of the human digestive system
		  • Alimentary canal
		  • Associated glands
		  • Nervous and endocrine regulation of digestion in man.
			7

Competency	Competency Level	Content	No. of Periods

		• Components of food and their functions.
		  • Carbohydrates
		  • Proteins
		  • Lipids
		  • Vitamins
		  • Mineral elements
		  • Water
		  • Fibers
		• Sources and deficiency symptoms
		• Food related disorders in the alimentary canal
		  • Gastritis
		  • Constipation
		• **Study the basic histologcal structure of the alimentary canal of man and relates the major variations in different regions to their functions**	

	Unit 5 - Respiration		**(10 Periods)**

5.1.0 Investigates the process of gaseous exchange in animals.	5.1.1 Explores the diversity of respiratory structures in the animal kingdom	• Characteristics of respiratory surfaces.
		• Diffusion and surface to volume ratio
		• Respiratory structures in animals (structures of tracheal systems of insects and gills of bony fish not necessary)
		  • Body covering
		  • External gills
		  • Internal gills
		  • Trachea
		  • Book lungs
		  • Lungs
			4

Competency	Competency Level	Content	No. of Periods

	5.1.2 Relates the structure of the human respiratory system to its functions.	• Gross structure of the human respiratory system.
		• Mechanism of ventilation of lungs.
		• Respiratory cycle and lung volumes.
		• Exchange of gases between blood and air.
		• Exchange of gases between blood and tissues.
		• Regulation of respiration in man
		• Disorders of the human respiratory system.
		  • Impacts of smoking on the respiratory system.
		  • Impacts of dust on the respiratory system.
		  • Occupational hazards associated with the exposure to particles of silica and asbestos particles.
		• **Study of human respiratory system using models/diagrams and observation of effects of exercise on respiratory rate and pulse rate**
			6

	Unit 6 - Transport		**(32 Periods)**
6.1.0 Investigates processes involved in transport of materials in organisms.	6.1.1 Investigates the concepts and processes involved in transport of water and minerals in plants.	• Need for transport. • Concept of water potential • Water potential of a cell. • Entry of water into vacuolated cells, turgour and plasmolysis. • Structure of a plant root • Absorption and radial transport of water	8

Competency	Competency Level	Content	No. of Periods

		• Transport of water within a plant.
		  • Apoplast pathway
		  • Symplast pathway
		  • Vacuolar pathway
		• Upward movement of water and minerals in a plant.
		• Adhesion - Cohesion - Tension theory
		• **Determintion of solute potential of epidermal peels of *Rhoeo***
		• **Determintion of water potential of petioles of *Colocasia* / potato strips**	

	6.1.2 Investigates the process of gaseous exchange in plants.	• Leaves of plants as the main surface for gaseous exchange.
		  • Structure of leaves.
		  • Structure and function of stomata
		• Gaseous exchange through stomata and lenticels.
			1

	6.1.3 Investigates the processes of water loss in plants.	• Transpiration
		  • Routes of transpiration
		  • Factors affecting transpiration.
		  • Plant modifications for minimizing transpiration.
		• Root pressure and guttation
		• **Determination of rates of transpiration from leaves and shoots**
			3

Competency	Competency Level	Content	No. of Periods

	6.1.4 Investigates the processes involved in translocation of food in plants.	• Phloem translocation
		  • Structure of the phloem tissue
		  • Phloem Loading
		  • Mass flow in the phloem
		  • Phloem unloading
			2

	6.1.5 Investigates the organization of circulatory systems in animals	• Main circulatory systems in animals.
		  • Open & closed circulatory systems.
		  • Single circulation and double circulation.
			2

	6.1.6 Relates the structure of the human circulatory system to its functions.	• Structure and functions of the human circulatory system.
		  • Blood circulatory system and lymphatic system.
		  • Structure & function of the heart.
		  • Cardiac muscle
		  • Cardiac cycle
		  • Electrocardiogram
		  • Systolic & diastolic pressure
		  • Hypertension and hypotension
		  • Coronary circulation and consequences of blockage of coronary arteries.
		• Surgical interventions
		  • Bypass surgery, open heart surgery and heart transplants.
			10

Competency	Competency Level	Content	No. of Periods
	6.1.7 Inquires into the role of blood.	• Composition of blood. • Respiratory pigments in man. • Respiratory pigments of other animals. • Transportation of respiratory gases and other substances. • Other functions of blood. • Blood tests as diagnostic tools. (methods and equipment not necessary) • Blood counts • Blood groups • **Study the circulatory system of man using specimens/ models/diagrams**	6
Unit 7 - Coordination and homeostasis			**(45 Periods)**

7.1.0 Investigates the structures & functions involved in coordination and homeostasis of animals.	7.1.1 Inquires in to the processes and systems involved in coordination.	• Need for coordination
		• Systems contributing to coordination
		  • Nervous system
		  • Endocrine system
		• Contribution of the blood circulatory system for coordination.
		• Similarities and differences (in relation to coordination) of the nervous system and the endocrine system.
			2

	7.1.2 Elaborates on the nervous organization among animals.	• Types of nervous organization of animals.
		  • Unicellular
		  • Multicellular
		  • Cnidarians – Nerve network
			2

