

**General Certificate of Education (Advanced Level)
Grades 12-13**



BIOLOGY SYLLABUS
(Implemented from 2017)



**Department of Science
National Institute of Education
Sri Lanka
www.nie.lk**

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 view of 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 environment.

The Biology syllabus for G.C.E. (A/L) has been developed 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.

1.1 National goals

1. Based on the concept of respecting human values and understanding the differences between the Sri Lankan multi-cultural society, building up the nation and confirming the identity of Sri Lanka by promoting national integrity, national unity, national coherence and peace.
2. While responding to the challenges of the dynamic world, identifying and conserving the national heritage.
3. Creating an environment which comprises the conventions of social justice and democratic life to promote the characteristics of respecting human rights, being aware of the responsibilities, concerning each other with affectionate relationships.
4. Promoting a sustainable life style based on the people's mental and physical wellbeing and the concept of human values.
5. Promoting positive feelings needed for a balanced personality with the qualities of creative skills, initiative, critical thinking and being responsible.
6. Developing the human resources, needed for the progress of the wellbeing of an individual, the nation as well as the economic growth of Sri Lanka, through education.
7. Preparing the people for the changes that occur in a rapidly changing world by adapting to it and controlling them; developing abilities and potentialities of people to face the complex and unexpected occasions.
8. Sustaining the skills and attitudes based on justice, equality, mutual respect which is essential to achieve a respectable place in the international community.

National Education Commission Report (2003).

1.2 Basic Competencies

The competencies promoted through the education mentioned below help to achieve the above mentioned National Goals.

i. Competencies in Communication

This first set of competencies is made up of four subsets - Literacy, Numeracy, Graphics and Information Communication skills:

Literacy :	Listening, carefully speaking clearly, and reading for comprehension, writing clearly and accurately.
Numeracy:	Using numbers to count, calculate, code and to measure, matter, space and time.
Graphics :	Making sense of line and form, expressing and recording essential data, instructions and ideas with line, form, colour, two and three-dimensional configurations, graphic symbols and icons.
ICT Competencies:	Knowledge on computers, and the ability to use the information communication skills at learning or work as well as in private life.

ii. Competencies relating to personality development

- Generic skills such as creativity, divergent thinking, initiative, decision making, problem-solving, critical and analytical thinking, team work, inter-personal relationships, discovering and exploring
- Values such as integrity, tolerance and respect for human dignity.
- Cognition

iii. Competencies relating to the environment

This is the second set of competencies related to the Social, Biological and Physical Environments.

Social Environment:	Awareness, sensitivity and skills linked to being a member of society, social relationship, personal conduct, general and legal conventions, rights, responsibilities, duties and obligations.
Biological Environment:	Awareness, sensitivity and skills linked to the living world, man and the ecosystem, the trees, forests, seas, water, air and life - plant, animal and human life.
Physical Environment:	Awareness, sensitivity and skills relating to space, energy, fuel, matter, materials and their links with human living, food, clothing, shelter, health, comfort, respiration, sleep, relaxation, rest, waste and excretion, media of communication and transport.

Included here are the skills in using tools to shape and for materials for living and learning.

iv. Competencies relating to preparation for the world of work

Employment related skills to maximize their potential and to enhance their capacity to contribute to economic development; to discover their vocational interests and aptitudes; to choose a job that suits their abilities and to engage in a rewarding and sustainable livelihood.

v. Competencies relating to religion and ethics

- Develop competencies pertaining to managing environmental resources intelligently by understanding the potential of such resources.
- Develop competencies related to the usage of scientific knowledge to lead a physically and mentally healthy life.
- Develop competencies pertaining to becoming a successful individual who will contribute to the development of the nation in collaboration, engage in further studies and undertake challenging job prospects in the future.
- Develop competencies related to understanding the scientific basis of the natural phenomena and the universe.
- Use appropriate technology to maintain efficiency and effectiveness at an optimum level in utilizing energy and force.

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	05
Unit 02	Chemical & cellular basis of life	85
Unit 03	Evolution and diversity of organisms	61
Unit 04	Plant form and function	77
Unit 05	Animal form and function	193
Unit 06	Genetics	22
Unit 07	Molecular Biology & Recombinant DNA Technology	42
Unit 08	Environmental Biology	41
Unit 09	Microbiology	50
Unit 10	Applied Biology	24
	Total	600

Grade	Term	Competency Levels
Grade 12	First Term	From 1.1.1 to 3.2.3 (16 Competency Levels)
	Second Term	From 3.2.4 to 4.5.1 (17 Competency Levels)
	Third Term	From 5.1.1 to 5.5.3 (12 Competency Levels)
Grade 13	First Term	From 5.6.1 to 6.1.5 (23 Competency Levels)
	Second Term	From 7.1.1 to 8.5.1 (14 Competency Levels)
	Third Term	From 9.1.1 to 10.1.5 (12 Competency Levels)

Unit 1 –Introduction to Biology

(05 periods)

Competency	Competency level	Content	Learning outcomes	Number of periods
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 mankind	<ul style="list-style-type: none"> • Scope and importance of biology • Issues pertaining to biology <ul style="list-style-type: none"> • Understanding biological diversity • Understanding the human body and its functions • Understanding plant life • Management of natural resources and environment • Sustainable food production • Understanding of diseases and causes • Addressing some legal and ethical 	<ul style="list-style-type: none"> • describe the nature, scope and importance of biology • discuss the issues and challenges faced by mankind with reference to biology • discuss how challenges are overcome using new technologies • appreciate the study of biology as a multidisciplinary subject 	02
	1.1.2 Reviews the nature and the organizational patterns of the living world	<ul style="list-style-type: none"> • Diversity of organisms– size, shape, form, habitat • Characteristics of organisms <ul style="list-style-type: none"> • Order and organization • Metabolism • Growth and development • Irritability and coordination • Adaptation • Reproduction • Heredity and evolution 	<ul style="list-style-type: none"> • discuss the wide range in shapes, sizes , forms and habitats of living organisms • elaborate characteristics of living organisms • construct the hierarchical levels of organization with suitable examples • justify the cell as the basic structural and functional unit of life 	03

		<ul style="list-style-type: none"> • Hierarchical levels of organization of living things <ul style="list-style-type: none"> • Molecules • Organelles • Cells • Tissues • Organs • Organ systems • Organism • Population • Community • Ecosystem • Biosphere • Cell as the basic structural and functional unit of life 	<ul style="list-style-type: none"> • appreciate all kinds of living organisms and their interactions 	03
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For Comments