Competency	Competency Level	Content	No. of Periods
		• Platyhelminthes – cerebral ganglion & longitudinal nerves • Annelida – cerebral ganglion, ventral ganglion, double ventral nerve cord. • Arthropoda – cerebral ganglion • Mollusca – nervous system • Echinodermata – radial nerve cord & nerve net. • Chordata – brain and dorsal nerve cord. • **Study of patterns of nervous systems in animals using models/diagrams**	
	7.1.3 Investigates the gross structure & functions of the human nervous system.	• Organization and main parts of the human nervous system • Central nervous system • Brain • Spinal cord. • Peripheral nervous system • Cranial nerves. • Spinal nerves. • Autonomic nervous system • Sympathetic and parasympathetic nervous systems and their functions • Overall function	4

Competency	Competency Level	Content	No. of Periods
	7.1.4 Explores how nerve impulses are generated and transmitted.	• Organization of the human nervous system • Structure of neurons • Cell body • Dendrites • Axon • Associated cells • Neuroglea • Schwann cells • Physiology of neurons • Resting (membrane) potential • Action potential • Nerve impulse conduction (In myalinated and non myalinated nerves) • Synapses • Neuron – neuron • Neuron– skeletal muscles • Role of neurotransmitters (acetyl choline, adrenalene and noradrenaline) • Reflex arc • Afferent – sensory neurons • Efferent – Motor neurons • Intermediate neurons	6

Competency	Competency Level	Content	No. of Periods

	7.1.5 Explores into the structure and functions of the human brain.	• Main parts (components) of the human brain and their functions.
		• Meninges
		• Cerebro ventricles and cerebro spinal fluid.
		• Brain stem
		  • Pons varoli
		  • Medulla oblongata
		  • Mid brain
		• Cerebellum
		• Cerebrum
		  • Lateral lobes
		  • Cerebral cortex
		  • Sensory area
		  • Associated area
		  • Motor area
		• Thalamus
		• Hypothalamus
			6

	7.1.6 Explores the functions of different sensory organs.	• Human sensory structures (Receptors)
		• Basic characteristics
		• Types
		  • Chemoreceptors
		  • Taste receptors
		  • Olfactory receptors
			5

Competency	Competency Level	Content	No. of Periods

		• Thermo receptors
		  • Cold - Krauses's end bulbs
		  • Warmth –Ruffini bodies (corpuscles)
		  • Free nerve endings
		• Photo receptors
		  • Rods
		  • Cones
		• Mechano receptors
		  • Touch receptors– Meissner corpuscles,Merkel's discs
		• Pressure receptors
		  • Pacinian corpuscles
		• Vibration receptors
		  • Most of the touch receptors
		• Pain receptors
		  • Special nerve endings.
		• Types of receptors found in animals
		  • Eye spots
		  • Simple eyes
		  • Compound eyes
		• **Study of selected sense organs of animals using diagrams / models/charts**	

	7.1.7 Relates the structures of the eye and ear to their functions.	• Basic structure and functions of the human eye. • Basic structure and functions of the human ear. • **Study the structures of human eye and ear using diagrams/models/charts**	6

Competency	Competency Level	Content	No. of Periods

	7.1.8 Analyses the role of human endocrine system	• Human endocrine system
		  • Endocrine glands , their locations and functions.
		  • Hypothalamus.
		  • Pituitary gland
		  • Thyroid gland
		  • Parathyroid gland
		  • Thymus gland
		  • Adrenal glands
		  • Islets of Langerhans
		  • Gonads
		• Feed back mechanism (with relevance to the endocrine system)
		  • Negative
		  • Positive
			7

	7.1.9 Investigates how a constant internal environment is maintained.	• Homeostasis
		  • Internal & external environment
		• Homeostasis of man
		  • Regulation of body temperature
		  • Regulation of blood glucose
		  • Osmoregulation
		• Role of the liver in homeostasis
			5

	7.1.10 Investigates the basic structure and functions of the human skin	• Basic layers of the human skin • Hairs • Glands • Receptors • Functions of the skin	2

Unit 8 - Excretion

(15 Periods)

Competency	Competency Level	Content	No. of Periods

8.1.0 Analyses the contribution of the excretory system in maintaining a healthy life.	8.1.1 Examines the relationship between metabolism and excretory substances	• Excretion , its importance and need
		• Relationship between excretory products and metabolism
		  • Carbohydrates
		  • Fats
		  • Proteins
		  • Nucleic acid
		• End products of nitrogenous excretion
		  • NH_3
		  • Urea
		  • Uric acid
		  • Creatinine
		• Advantages and disadvantages of excreting above end products.
		• Relationship between the end products and living environment
		• Other end products of excretion
		  • CO_2
		  • Bile pigments.
			4

	8.1.2 Investigates the diversity of excretory structures of animals.	• Different excretory structures in animals. (Details of fine structure of excretory structures not necessary)
		  • Body surface
		  • Contractile vacuoles
		  • Flame cells (Protonephridia)
		  • Nephridia
		  • Malpigian tubules
		  • Green glands / antennal glands
		  • Sweat glands
		  • Salt glands
		• **Study of major types of excretory structures in animals using diagrams and charts**
			2

Competency	Competency Level	Content	No. of Periods
	8.1.3 Investigates the gross structure and functioning of the human urinary system	9 • Human urinary system • Parts of the human urinary system • Kidney • Location • Blood supply • Structure • Ureters • Urinary bladder • Urethra (urinary passage) • Nephron as the structural and functional unit • Process of urine formation • Ultra Filteration • Reabsorption • Secretion • Impact of hormones on the functions of the kidneys • ADH • Aldosterone • Other functions of the kidney (Kidney as a main homeostatic organ) • Osmo-regulation • Control of blood volume	

Competency	Competency Level	Content	No. of Periods

		• Blood pH regulation
		• Secretion of hormones
		  • Erythropoietin
		  • Renin
		• Maintenance of blood volume and blood pressure.
		• Disorders of the human urinary system
		  • Bladder & kidney stones
		• Measures for prevention of disorders.
		• Diagnostic role of urine
			160

Unit 9 - Support and movement

(33 Periods)

Competency	Competency Level	Content	No. of Periods

9.1.0 Inquires in to the types of supporting systems and movement in organisms.	9.1.1 Inquires in to the structure and functions of the skeletal systems of animals .	• Main types of skeletons of animals and their organization
		  • Hydrostatic skeleton
		  • Coelom - Annelida
		  • Exoskeleton
		  • Chitinous exoskeleton - Arthropoda
		  • Calcium carbonate exoskeleton - Mollusca
		  • Bony plates – Reptiles
		  • Endoskeleton
		  • Plates of calcium carbonate - Echinodermata
		  • Bones - Chordata
		  • Cartilage - Chordata
		• Microscopic structure of human bones and cartilage
		• Functions of the skeletal system
		  • Support
		  • Protection
		  • Movement
		  • Storage & release of calcium
		  • Storage & release of phosphates
		  • Production of blood cells.
			6

Competency	Competency Level	Content	No. of Periods
	9.1.2. Investigates the structure and functions of the axial skeleton of man .	• Organization of the human skeletal system • Axial skeleton • Skull • Main bones • Upper & lower jaws • Sinuses • Main processes • Vertebral column • Four curvatures & main areas • Types of vertebrae • Intervertebral discs • Ribs • Sternum • **Study the gross structure of human skull and vertebral column in relation to functions of various parts using specimens/models /diagrams**	8
	9.1.3. Investigates the structure and functions of the appendicular skeleton of man .	• Appendicular skeleton • General structure of the pectoral girdle in relation to its functions. • General structure of the pelvis in relation to its functions. • Pelvis of the male & female • General structure of the fore limb in relation to flexibility.	6

Competency	Competency Level	Content	No. of Periods
		• General structure of the hind limb in relation to strength,erect body position (posture), bearing of body weight and walking. • Arches of foot. • Disorders and abnormalities • Osteoarthritis. • Osteoporosis • **Study of the human pectoral and pelvic girdles and appendicular skeleton using specimens/ models/ diagrams.**	
	9.1.4 Explores the locomotary structures in animals.	• Movement • Types of locomotary movement (details of fine structure of pseudopodial,flagellar and ciliary movement not necessary) • Pseudopodial • Flagellar • Ciliary • Muscular	2
	9.1.5 Investigates the basic structure and physiology of different types of muscle tissues.	• Muscle tissue • Basic characteristics • Contractility • Excitability • Extensibility • Elasticity	6

Competency	Competency Level	Content	No. of Periods

		• Types of muscles and basic structure and functions of the muscle fibers.
		  • Smooth muscle.
		  • Cardiac muscle
		  • Skeletal muscle.
		• Structure of the sarcomere and basic mechanism of skeletal muscle movement
		• Basic concepts of the Sliding filament theory (model)	

	9.1.6 Inquires into the support and types of movement in plants.	• Support in plants
		  • Turgor
		  • Tissues that provide supportive strength in primary & secondary plant bodies.
		• Movements in plants.
		  • Tropic movements
		  • Phototropic, geotropic, and thigmotropic movements
		  • Function of auxins in tropic movements.
		  • Tactic movements.
		  • Nastic movements.
		  • Thigmonasticism
		  • Nictinasticism
			5

3.0 Syllabus
3.2 - Grade 13

Unit 10 - Reproduction, growth and development

(60 Periods)

Competency	Competency Level	Content	No. of Periods
10.1.0 Inquires into the reproductive process in organisms.	10.1.1 Inquires in to different patterns of reproduction.	• Different types of reproduction • Asexual, sexual reproduction • Asexual reproduction • Fission • Binary fission • Multiple fission • Budding • Fragmentation • Formation of spores (Sporulation) • Sexual reproduction • Bisexuality and unisexuality • Parthenogenesis • Gamete formation • Fertilization • External & Internal	4

Competency	Competency Level	Content	No. of Periods

	10.1.2 Inquires structure and functions of male reproductive system.	• Structure & function of the male reproductive system
		  • Scrotal sacs
		  • Testis (with microscopic anatomy)
		  • Seminiferous tubules
		  • Leydig cell
		  • Sertoli cell
		  • Basic structure and function of sperm.
		  • Main steps in the development of sperms (spermatogenesis)
		  • Epididymis
		  • Vas deferens
		  • Ejaculatory duct
		  • Urethra and penis
		  • Accessory glands related to the male reproductive system
		  • Seminal vesicles
		  • Prostate glands
		  • Cowper's glands
		  • Semen
		  • Seminal fluid
		  • Spermatozoa (Sperms)
		• Hormonal regulation of the male reproductive system
		  • GnRH
		  • FSH
		  • LH
		  • Testosterone
		• **Study of the male reproductive system using models/ diagrams.**
			8