Unit 2 – Chemical & cellular basis of life

(85 Periods)

Competency	Competency level	Content	Learning outcomes	Number of periods
2.1.0 Investigates the chemical basis of life.	2.1.1 Inquires into the elemental composition of living organisms	<ul style="list-style-type: none"> Elemental composition of living matter 	<ul style="list-style-type: none"> list the elements present in organisms. state the most abundant elements in organisms 	02
	2.1.2 Investigates the physical and chemical properties of water important for life	<ul style="list-style-type: none"> Importance of water for life Importance of physical and chemical properties of water for life 	<ul style="list-style-type: none"> describe physical and chemical properties of water which are important for life. relate the physical and chemical properties of water to its functions performed in living systems explain the importance of water for life. appreciate the unique properties of water for existence of life 	04
	2.1.3 Examines the chemical nature and functions of main organic compounds of organisms	<ul style="list-style-type: none"> Structure and function of the four main types of organic compounds found in organisms; Carbohydrates, lipids, proteins, and nucleic acids 	<ul style="list-style-type: none"> describe the basic chemical nature of four main types of organic compounds found in organisms elaborate on the functions of four major types of organic compounds with relevant examples 	09

		<ul style="list-style-type: none"> • Carbohydrates <ul style="list-style-type: none"> • Monosaccharides, disaccharides and polysaccharides • Functions of carbohydrates • Lipids <ul style="list-style-type: none"> • Fats and oils, phospholipids and other lipids • Functions of lipids • Proteins <ul style="list-style-type: none"> • Amino acids and peptide bonds. • Primary, secondary, tertiary and quaternary structures of proteins • Properties of proteins • Functions of proteins • Nucleic acids <ul style="list-style-type: none"> • Nucleosides, nucleotides and polynucleotides along with appropriate examples • Ribonucleotides and deoxyribonucleotides • Structure of DNA-double helical structure • Main functions of DNA 	<ul style="list-style-type: none"> • identify structure and functions of DNA and RNA • differentiate DNA and RNA • explain the role of DNA and RNA as hereditary material • state functions of ATP, NAD, FAD and NADP • conduct laboratory tests to identify the reducing sugars, non-reducing sugars, starch, proteins and lipids. • appreciate that protein, carbohydrates, lipids and nucleic acids form the chemical basis of life • appreciate the unique properties of DNA which are important to act as the hereditary material of all organisms 	
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		<ul style="list-style-type: none"> • Structure of RNA and main functions • Nucleotides found in other molecules (ATP,NAD,NADP,FAD) and their major role • Simple laboratory tests for the identification of reducing and non-reducing sugars, starch, proteins and lipids 		
2.2.0 Examines cell as the basic functioning unit of life	2.2.1Elaborates on the contribution of microscopes to the expansion of knowledge on cells and cellular organization.	<ul style="list-style-type: none"> • Microscopes as tools in biology • Properties of microscopes <ul style="list-style-type: none"> • Magnification • Resolution power • Types of microscopes <ul style="list-style-type: none"> • Light microscope • Electron microscope <ul style="list-style-type: none"> • SEM • TEM • Parts and functions of light microscope and using microscope to observe specimens 	<ul style="list-style-type: none"> • compare significant features of the electron microscope and light microscope • explain magnification and resolution • explain main features of transmission and scanning electron microscopes • identify cellular and sub cellular componenets using light microscope and electron micrographs • develop the skill for handling light microscope efficiently • use the light microscope properly to observe specimens • value the contribution of microscope in biological studies 	07

	<p>2.2.2 Describes the historical background of cell and analyses the structure and functions of the sub cellular units.</p>	<ul style="list-style-type: none"> • Historical background of cell • Cell theory • Organization of cells <ul style="list-style-type: none"> • Prokaryotic • Eukaryotic . • Structure of a typical plant cell and an animal cell • Structure and functions of organelles and sub cellular components <ul style="list-style-type: none"> • Plasma membrane • Cytoplasm • Nucleus • Ribosomes • Endoplasmic reticulum (Rough and Smooth) • Golgi bodies • Lysosomes • Peroxisomes and glyoxysomes • Mitochondria • Chloroplasts • Cytoskeleton (microfilaments, microtubules and intermediate filaments) • Vacuoles • Flagella and cilia 	<ul style="list-style-type: none"> • describe the contribution of scientists towards cell theory • explain the cell theory • explain the difference between eukaryotic and prokaryotic cells • compare the structural differences between plant and animal cells. • describe the structure and function of organelles and sub cellular components of cells. • describe extra cellular components • explain the need and significance of cellular communications • state components of cell communication • use electron micrographs to identify cellular organelles and sub cellular components of a cell • use electron micrographs to differentiate eukaryotic and prokaryotic cellular organization • appreciate division of labour and compartmentalization within a cell 	<p>18</p>
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		<ul style="list-style-type: none"> • Centriole • Extra cellular components • Cell wall • Cell junctions • Extracellular matrix of animal cells • Need and significance of cell communication • Components involved in cell communication • Receptors located on cell membranes or intracellular receptors • Response • Use of electron micrographs to understand the structure of cellular components 		
2.3.0 Investigates the importance of cell cycle and cell division.	2.3.1 Describe the cell cycle and the process of cell division	<ul style="list-style-type: none"> • Cell cycle • Chromosomes • Mitosis <ul style="list-style-type: none"> • Behaviour of chromosomes and other parts of a cell during mitosis • Significance of mitosis. • Meiosis <ul style="list-style-type: none"> • Behaviour of chromosomes and other parts of a cell during meiosis • Significance of meiosis • Galls, tumours and cancers 	<ul style="list-style-type: none"> • elaborate on the phases and main events of cell cycle. • describe the basic structure of eukaryotic chromosome • discuss the main events that occur in each phase. • describe the stages in mitosis and meiosis with reference to chromosomal behavior • describe the significance of synaptonemal complex and kinetochore 	09

		<ul style="list-style-type: none"> • Identification of different stages of mitosis and meiosis using microscopic slides 	<ul style="list-style-type: none"> • compare and contrasts mitosis and meiosis • state the significance of mitosis and meiosis • use prepared slides to identify different stages of mitosis and meiosis under light microscope. • state rapid and uncontrolled mitotic cell division results in formation of galls, tumors and cancers 	
2.4.0 Investigates energy relationships in metabolic processes of organisms.	2.4.1 Analyses the energy relationships in metabolic processes.	<ul style="list-style-type: none"> • Metabolism • Need of energy for living systems. <ul style="list-style-type: none"> • Anabolic and catabolic reactions, • structure of ATP • Importance of ATP as an energy carrier 	<ul style="list-style-type: none"> • explain metabolism • highlight the need of energy for living systems • explain catabolic and anabolic reactions with examples • discuss the structure and the importance of ATP as an universal energy currency unit • list the cellular processes involving energy • appreciate the role of ATP as an universal energy currency 	02