Competency	Competency Level	Content	No. of Periods
	10.1.3 Inquires in to structure and functions of female reproductive system.	• Structure & function of the female reproductive system • Ovaries (including the microscopic structure) • Germinal epithelium • Follicles • Primary • Graffian • Corpus luteum • Corpus albicans • Oogenesis, ovulation and its hormonal regulation • Structure & function of an ovum • Uterine ducts/ fallopian tubes/ oviducts • Uterus • Myometrium • Endometrium • Vagina • Puberty • Menstrual cycle and its hormonal regulation (FSH, GnRH, LH, Progesterone, Oestrogen) • Menopause • **Study of the female reproductive system using models / diagrams.**	8

Competency	Competency Level	Content	No. of Periods

	10.1.4 Inquires into the processes involved in fertilization upto birth.	• Location of fertilization
		• Process of fertilization at microscopic level
		• Implantation
		• Placenta, foetal membranes and umbilical cord.
		• Pregnancy and its duration
		• Major foetal changes associated with each trimester of pregnancy.
		• Parturition
		  • Process
		  • Role of the positive feedback system.
			5

	10.1.5 Inquires into the nutrition and development of child	• Mammary glands
		  • System of ducts.
		  • Lobules
		• Nervous & hormonal control of production and ejection of milk.
		  • Major components of milk.
		  • Functions of breast milk
		  • Advantages of breast feeding over bottle feeding.
		• Nutrition in early neonatal stage
		• Mental development of the infant and child.
			2

Competency	Competency Level	Content	No. of Periods

	10.1.6 Develops an awareness on reproductive health.	• Puberty and associated major body changes
		• Early signs of pregnancy
		• Pregnancy tests
		• Family Planning
		• Birth control methods
		  • Female
		  • Male
		• Sexually transmitted infections
		  • Gonorrhoea
		  • Syphilis
		  • Genital herpes
		  • HIV/AIDS
		• Infertility
		• Assisted reproduction
		  • In vitro fertilization
			4

Competency	Competency Level	Content	No. of Periods

	10.1.7. Gains experience in productive use of methods of plant propagation.	• Vegetative reproduction in plants
		  • Rhizomes
		  • Corms
		  • Bulbs
		  • Runners
		  • Tubers
		• Vegetative propagation of plants
		  • Cuttings
		  • Bud grafting
		  • Stem grafting
		• Plant Tissue Culture
		  • Totipotency
		  • Plant growth substances in culture media
		  • Constituents of Culture media
		  • Explants
		  • Steps and basic procedures in micro-propagation
		  • Benefits of plant tissue culture
			4

	10.1.8 Uses the trends in life cycles , to relate the adaptations of plants for a terrestrial life.	• Sexual reproduction of terrestrial plants
		  • Alternation of generations in plants
		  • Haploid and diploid generations
		  • Gametophytes and Sporophytes
			10

Competency	Competency Level	Content	No. of Periods

		• Diversity in the life cycles of terrestrial plants.
		  • *Pogonatum*
		  • *Nephrolepis*
		  • *Selaginella*
		  • *Cycas*
		  • Angiosperms
		• Basic features of the life cycles of above plants
		• Reduction of the gametophyte and complexity of sporophyte in order to adapt for terrestrial life. (Morphological details are not required)	

	10.1.9 Examines structures and functions associated with sexual reproduction in flowering plants.	• Sexual reproduction in flowering plants
		  • Structure and functions of the flower
		  • Pollination and fertilization
		  • Embryo, development of fruits and seeds.
		• Parthenocarpy
		• Germination of seeds and seed dormancy
			4

	10.1.10 Investigates the role of plant growth substances.	• Growth and development of plants
		  • Plant growth substances
		  • Growth substances that contribute to the growth and development of plants .
		  • Auxins
		  • Gibberelins
			3

Competency	Competency Level	Content	No. of Periods
		• Cytokinin • Abscisic acid • Ethylene • Functions of the above growth substances • Uses of plant growth substances	
	10.1.11 Examines the external and internal changes taking place in the growth and development of a plant.	• Primary structure of the plant body • Localization of growing regions - apical, lateral and intercalary meristems. • Structure of the stem apex and root apex, differentiation of primary tissues . • Primary structure of monocotyledonous and dicotyledonous stems. • Primary structure of monocotyledonous and dicotyledonous roots. • Secondary growth in plants. • Secondary meristems, secondary growth of stems and roots • Formation of wood , growth rings, heartwood and sapwood • **Study of cross sections of primary stem and primary root of a Monocot and of a Dicot** • **Microscopic and macroscopic examination of secondary structure of Dicotyledonous wood**	8

Unit 11 - Heredity

(44 Periods)