	<p>2.4.2 Investigates the role of enzymes in regulating metabolic reactions.</p>	<ul style="list-style-type: none"> • Enzymes <ul style="list-style-type: none"> • General characteristics of enzymes • Mechanism of enzymatic reaction <ul style="list-style-type: none"> • Induced fit mechanism • Cofactors <ul style="list-style-type: none"> • Coenzymes • Inorganic ions • Factors affecting enzymatic reactions <ul style="list-style-type: none"> • pH • Temperature • Substrate concentration • Enzyme concentration • Inhibitors-competitive, non competitive • Laboratory experiment to demonstrate enzyme activity and to determine effect of temperature on rate of enzymatic reaction (starch-amylase) 	<ul style="list-style-type: none"> • define enzymes • explain the general characteristics of enzymes and their role • describe the importance of co-factors for enzymatic activities • describe the mechanism of enzyme activity by using suitable diagrams • explain how pH, temperature, substrate concentration, enzyme concentration and inhibitors (competitive and non competitive) affect the rate of enzyme activity • conduct laboratory experiments to show how temperature affects the rate of enzyme reaction using starch – amylase system • appreciate the role of enzymes in metabolic reactions 	<p>10</p>
	<p>2.4.3 Examines photosynthesis as an</p>	<ul style="list-style-type: none"> • Importance of photosynthesis 	<ul style="list-style-type: none"> • define photosynthesis • discuss the global and biological 	<p>12</p>

	<p>energy fixing mechanism.</p>	<ul style="list-style-type: none"> • Pigments and photosystems • Light dependent reaction of photosynthesis <ul style="list-style-type: none"> • Capturing energy from sun light • Photolysis of water • Synthesis of NADPH and ATP • Calvin cycle (C₃ pathway) <ul style="list-style-type: none"> • Carboxylation – function of RUBP carboxylase. • Reduction – Reduction of PGA and synthesis of carbohydrates. • Regeneration of RUBP • Photorespiration in C₃ plants • C₄ pathway of photosynthesis <ul style="list-style-type: none"> • Significance of C₄ pathway • Anatomical differences between C₃ and C₄ plant leaves • Blackman's principle of factors affecting photosynthesis • Limiting factors affecting photosynthesis <ul style="list-style-type: none"> • Carbon dioxide • Light 	<p>importance of photosynthesis</p> <ul style="list-style-type: none"> • differentiate the role of pigments involved in photosynthesis • describe the nature and significance of photosystems • describe the light dependent reaction of photosynthesis • describe the Calvin cycle of photosynthesis • describe the C₄ pathway of photosynthesis • describe the impact of photorespiration of C₃ plants • explain C₄ pathway has evolved to minimize photorespiration • differentiate C₃ and C₄ plants • correlate limiting factors of photosynthesis with the productivity/efficiency of plants in different environmental conditions • design and carryout experiments to determine the rate of photosynthesis by amount of oxygen released • discuss the effect of global warming on photosynthesis 	
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		<ul style="list-style-type: none"> • Temperature • Determination of rate of photosynthesis by amount of O₂ released using Audus apparatus (at different CO₂ concentrations and light intensities) • Microscopic observation of a cross sections of C₃ and C₄ leaves with special reference to adaptations for photosynthesis. 	<ul style="list-style-type: none"> • appreciate the universal role of photosynthesis 	
	2.4.4 Examines cellular respiration as a process of obtaining energy	<ul style="list-style-type: none"> • Cellular respiration <ul style="list-style-type: none"> • Importance of cellular respiration • Aerobic and anaerobic processes • Aerobic respiration- process of glucose oxidation <ul style="list-style-type: none"> • Glycolysis • Pyruvate oxidation and Citric acid cycle (Kreb`s cycle) • Electron transport chain • Anaerobic respiration • Ethanol fermentation and Lactic acid fermentation • Use of lipids (fats and oils) and proteins in respiration 	<ul style="list-style-type: none"> • define cellular respiration • highlight cellular respiration as the process of supplying energy for all cellular activities. • describe the location, major events and end products of aerobic respiration. • describe the location, major events and end products of anaerobic respiration • differentiate aerobic and anaerobic respiration • calculate efficiency of anaerobic and aerobic respiration • list out the significance of cellular respiration. 	12

		<ul style="list-style-type: none"> • Respiratory quotient • Determination of rate of respiration and respiratory quotient using germinating seeds 	<ul style="list-style-type: none"> • relate the substrate with respiratory quotient • determine the rate of respiration and respiratory quotient using germinating seeds • appreciate the significance of respiration for all organisms 	
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For Comments

Unit 3 –Evolution and diversity of organisms

(61 periods)

Competency	Competency level	Content	Learning outcomes	Number of periods
3.1.0 Explores evolution of life	3.1.1 Uses the theories of origin of life and natural selection to analyze the process of evolution of life	<ul style="list-style-type: none"> • Origin of life on earth • Evolution of biological diversity • Theories of evolution <ul style="list-style-type: none"> • Theory of Lamarck • Darwin – Wallace theory - Theory of natural selection • Neo-Darwinism 	<ul style="list-style-type: none"> • describe the conditions on earth before life • describe the theories on origin of life • explain the process of evolution of biological diversity • state four eras of geological time scale • explain theory of Lamarck and theory of natural selection • relate theory of Neo-Darwinism to natural selection 	07
3.2.0 Explores the diversity of organisms	3.2.1 Constructs hierarchy of taxa on scientific basis	<ul style="list-style-type: none"> • Identification of organisms, classification and nomenclature • Methods of natural & artificial classification • History of classification • Hierarchy of taxa from domains to species • Biological definition of species • Criteria used in Species identification • Binomial nomenclature 	<ul style="list-style-type: none"> • use classification and nomenclature to identify organisms • distinguish between natural and artificial classification methodologies. • describe history of systems of classification • define Species • state advantages of classification of organisms • use and construct a 	12