Competency	Competency Level	Content	No. of Periods
11. 1.0 Explores the basic principles of genetics for applications	11.1.1 Inquires the Scientific basis of Mendel's Experiments.	• Mendelian Heredity (Mendelism) • Mendel's Experiments • Monohybrids • Monohybrid test crosses • Mendels' first law • Dihybrids • Dihybrid test crosses • Mendel's second law • Multiple factor crosses • Success of Mendel's Experiments	6
	11.1.2 Analyses the contribution of chromosomes for inheritance of characters.	• Chromosomal basis of inheritance • Significance of Mitosis • Significance of Meiosis • Independent segregation and independent assortment of chromosomes during Meiosis	2
	11.1.3 Examines the patterns of inheritance of Mendelian traits in man.	• Human Mendelian Genetics • Common human Mendelian characteristics • Pedigree Charts	1

Competency	Competency Level	Content	No. of Periods
	11.1.4 Uses concepts and principles to explain genetic patterns that deviate from Mendel's laws.	• Non Mendelian Genetics • Incomplete dominance • Codominance • Poly allelism • Gene interaction • Polygenic Inheritance • Gene linkage • Human sex determination • Human sex linked characteristics	8
	11.1.5 Examines the molecular basis of genetics.	• Molecular basis of Genetics • DNA • Chromosomes and Genes • Gene expression and synthesis of protein • Gene- polypeptide relationship • Genetic code (Codon) • RNA, rRNA , mRNA ,tRNA • Mechanism of protein synthesis • Transcription • Translation	6

Competency	Competency Level	Content	No. of Periods

	11.1.6 Explores comparatively the influence of genetic variations created by mutations on the survival of organisms.	• Mutations
		  • Causes of mutations
		  • Types of mutations
		• Mutations and evolution
		• Mutagens
		• Human genetic disorders created by mutations
		  • Single gene mutations
		  • Mutations created by changes in the number of chromosomes
		• Genetic counseling
			4

	11.1.7 Investigates evolution of life by using changes in gene frequencies.	• Population genetics , evolution and selective breeding. • Hardy Weinberg equilibrium	3

	11.1.8 Uses the theory of natural selection to analyse the process of evolution of life.	• Natural selection and Evolution
		  • Theory of Lamarck , Theory of Evolution
		  • Darwin – Wallace theory – Theory of natural selection .
			2

	11.1.9 Examines the principles of selective breeding in obtaining modified varieties of plants and animals.	• Plant and animal breeding
		  • Artificial selection
		  • In breeding and Out breeding
		  • Hybrids
		  • Interspecific breeding
		  • Polyploidy
		  • Mutagenesis
		  • Genetic modifications
			3

Competency	Competency Level	Content	No. of Periods

11.2.0 Gets updated on gene technology.	11.2.1 Gets updated on techniques and methods of gene technology.	• Techniques and methods related to Molecular Genetics
		  • Test tube experiments with DNA
		  • Enzymes reacting with DNA (nucleases, ligases , polymerases)
		  • Agarose Gel Electrophoresis
		• DNA probes , hybridization
		  • DNA finger print technology
		  • Recombinant DNA technology
		  • Bacterial plasmids and viral genomes
		  • Recombinant DNA carriers
		  • Transformation of Bacteria
		  • Cloning of genes
			6

	11.2.2 Updates on the applications of gene technology.	• Genetically modified organisms and their uses
		  • Agriculture
		  • Medicine
		  • Industry
		• Social problems of using genetically modified organisms.
			3

Unit 12 - Environmental Biology

(39 Periods)

Competency	Competency Level	Content	No. of Periods

12.1.0 Engages in a biological analysis on relationships between organisms and their environment.	12.1.1 Engages in an analysis of the biosphere through different organizational levels.	• Importance of the knowledge in principles of environmental science
		• Organizational levels of the environment and the basic characteristics .
		  • Individual organism
		  • Species
		  • Population
		  • Community
		  • Ecosystem
		  • Biosphere
		• Earth
			3

	12.1.2 Investigates the components and activities of ecosystems.	• Structure and functions of ecosystems
		  • Components of ecosystems
		  • Concept of Niche
		  • Food chains and food webs
		  • Energy flow
		  • Ecological pyramids
			5

	12.1.3 Investigates the main biomes of the world.	• Biomes
		  • Main biomes of the world
		  • Distribution
		  • Characteristics
			4

Competency	Competency Level	Content	No. of Periods

	12.1.4 Utilizes the knowledge on ecosystems of Sri Lanka to contribute to their sustainable usage.	• Ecosystems in Sri Lanka
		  • Forests
		  • Tropical rain forests
		  • Dry mixed evergreen forests
		  • Montane forests
		  • Thorn forests, shrubs
		  • Grasslands
		  • Savannahs
		  • Patana
		  • Inland wet lands
		  • Rivers and streams
		  • Reservoirs, Lakes
		  • Marshes and swamps
		  • Villus
		  • Coastal ecosystems
		  • Lagoons and estuaries
		  • Mangrooves
		  • Coral reefs
		  • Sea shore
		  • Sea grass beds
			8

	12.1.5 Utilizes the knowledge of Biodiversity for conservation	• Biodiversity
		• Defining bio diversity (As defined in article 2 of the convention of biodiversity)
		  • Genetic diversity
		  • Species diversity
		  • Ecosystem diversity
			8