		<ul style="list-style-type: none"> • Use of dichotomous key • Present system of classification and its basis • Domains <ul style="list-style-type: none"> • Bacteria • Archaea • Eukarya • kingdoms of Domain Eukarya <ul style="list-style-type: none"> • Protista • Plantae • Fungi • Animalia 	<ul style="list-style-type: none"> • dichotomous key • identify taxonomic levels used in classification of organisms • name organisms according to binominal nomenclature. • use specific characteristics of organisms to classify them in to three domains • describe the differences of three domains • state examples of each domain • explain the basic characteristics of kingdoms of Eukarya • appreciate natural diversity of organisms on earth and the need for classifying them 	
	3.2.2 Explores the diversity of organisms within Domain Bacteria	<ul style="list-style-type: none"> • Domain - Bacteria <ul style="list-style-type: none"> • Characteristic features of Bacteria and Cyanobacteria • Observe and distinguish between Bacteria and Cyanobacteria under light microscope • Use of electron micrographs to study morphological features of Bacteria and Cyanobacteria 	<ul style="list-style-type: none"> • differentiate between bacteria and Cyanobacteria. • explain the characteristic features of bacteria and cyanobacteria • observe and distinguish bacteria and Cyanobacteria under light microscope • recognize the importance of bacteria and Cyanobacteria to the ecosystems 	05

	<p>3.2.3 Explores the diversity of organisms within the kingdom Protista.</p>	<ul style="list-style-type: none"> • Key morphological characteristics of kingdom Protista giving suitable examples. <ul style="list-style-type: none"> • <i>Euglena</i>. • <i>Paramecium</i>. • <i>Amoeba</i>. • <i>Ulva</i>. • <i>Gelidium</i>. • <i>Sargassum</i>. • Diatoms • Observation of morphological features of typical organisms of the above phyla using suitable examples 	<ul style="list-style-type: none"> • state key characteristics of kingdom Protista giving suitable examples • observe and identify characteristic features of typical organisms • recognize the importance of Protista in ecosystems 	<p>06</p>
	<p>3.2.4 Explores the diversity of organisms within the kingdom Plantae</p>	<ul style="list-style-type: none"> • Kingdom – Plantae • Evolutionary relationship among major groups of plants • Characteristic features of the following phyla and groups referring to the given examples • Non vascular <ul style="list-style-type: none"> • Phylum – Hepatophyta • Phylum - Bryophyta • Phylum – Anthocerothyta • Vascular seedless plants <ul style="list-style-type: none"> • Phylum – Lycophyta • Phylum – Pterophyta 	<ul style="list-style-type: none"> • state characteristic features of non vascular, vascular, vascular seedless and vascular seeded plants • show evolutionary relationships among major groups of plants • classify flowering plants as Monocots and Dicots using characteristic features. • observe morphological features of typical organisms of the given phyla and groups • appreciate the importance of members of kingdom Plantae in 	<p>08</p>

		<ul style="list-style-type: none"> • Vascular,seed plants • Phylum-Cycadophyta • Phylum-Gnetophyta • Phylum – Coniferophyta • Phylum – Anthophyta <ul style="list-style-type: none"> • Monocots • Dicots • Observation of morphological features of typical organisms of the above phyla and groups using suitable examples 	ecosystems.	
	3.2.5 Explores the diversity of organisms within the kingdom Fungi.	<ul style="list-style-type: none"> • Kingdom – Fungi • Characteristic features of the following phyla using given examples <ul style="list-style-type: none"> • Phylum – Chytridiomycota • Phylum – Zygomycota • Phylum – Ascomycota • Phylum – Basidiomycota • Observation of key characteristic features of typical organisms of the above phyla using suitable examples 	<ul style="list-style-type: none"> • elaborate the characteristic features of kingdom Fungi. • classify organisms in kingdom Fungi into phyla using their vegetative and reproductive patterns. • observe and identify key characteristic features of typical organisms of the given phyla • recognize the role of fungi in ecosystems 	06

	<p>3.2.6 Explores the diversity of organisms within the kingdom Animalia</p>	<ul style="list-style-type: none"> • Kingdom– Animalia • Evolutionary relationships among major groups of animals • Characteristic features of the following phyla (Details of feeding, osmo regulation, excretion, nervous & hormonal regulations, respiration, reproduction) • Cnidaria • Platyhelminthes • Rotifera • Nematoda • Annelida • Arthropoda • Mollusca • Echinodermata • Cephalochordata • Chordata • Observation of morphological features of each phyla using typical organisms of the above phyla 	<ul style="list-style-type: none"> • elaborate the characteristic features of kingdom Animalia. • explains evolutionary relationships of major phyla • classify organisms in kingdom Animalia into phyla using characteristic features. • observe characteristic features of typical organisms of the given phyla • appreciate the diversity of invertebrates. • recognize the importance of members of kingdom Animalia to the ecosystem 	<p>09</p>

	<p>3.2.7 Uses the characteristic features to study organisms belonging to phylum Chordata</p>	<ul style="list-style-type: none"> • Characteristic features of classes of phylum Chordata <ul style="list-style-type: none"> • Chondrichthyes • Osteichthyes • Amphibia • Reptilia • Aves • Mammalia • Observation of characteristic features of typical organisms of the above classes using suitable examples 	<ul style="list-style-type: none"> • identify organisms belonging major classes of phylum Chordata • construct dichotomous keys to identify given examples • observe characteristic features of typical organisms of the given classes • appreciate the diversity of major classes of phylum Chordata 	<p>08</p>
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**Unit 4 – Plant form and function
(80 Periods)**

Competency	Competency Level	Content	Learning outcomes	No. of Periods
4.1.0 Explores structure, growth and development of plants	4.1.1 Examines different types of tissues and relates the structure of plant tissues to their functions	<ul style="list-style-type: none"> • Meristems, their locations and role in plant growth <ul style="list-style-type: none"> • Apical meristems • Lateral meristems • Intercalary meristems • Three basic types of tissue systems of plants <ul style="list-style-type: none"> • Dermal tissues <ul style="list-style-type: none"> • Epidermis • Guard cells • Trichomes • Root hairs • Ground tissues <ul style="list-style-type: none"> • Parenchyma • Collenchyma • Sclerenchyma • Vascular tissues <ul style="list-style-type: none"> • Xylem • Phloem 	<ul style="list-style-type: none"> • explain characteristic features of meristematic cells • describe the regions of shoot apex and root apex • explain the role of each meristem and their locations • describe how differentiation of tissues takes place at growing regions • distinguish three types of tissue systems in plants • discuss the role and functions of each tissue • identify special characters of cell types of each tissue by using light microscope • appreciate that plant tissues and their differentiations are evolved to perform respective functions efficiently 	08