Competency	Competency Level	Content	No. of Periods

		• Origin of biodiversity, evolution and extinction
		  • Origin of the earth
		  • Origin of life
		  • Evolution of biodiversity
		  • Main extinctions
		  • Biodiversity Hotspots
		  • Following species with suitable examples from Sri Lanka .
		  • Endemic species
		  • Indigenous species
		  • Exotic species
		  • Migratory species
		  • Relict species
		  • Flagship species
		  • Keystone species
		• Different categories of threatened organisms according to the IUCN Red Data Book
		• Examples of species given in the Red Data Book for each group (with one local example in each category and a few global examples for the CR category)
		• Need for conservation
		  • In-situ conservation
		  • Ex- situ conservation	

Competency	Competency Level	Content	No. of Periods
		• Main features of the conventions and Acts related to conservation of bio diversity • CITIES • Bio diversity convention • RAMSAR convention • Fauna and flora protection Act	
	12.1.6 Contributes to maintain the quality of the environment by controlling the factors affecting environmental degradation.	• Environmental degradation • Air pollution • Pollutants and their sources • Impacts of pollution • Water pollution • Pollutants and their sources • Impacts of pollution • Soil pollution • Pollutants and their sources • Impacts of pollution	3
	12.1.7 Gets updated on the global environmental problems.	• Global environmental problems • Global warming • Contributory factors • Impacts • Depletion of the ozone layer • Contributory factors • Impacts	5

Competency	Competency Level	Content	No. of Periods

		• Desertification
		  • Contributory factors
		  • Impacts
		• Acid rains
		  • Contributory factors
		  • Impacts	

	12.1.8 Contributes to sustainable usage of environmental resources by getting enlightened on the environmental related protocols and acts.	• Main conventions, protocols and parliamentary acts contributing to environmental conservation.
		  • Basel convention
		  • Marpol convention
		  • Montreal protocol
		  • Kyoto protocol
		  • National environment act
		• Environmental resources
		  • Types of environmental resources.
		• Need for the sustainable use of environmental resources
			3

Unit 13 - Microbiology

(49 Periods)

Competency	Competency Level	Content	No. of Periods

13.1.0 Uses diversity, functions and impacts of micro-organisms for the success of human activities.	13.1 .1 Explores the diversity and nature of micro-organisms.	• Types of micro-organisms
		  • Bacteria (including Cyanobacteria)
		  • Viruses
		  • Prions
		  • Fungi
		  • Protozoa
		  • Unicellular algae
		• Microscopic nature of micro-organisms in terms of their relative size and units of measurements.
		• Ubiquitous nature of micro-organisms
		• High growth rate of micro-organisms
		• Different forms and organization of bacteria
		  • Rod shaped, globular and spiral
		• Structure of viruses
		  • Protein coat and nuclear material
		  • Polyphospholipid coating of retro viruses
		• Nature of viruses
		  • Compulsory (Obligatory) parasitism
		  • Infection of plants, animals, humans and bacteria by viruses.
		  • Reproduction of viruses
		  • Bacteriophage
			7

Competency	Competency Level	Content	No. of Periods

		• Nature of prions , their protein structure and importance as a disease causing agent.
		• Fungi
		  • General characteristics of fungi
		• Classification of fungi based on the morphological features of their mycelium and reproduction (Refer to 3rd unit)
		  • Chytridiomycota • Ascomycota
		  • Zygomycota • Basidiomycota
		• **Identification of different types of micro- organisms and observation of bacteria and fungi**
		• **Preparation of a simple culture medium (NA) and inoculation with a sample of toddy/yoghurt**
		• **Staining of bacteria found in toddy or yoghurt using a simple stain**	

	13.1.2 Explores the concepts, principles relevant to infectious diseases	• Micro-organisms and diseases
		• The nature , distribution and functions of the normal micro biota living in human body
		• Following concepts in relation to diseases
		  • Diseases
		  • Pathogenecity
		  • Pathogen
		  • Host
		  • Parasite
			8

Competency	Competency Level	Content	No. of Periods

		• Disease occurrence as expressions of ecological relationship between the host and the parasite
		• Characteristics of the pathogens
		  • Virulence
		  • Virulent factors that increase the pathogenicity
		• Dependence of virulence on invasiveness and toxigenicity
		• Role of enzymes on invasiveness -Phospolipase, lecithinase , Hyaluronidase
		• Exotoxin producing bacteria and role of exotoxins in pathogenecity (Cytotoxins, Enterotoxins , Neurotoxins)
		• Portals of entry of pathogens into the human body
		  • Respiratory tract
		  • Genito -urinary tract
		  • Gastrointestinal tract
		  • Wounds on skin
		• **Practice techniques for sterilization of water, culture media,glassware,heat labile substances and inoculating needles.**	

	13.1.3 Explores the defence mechanism of the human body.	• Defence systems of the human body against microbial infections. • Non specific defense systems – skin - mucous membranes, antimicrobial substances in body fluid , phagocytosis,inflammatory response.	5

Competency	Competency Level	Content	No. of Periods

		• Immune system
		  • Components of the immune system.
		  • Antibody-antigen reaction
		  • Role of the immune system
		  • Active and passive immunity
		  • Natural and artificial immunity	