	<p>4.1.2 Examines the changes taking place in the growth and development process of a plant</p>	<ul style="list-style-type: none"> • Primary structure of monocotyledonous and dicotyledonous stems • Primary structure of monocotyledonous and dicotyledonous roots • Secondary growth in plants • Formation of wood, growth rings, heart wood and sapwood, hard wood and soft wood • Study of cross sections of primary stem and primary root of a Monocot and a Dicot • Microscopic and macroscopic examination of secondary structure of Dicotyledonous wood using transverse sections 	<ul style="list-style-type: none"> • distinguish between primary and secondary growth • illustrate the histological structure of primary stems and roots of Monocotyledonous and Dicotyledonous plants • describe how secondary growth of Dicotyledonous stems and roots takes place • describe the structure as seen in a cross section of a Dicotyledonous stem after secondary growth • appreciate the importance of secondary growth for existence of perennial plants • differentiate heart wood and sap wood • differentiate hard wood and soft wood 	<p>10</p>
<p>4.2.0 Examines resource acquisition and transport in vascular plants</p>	<p>4.2.1 Investigates the shoot architecture and light capture</p>	<ul style="list-style-type: none"> • Structure and functional adaptations of leaf for efficient photosynthesis • Shoot and leaf architecture facilitate light capture for photosynthesis • The length of stems and their branching patterns • Leaf size and structures • The arrangement of leaves on a stem-phyllotaxy 	<ul style="list-style-type: none"> • describe the various adaptations seen in plants to maximize capturing of light • define the leaf area index • carry out experiments to observe cross section of mesophytic dicot leaf with special reference to 	<p>02</p>

		<ul style="list-style-type: none"> • Leaf area index • Leaf orientation 	adaptations for photosynthesis	
	4.2.2 Investigates the process of gaseous exchange in plants	<ul style="list-style-type: none"> • Leaves of plants as the main surface for gaseous exchange • Anatomy of typical dicot and monocot leaves • Typical structure of stomata • Mechanisms of action of opening and closing of stomata • Factors affecting stomatal action 	<ul style="list-style-type: none"> • describe and compare typical leaf structure of monocot and dicot leaf • relate the structure of stomata to its function • describe the gaseous exchange through stomata, cuticle and lenticels • describe the mechanisms of opening and closing of stomata using K^+ influx • explain role of ABA in stomatal closure in drought • observe the structure of stomata and lenticels through microscope • appreciate the mechanisms of stomatal opening in relation to different environmental conditions 	04

	<p>4.2.3 Investigates the concepts of acquisition of water and minerals</p>	<ul style="list-style-type: none"> • Concepts of water potential, solute potential of solutions, cell and soil • Pathway of entry of water into root cells • Transport of water within the root • Entering of water into vascular tissue • Travelling of water up to aerial parts of the plant • Cohesion-adhesion theory and mass flow • Mechanisms of mineral absorption into root • Determination of solute potential of epidermal peels of <i>Rhoeo</i> • Determination of water potential of petioles of <i>Colocasia</i> / potato strips 	<ul style="list-style-type: none"> • explain the need for transport of materials in plants • describe the pathway of water and mineral movement through and between the cells of the plant body • elaborate on the concepts and principles underlying transport of water and minerals in plants • explain absorption and radial transport of minerals and water in a plant • relates the root anatomy with absorption and transport of water and minerals • explain the upward movement of water & minerals in a plant • appreciate roots as a main route of water and mineral acquisition to a plant 	<p>08</p>
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For Comments

	4.2.5 Investigates the process involved in transport of materials in plants	<ul style="list-style-type: none"> • basic characteristics of phloem transport • Materials transport through phloem • Mechanisms of phloem transport • Phloem loading, mass flow and phloem unloading <ul style="list-style-type: none"> • Pressure flow hypothesis 	<ul style="list-style-type: none"> • state the materials transported through phloem • describe the mechanism of phloem translocation • relate the structure of the phloem tissue to its function • appreciate the process of phloem translocation 	04
	4.2.6 Investigates the processes of water loss in plants	<ul style="list-style-type: none"> • Transpiration <ul style="list-style-type: none"> • Routes of transpiration • Factors affecting transpiration rate • Root pressure and guttation <p>Determination of rates of transpiration from leaves and shoots using photometer</p>	<ul style="list-style-type: none"> • describe the routes of transpiration • list the factors affecting transpiration rate and discuss how those factors effect transpiration • describe guttation • elaborate on how root pressure develops in plants and its effects on guttation • compare transpiration and guttation • conduct experiments to determine solute potential and water potential of cells using <i>Rhoeo</i>, potato tubers and petioles of <i>Colocasia</i> respectively • design and conduct experiments to determine the rates of transpiration from leaves & shoots under different environmental conditions • appreciate the routes of transpiration in plants 	04

<p>4.3.0 Explores the diversity of nutritional processes in plants</p>	<p>4.3.1 Investigates the modes of nutrition of plants</p>	<ul style="list-style-type: none"> • Nutrition and its importance for plants • Autotrophic nutrition <ul style="list-style-type: none"> • Photoautotrophic • Symbiosis <ul style="list-style-type: none"> • Mutualism • Parasitism • Commensalism • Insectivorous plants 	<ul style="list-style-type: none"> • explain the importance of nutrition for life • describe with examples the special modes of nutrition in organisms • appreciate that plant nutrition often involves relationships with other organisms 	<p>08</p>
	<p>4.3.2 Investigates nutritional requirement for the optimal growth of plants</p>	<ul style="list-style-type: none"> • Form of absorption, functions and deficiency symptoms <ul style="list-style-type: none"> • Essential elements in plants <ul style="list-style-type: none"> • Macronutrients • Micronutrients 	<ul style="list-style-type: none"> • define the terms of essential elements, macronutrients and micronutrients • state the relative abundance of them in plant • describe the functions and deficiency symptoms of macro and micro nutrients in plants 	<p>06</p>
<p>4.4.0 Inquires into reproductive process in plants</p>	<p>4.4.1 Uses the trends in life cycles, to relate the adaptations of plants for a terrestrial life</p>	<ul style="list-style-type: none"> • Sexual reproduction of terrestrial plants • Alternation of generations in plants • Haploid and diploid generations • Gametophytes and sporophytes • Diversity in the life cycles of terrestrial plants. <ul style="list-style-type: none"> • <i>Pogonatum</i> • <i>Nephrolepis</i> 	<ul style="list-style-type: none"> • explain alternation of generation • explain that in the evolution of land plants, gametophytic generation gradually reduced and the sporophytic generation became dominant as adaptation to land habit 	<p>10</p>