	13.1.4 Explores the methods of controlling microbial diseases/infections.	• Methods of controlling microbial diseases.
		  • Use of disinfectants
		  • Use of antiseptics
		  • Immunization
		• Curative methods of microbial diseases
		  • Antibiotics
		  • Chemotherapeutics
		• Mode of action of some common antibiotics.
		  • Penicillins -Inhibition of the synthesis of bacterial cell wall.
		  • Ciprofloxacin –Inhibition of the synthesis of bacterial DNA
		  • Erythromycin -Inhibition of the synthesis of bacterial protein
		  • Polymyxin - Inhibiton of the permeability of bacterial cell membrane.
		  • Ketoconazole/clotrimazole - Inhibition of synthesis of fungal cell membrane.
			4

Competency	Competency Level	Content	No. of Periods

	13.1.5 Investigates the use of micro -organisms in industry and agriculture.	• Use of micro-organisms in industry and agriculture.
		  • Historical background of using micro-organisms and their functions in different products.
		  • Use of micro-organisms in commercial products that are useful for humans
		  • Basic principles of metabolic processes of micro-organisms for product formation.
		  Micro-organisms + substrate → products
		• Micro-organisms used – Bacteria, Viruses,Fungi, Algae.
		• Advantages of using microbial processes over chemical processes .
		  • High growth rate
		  • Metabolic versatility of micro-organisms
		• Commercially used microbial products
		  • Alcoholic beverages, vinegar, lactic acid, dairy products, enzymes, antibiotics , vaccines, plant growth substances, unicellular proteins, food supplements.
		• Commercially used microbial processes .
		  • Biofertilizer
		  • Biopesticides
		  • Bioinsecticides.
		  • Inoculation of *Rhizobium*
		  • Bacterial inocula for soil fertility
		  • Composting.
			5

Competency	Competency Level	Content	No. of Periods
		• Bio gas production. • Extraction of metals like copper and uranium • Retting (Fiber industry) • Removal of environmental pollutants • Bio-remediation • Using genetically modified micro-organisms for commercial purposes • Hormones , vaccines, Insulin and other pharmaceutical substances	

	13.1.6 Uses the functions of soil micro- organisms to maintain the agricultural activities at optimum level.	• Nature, distribution and processes of soil microbes
		• Soil microbes in abundance
		• Bacteria, Actinomycetes , Cyanobacteria , Fungi, Algae, and Protozoa
		• Chemical and Physical environment of soil as a healthy media for growth of micro-organisms
		• Role of micro-organisms in cyclic process of minerals
		  • Mineralization
		  • Carbon cycle
		  • Nitrogen cycle
		• Soil microbes relevant to plant growth
		  • Microbial function in Rhizosphere.
			5

Competency	Competency Level	Content	No. of Periods

		• Interactions of soil micro-organisms associated with roots
		  • Formation of soil aggregates
		  • Formation of mycorrhiza
		  • Symbiotic and non symbiotic nitrogen fixation.
		  • Production of plant growth substances (IAA, Gibberellins)
		  • Micro-organisms as causative agents of plant diseases	

13.2. 0 Utilizes the microbiological concepts and principles to maintain the quality of drinking water and for solid waste management.	13.2.1 Uses the microbiological concepts and principles in drinking water and waste water management.	• Microbiology of drinking water, waste water and solid waste.
		  • Natural sources of drinking water and possible contamination methods .
		  • Diseases that are transmitted by water.
		  • Using microbes as indicators of water pollution.
		  • Steps in water treatment in an urban water treatment plant.
		  • Steps in water purification.
		  • Water quality testing.
		  • Coliform test for identification of polluted water .
		• Waste water
		  • Components in domestic and industrial waste water
		  • Adverse effects of discharging large amounts of waste water into natural water resources.
			5

Competency	Competency Level	Content	No. of Periods

		• Principles and main steps in purification of industrial waste water.
		  • Primary treatment
		  • Secondary treatment
		  • Disinfection
		• Legal limits in releasing waste water into water bodies according to Sri Lankan standards.	

	13.2.2 Explores the environtmetal and sanitory importance of recycling of solid waste matter.	• Solid waste matter
		  • Nature of solid waste matter
		• Environmental and hygienic importance in recycling solid waste matter
		  • Separation and recycling
		  • Decomposition of organic matter
		  • Sanitary land fills.
		  • Production of organic manure (Composting)
			2

13.3.0 Explores the impact of microbes on food.	13.3.1 Contributes to the prevention of diseases that are caused by spoiled food.	• Micro-organisms and food • Food spoilage by micro-organisms • Presence of nutritious matter in plant and animal food used for human consumption • Physical, chemical and biological changes taking place in food by the growth of heterotrophic micro-organisms	7

Competency	Competency Level	Content	No. of Periods

		• External factors affecting food spoilage – temperature, oxygen supply
		• Internal factors affecting food spoilage –pH value, moisture content, amount of nutrients, biological structure of food
		• Food borne diseases .
		  • Food borne infections
		  • Food intoxication
		• Infections caused by food
		  • Typhoid – *Salmonella typhi*
		  • Dysentery –*Shigella*
		  • Cholera – *Vibrio cholerae*
		• Food intoxication
		  • Intoxication by *Staphylococcus aureus*
		  • Intoxication by *Clostridium botulinum*	