		<ul style="list-style-type: none"> • <i>Selaginella</i> • <i>Cycas</i> • Angiosperms (flowering plants) • Basic features of the life cycles of above plants • Reduction of the gametophyte and complexity of sporophyte in order to adapt for terrestrial life. <p>(details of reproductive structures are not required)</p>		
	4.4.2 Examines structures and functions associated with sexual reproduction in flowering plants	<ul style="list-style-type: none"> • Sexual reproduction in flowering plants • Structure and functions of the flower • Pollination and fertilization • Significance of cross pollination • Embryo, development of fruits and seeds • Parthenocarpy and parthenogenesis • seed dormancy • Physiological changes happening at the initiation of seed germination 	<ul style="list-style-type: none"> • elaborate the structure and function of a flower • describe pollination and fertilization in flowering plants • describe the significance of cross pollination • state the significance of development of seeds and fruits • explain parthenocarpy and parthenogenesis with examples • describe the significance of seed dormancy • state the major physiological changes occurring in seed germination • appreciate the diversification of plants for the existence of all other forms of life on land 	08

<p>4.5.0 Explores plant responses to internal and external signals</p>	<p>4.5.1 Inquires into types of movement in plants in response to different stimuli</p>	<ul style="list-style-type: none"> • Different types of movements in plants <ul style="list-style-type: none"> • Turgor movements • Tropic movements <ul style="list-style-type: none"> • Phototropic, geotropic, and thigmotropic movements • Function of auxins in tropic movements. • Tactic movements • Nastic movements <ul style="list-style-type: none"> • Thigmonasticism • Nyctinasticism 	<ul style="list-style-type: none"> • explain four basic types of movements in plants • state examples for each type of movement • compare nastic and tropic responses • appreciate the contribution of plant movements for the survival of plants in their environment 	<p>02</p>
	<p>4.5.2 Investigates the role of plant growth substances/regulators/hormones in</p>	<ul style="list-style-type: none"> • Compounds that contribute to the growth and development of plants <ul style="list-style-type: none"> • Auxins • Gibberellins • Cytokinin 	<ul style="list-style-type: none"> • explain general characteristics of plant growth substances/ regulators • state major types of plant growth substances • state the functions of auxins, cytokinins, gibberellins, abscisic acid, ethylene and jasmonic 	<p>04</p>

	response to different stimuli	<ul style="list-style-type: none"> • Abscisic acid • Ethylene • Jasmonic acid • Agricultural uses of the above plant growth substances 	<p>acid in plant life</p> <ul style="list-style-type: none"> • state agricultural uses of plant growth substances 	
	4.5.3 Investigates response of plants to some biotic and abiotic stresses	<ul style="list-style-type: none"> • Abiotic stress <ul style="list-style-type: none"> • Al and Fe³⁺ toxicity • Salinity • Biotic stress <ul style="list-style-type: none"> • Pests • Pathogens • Herbivore attacks • Major groups of secondary metabolites (Cyanogenic glucoside, terpenoid, alkaloid and phenolics) of plants important for responding to above stresses 	<ul style="list-style-type: none"> • explain selected resistance mechanisms against abiotic stress • state secondary metabolites found in plants responsible for plant defense • appreciate secondary metabolites have medicinal and economical value 	03

Unit 5- Animal form and function

(193 periods)

Competency	Competency level	Content	Learning outcomes	Number of periods
5.1.0 Explores structure, growth and development of animals	5.1.1 Relates the structure of animal tissues to their functions	<ul style="list-style-type: none"> • Types of animal tissues, their structure, functions and locations • Epithelial tissues <ul style="list-style-type: none"> • Simple (squamous, cuboidal, columnar, pseudo stratified) • Compound -stratified • Connective tissues <ul style="list-style-type: none"> • Loose- (Areolar) • Dense(fibrous) • Adipose • Blood • Cartilage • Bone • Muscle tissue (smooth, skeletal, cardiac) • Nervous tissue (neurons and neuroglia) • Microscopic observation and identification of different types of animal tissues 	<ul style="list-style-type: none"> • list main types of animal tissues • relate the structural features of animal tissues to their function • list characters of main types of animal tissues • use characters of animal tissues to identify the main types under microscope. • compare the different types of animal tissues • appreciate that animal tissues are adapted to perform functions in animals 	10

<p>5.2.0 Explores nutrition in animals</p>	<p>5.2.1 Explores heterotrophic nutrition in animals</p>	<ul style="list-style-type: none"> • Heterotrophic nutrition <ul style="list-style-type: none"> • Holozoic nutrition • Symbiosis • Main stages in holozoic nutrition <ul style="list-style-type: none"> • Ingestion • Digestion • Absorption • Assimilation • Elimination/Egestion • Feeding mechanisms of animals <ul style="list-style-type: none"> • Suspension feeders • Substrate feeders • Fluid feeders • Bulk feeders • Symbiosis <ul style="list-style-type: none"> • Mutualism • Parasitism • Commensalism 	<ul style="list-style-type: none"> • describe heterotrophic nutrition • explain stages in holozoic nutrition • describe feeding mechanisms of animals • describe symbiosis with examples 	<p>05</p>
	<p>5.2.2 Relates the structure of the human digestive system to its functions.</p>	<ul style="list-style-type: none"> • Structure and functions of the human digestive system <ul style="list-style-type: none"> • Alimentary canal • Associated glands <ul style="list-style-type: none"> • Gross morphological and histological structure of liver and pancreas 	<ul style="list-style-type: none"> • explain the structure of the human digestive system. • state the locations of the different organs of the digestive system • relate the structure with the functions of each organ in the digestive system • describe the gross morphological and histological structure of liver 	<p>13</p>

		<ul style="list-style-type: none"> • endocrine regulation of digestion in man • Balanced diet • Components of food and their functions <ul style="list-style-type: none"> • Carbohydrates • Proteins • Lipids • Vitamins • Mineral elements • Water • Fibers • Essential Amino acids and essential fatty acids • Sources and deficiency symptoms of vitamins and minerals • Basal metabolic rate and energy budget • Food for healthy life • Obesity • Malnutrition • Food allergies • Food related disorders in the alimentary canal <ul style="list-style-type: none"> • Gastritis • Constipation • Study the human digestive system using diagrams and models 	<p>and pancreas</p> <ul style="list-style-type: none"> • explain the contribution of associated glands in the process of digestion • explain the process of digestion • explain the causes and precautions of food related disorders in the alimentary canal • state the major endocrinal secretions related to digestion and their functions in man • explain balanced diet • explain major causes and symptoms of malnutrition and obesity • state essential amino acids and essential fatty acids • describe the components of food & their function. • state the sources & deficiency symptoms of vitamins and minerals • avoid food related disorders by practicing proper food habits • appreciate the role of dietary fibres and antioxidants for healthy life in avoiding disorders in alimentary canal 	
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<p>5.3.0 Investigates on circulation and gas exchange of animals</p>	<p>5.3.1 Investigates the organization of circulatory systems in animals</p>	<ul style="list-style-type: none"> • Need of a circulatory system in animals • Main circulatory systems in animals. <ul style="list-style-type: none"> • Open & closed circulatory systems. • Single circulation and double circulation. 	<ul style="list-style-type: none"> • explain the need of a circulatory system for animals • compare open and closed circulatory systems using simple diagrams • compare single and double circulation. • elaborate the features of double circulation. 	<p>03</p>
	<p>5.3.2 Relates the structure of the human circulatory system to its functions.</p>	<ul style="list-style-type: none"> • Basic plan of vertebrate and mammalian circulatory systems • Structure and functions of the human circulatory system. <ul style="list-style-type: none"> • Blood circulatory system and lymphatic system. • Structure of blood vessels and lymphatic vessels • Structure & function of the heart. <ul style="list-style-type: none"> • Cardiac cycle <ul style="list-style-type: none"> • Electrocardiogram • Systolic & diastolic pressure • Hypertension and hypotension • Coronary circulation and consequences of blockage of coronary arteries. 	<ul style="list-style-type: none"> • describe basic plan of human circulatory system & lymphatic system. • compare the structure of human blood vessels and lymph vessels • explain the structure & function of human heart. • describe the cardiac cycle. • identify the peaks of a typical ECG • explain causes of hypertension and hypotension • explain systolic & diastolic pressure. • describe hypertension & hypotension as conditions leading to cardiovascular disorders • briefly describe the coronary 	<p>11</p>

			circulation & consequences of blockage of coronary arteries.	
	5.3.3 Inquires into the role of blood.	<ul style="list-style-type: none"> • Respiratory pigments in man. • Respiratory pigments of other animals. • Transport of respiratory gases and other substances. • Blood clotting • Grouping of blood <ul style="list-style-type: none"> • ABO grouping • Rh factor • Study the circulatory system of man using specimens/ models/diagrams 	<ul style="list-style-type: none"> • state respiratory pigments in man. • state respiratory pigments in other animals. • describe the transport of respiratory gases & other substances. • draw a flow chart of sequence of blood clotting process • describe the ABO grouping based on agglutinogen and agglutinin • describe Rh blood factors based on antigen and antibodies • explain significance of blood groups in blood transfusion • explain the importance of Rh factor in pregnancy 	08
	5.3.4 Explores the diversity of respiratory structures in the animal kingdom	<ul style="list-style-type: none"> • Respiratory surface • Respiratory structures of animals <ul style="list-style-type: none"> • Body covering, external gills, internal gills, trachea, book 	<ul style="list-style-type: none"> • define and state the need of respiratory surfaces in animals • describe the characteristics of respiratory surfaces 	02

		<p>lungs ,respiratory tree and lungs</p> <ul style="list-style-type: none"> • (Detailed structures are not necessary. The students should be able to identify the respiratory structures) 	<ul style="list-style-type: none"> • state different respiratory structures of animals 	
	<p>5.3.5 Relates the structure of the human respiratory system to its functions.</p>	<ul style="list-style-type: none"> • Gross structure of the human respiratory system • Mechanism of ventilation of lungs • Respiratory cycle and lung volumes and capacities • Exchange of gases between blood and air (external respiration) • Exchange of gases between blood and tissues (internal respiration) • Dissociation curve of Oxy-hemoglobin • Regulation of respiration in man • Disorders of the human respiratory system. <ul style="list-style-type: none"> • 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 • Lung cancers 	<ul style="list-style-type: none"> • explain the gross structure of the human respiratory system. • relate the structure with the function of each part of the respiratory system • describe the mechanism of ventilation of lungs. • explain the respiratory cycle & lung volume. • explain the exchange of gases between blood & air and blood & tissue. • discuss the dissociation curve of Oxy-hemoglobin • describe the regulation of respiration in man. • state the changes in lung capacity ,tidal volume during a strenuous exercise • state the major disorders of the human respiratory system 	<p>08</p>

		<ul style="list-style-type: none"> • Tuberculosis • Asthma • Study of human respiratory system using models/diagrams and observation of effects of exercise on respiratory rate and pulse rate 	<ul style="list-style-type: none"> • measure effects of exercise on respiratory rate and pulse rate 	
5.4.0 Explores immunity -	5.4.1 Explores types of immunity	<ul style="list-style-type: none"> • Immunity • Innate immunity • External defenses <ul style="list-style-type: none"> • Skin • Mucous membranes • Secretions • Internal defenses <ul style="list-style-type: none"> • phagocytic cells • antimicrobial proteins • inflammatory response • natural killer cells • Acquired immunity <ul style="list-style-type: none"> • Humoral immunity response • Cell-mediated immune response • Antigens • Antibodies • Lymphocytes <ul style="list-style-type: none"> • T- lymphocytes • B-lymphocytes 	<ul style="list-style-type: none"> • explain immunity • describe humoral response • describe cell mediated response • explain types of external immunity • explain types of internal immunity • explain active immunity with examples • explain passive immunity with examples • state possible causes for allergies, auto immune diseases and immunodeficiency diseases • describe antigens and antibodies • describe role of T lymphocytes and B lymphocytes in immunity • appreciate the importance of immune system for survival 	08

		<ul style="list-style-type: none"> Naturally acquired immunity <ul style="list-style-type: none"> Active immunity Passive immunity Artificially acquired immunity <ul style="list-style-type: none"> Active immunity Passive immunity Allergies Auto immune diseases Immunodeficiency diseases 		
5.5.0 Explores osmoregulation and excretion	5.5.1 Examines the relationship between metabolism and excretory substances	<ul style="list-style-type: none"> Importance and need of osmoregulation and excretion Excretory products Relationship between metabolism of substrates and their excretory products Nitrogenous excretory products Advantages and disadvantages of excreting different types of nitrogenous end products. Relationship between the nitrogenous end products and living environment 	<ul style="list-style-type: none"> explain the process of excretion & its importance. describe the relationship between excretory products & metabolism explain the end products of nitrogenous excretion. compare advantages & disadvantages of excreting different nitrogenous excretory products. state examples for organisms excreting different types of nitrogenous end products 	04
	5.5.2 Investigate the diversity of excretory structures of organisms	<ul style="list-style-type: none"> Different excretory structures in animals (Details of fine structure of excretory structures not necessary) <ul style="list-style-type: none"> Body surface 	<ul style="list-style-type: none"> list the different excretory structures in animals giving suitable examples explain the different excretory 	04