	13.3.2 Utilizes the knowledge on food preservation for successful applications	• Food preservation • Importance of food preservation • Principles of food preservation • Methods of food preservation and relevant principles	1

Unit 14 - Applied Biology

(30 Periods)

Competency	Competency Level	Content	No. of Periods

14.1.0 Uses biological concepts and principles to promote the quality of living.	14.1.1 Investigates aquaculture systems to suggest actions for systemic maintenance	• Aquaculture
		• Need of aquaculture
		• Species grown in Sri Lanka
		  • Species of shrimps
		  • Species of fish
		  • Aquatic plants
		• Methods of aquaculture
		  • Intensive
		  • Semi intensive
		  • Extensive
		• Characteristic features of species that could be cultured
		• Monoculture and polyculture
		• Environmental impacts of shrimp cultivation in Sri Lanka .
		• Ornamental fish cultivation
		  • Species that are used
		  • Identification of main species
		  • Maintenance of an aquarium
		• **Identification of fish, prawn and aquatic plant species used in aquaculture**
			8

Competency	Competency Level	Content	No. of Periods

	14.1.2 Suggests solutions to overcome the damage caused by pests	• Identifying a pest
		  • Morphological characteristics of identification, nature of the damage and methods of controlling main coconut pests .
		  • Red weevil
		  • Black beetle
		  • Mite
		  • Morphological characteristics of identification, nature of the damage and methods of controlling paddy pests .
		  • Brown plant hopper
		  • Paddy bug
		  • Yellow stem borer
		• Methods of pest control
		  • Traditional methods
		  • Chemical methods
		  • Biological methods
		  • Integrated pest management
		• **Study of common insect pests of paddy and coconut in Sri Lanka**
			8

Competency	Competency Level	Content	No. of Periods

	14.1.3 Uses the biological knowledge and understanding in minimizing the damage caused by parasites.	• Life cycles of parasites , methods of transmission , symptoms of infection and controlling methods
		  • Malarial parasite
		  • Filarial parasite
		  • Hook worm
		• **Observation of stages of life cycles and study of data on incidence and distribution of the following parasites in Sri Lanka: malarial parasite, filarial parasite & hook worm**
			6

	14.1.4 Uses the biological knowledge and understanding in minimizing the damages caused by weeds.	• Weeds
		  • Characteristic features of weeds for competing with crop plants
		  • Weed control
		  • Principles
		  • Relative advantages and disadvantages
		• **Study of different kinds of weeds in a selected area and separation into morpho-species**
			2

	14.1.5 Uses the biological knowledge and understanding to minimize the damage caused by micro-organisms in plants.	• Plant diseases caused by micro-organisms
		  • Wilts - Bacteria/ Fungi
		  • Mildews - Fungi
		  • Rots - Bacteria
		  • Mosaics - Virus
		  • Blights - Bacteria/ Fungi
		• Prevention
		• Control
			2

	14.1.6 Gets updated in applications of emerging technologies related to biology	• Applications of
		  • Nanotechnology
		  • Stem cell therapy
		  • Human Genome project
			4

4.0 Learning Teaching process

Global trend in present day education is to introduce competency based curricula which promote collaborative learning through student centred activities where learning predominates teaching. It is intended for the students to actively participate in activities which enhances the development of individual social and mental skills . Emphasis is made on following aspects.

1. Dissection of animals has been totally omitted in the study of this biology syllabus.
2. It is advised to cover the content through 5E- model activities as far as possible.
3. Allow the students to acquire hands on experience through self directed activities.
4. Direct students to acquire knowledge and information through reliable sources wherever necessary.

5.0 School policies and programmes

1 The teacher has the liberty to follow any suitable teaching learning method to achieve the relevant learning outcomes.

2 It is expected that the theoretical components of each unit will be dealt with the relevant practical components, which is given in bold face letters.

3 Capacity of students should be enhanced through extra curricular activities, extensive use of supplementary reading materials and learning teaching aids such as Computer Assisted Learning (CAL) software.

4 With a view to extend learning beyond the class room work and to highlight the students' special abilities , it is expected to involve students in co-curricular activities such as;

- setting up school societies or clubs to pursue various aspects of Biology.
- guiding field trips to places of biological interest and subsequent preparation of reports.
- organising school exhibitions and competitions.
- organising guest lectures on relevant topics by resource persons such as experts or professionals.
- producing school publications.
- organising events such as debates, science days etc.
- establishing links with outside organisations who work towards the advancement of Biology.

5 School management is responsible in providing services such as equipment and assistance within the school and from outside resources

6 In order to develop school policies and programmes, in relation to biology, it would be desirable to form a committee comprising of suitable teachers and students.

7 Most importantly, the school should serve as the role model to be followed by the students.

8 The school will develop its annual programmes, consisting of a variety of activities for achieving policy goals. In determining the activities to be undertaken during a particular year, the school will need to identify priorities and consider feasibility in relation to time and resource constraints.

6.0 Assessment and Evaluation

It is intended to implement this syllabus in schools with the School Based Assessment (SBA) process. Teachers will prepare creative teaching - learning instruments on the basis of school terms.

The details together with the format and the nature of questions will be introduced by the Department of Examination.