		<ul style="list-style-type: none"> • Contractile vacuoles • Flame cells • Nephridia • Malpighian tubules • Green glands/antennal glands • Sweat glands • Salt glands • Study of major types of excretory structures in animals using diagrams and charts 	structures in animals by using simple diagrams	
	5.5.3 Investigates the gross functioning of the human urinary system	<ul style="list-style-type: none"> • Human urinary system <ul style="list-style-type: none"> • Parts of the human urinary system <ul style="list-style-type: none"> • Kidney <ul style="list-style-type: none"> • Location • Blood supply • Structure • Ureters • Urinary bladder • Urethra (urinary passage) • Nephron as the structural and functional unit • Process of urine formation <ul style="list-style-type: none"> • Ultrafiltration • Selective reabsorption • Secretion 	<ul style="list-style-type: none"> • describe parts of human urinary system and their functions • describe the location, blood supply and structure of the kidney • explain nephron as the structural and functional unit • describe the process of urine formation • construct a flow chart on the role of hormones on the functioning of the kidney • discuss role of kidney as a main homeostatic organ • explain the preventive measures of bladder and kidney stones • explain what CKDu is and discuss 	09

		<ul style="list-style-type: none"> • Role of hormones on the functions of the kidneys <ul style="list-style-type: none"> • ADH • Aldosterone • Other functions of the kidney (Kidney as a main homeostatic organ) <ul style="list-style-type: none"> • Osmo-regulation • Control of blood volume • Blood pH regulation • Secretion Erythropoietin and Renin • Maintenance of blood volume and blood pressure. • Disorders related to human urinary system <ul style="list-style-type: none"> • Bladder & kidney stones • Chronic kidney disease of unknown etiology (CKDu) • Measures of prevention of disorders 	<p>hypothesized reasons for its occurrence</p> <ul style="list-style-type: none"> • appreciate the importance of maintaining well being of urinary system 	
5.6.0 Investigates the structures & functions involved in nervous coordination	5.6.1 Inquires in to the processes and systems involved in coordination.	<ul style="list-style-type: none"> • Need for coordination • Systems contributing to coordination <ul style="list-style-type: none"> • Nervous system • Endocrine system • Similarities and differences (in relation to coordination) of the nervous system and the endocrine system 	<ul style="list-style-type: none"> • discuss the need for coordination. • describe the systems contributing to coordination • compare the nervous system & the endocrine system. • describe different types of nervous organizations among animals 	03

		<ul style="list-style-type: none"> • Organization of nervous systems (Cnidaria, Platyhelminthes, Arthropoda, Echinodermata and Chordata) 		
	5.6.2 Investigates the gross structure & functions of the human nervous system.	<ul style="list-style-type: none"> • Organization and main parts of the human nervous system • Central nervous system • Brain <ul style="list-style-type: none"> • Embryonic origin • Meninges • Cerebro ventricles and cerebro spinal fluid • Main parts of human brain <ul style="list-style-type: none"> • Cerebrum <ul style="list-style-type: none"> • Lobes of cerebral hemisphere • Functional areas of cerebral cortex <ul style="list-style-type: none"> • Sensory area • Associated area • Motor area 	<ul style="list-style-type: none"> • describe the organization & main parts of the human nervous system. • describe the autonomic nervous system & the functions • explain the importance of antagonistic effect of sympathetic and parasympathetic nervous system in smooth functioning of human body • state the overall function of the nervous system • describe major parts of the human brain • relate the main parts of the human brain to their functions • describe the importance of three major functional areas of cerebral cortex • explain organization of the human nervous system using diagrams/ models 	11

		<ul style="list-style-type: none"> • Brain stem <ul style="list-style-type: none"> • Medulla oblongata • Pons varoli • Mid brain • Cerebellum • Thalamus • Hypothalamus • Spinal cord. • Peripheral nervous system <ul style="list-style-type: none"> • Cranial nerves • Spinal nerves • Autonomic nervous system <ul style="list-style-type: none"> • Sympathetic and parasympathetic nervous systems and their functions • Overall function 	<ul style="list-style-type: none"> • appreciate the contribution of major parts of the brain for smooth functioning of human body and maintaining healthy life 	
	5.6.3 Explores how nerve impulses are generated and transmitted.	<ul style="list-style-type: none"> • Nerve impulse conduction <ul style="list-style-type: none"> • Resting potential • Ion exchange • Action potential • Synapses <ul style="list-style-type: none"> • Neurotransmitters • Reflex arc 	<ul style="list-style-type: none"> • describe how the nerve impulse is conducted along an axon • describe the gross structure of synapses • explain mechanism of transmitting a nerve impulse through synapses • explain the reflex arc • list different types of neurotransmitters and state the 	07

			basic role of each of them	
	5.6.4 Explores the injuries and common disorders of the nervous system	<ul style="list-style-type: none"> • Common disorders of nervous system • Schizophrenia • Depression • Alzheimer ,s disease • Parkinson’s disease 	<ul style="list-style-type: none"> • explain the reasons for common disorders of the nervous system and how those could be controlled 	02
	5.6.5 Explores the functions of different sensory structures in human	<ul style="list-style-type: none"> • Human sensory structures (Receptors) • Basic characteristics • Types • Chemoreceptors <ul style="list-style-type: none"> • Taste receptors • Olfactory receptors • Thermo receptors <ul style="list-style-type: none"> • Cold - Krauses’s end bulbs • Warmth–Ruffini bodies • Free nerve endings • Photoreceptors <ul style="list-style-type: none"> • Rods • Cones • Mechanoreceptors 	<ul style="list-style-type: none"> • state basic characteristics of the human sensory structures. • describe the sensory structures of man using diagrams/ models 	04

		<ul style="list-style-type: none"> • Touch receptors– Meissner corpuscles, Merkel’s discs • Pressure receptors <ul style="list-style-type: none"> • Pacinian corpuscles • Vibration receptors <ul style="list-style-type: none"> • Most of the touch receptors • Pain receptors <ul style="list-style-type: none"> • Special nerve endings. • Study of sensory structures of human using diagrams/ models/charts 		
	5.6.7 Relates the structures of the eye and ear to their functions.	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • describe the basic structure & functioning of the human eye. • state the advantages of binocular vision over monocular vision • describe the basic structure & functions of the human ear. • identify main components of human eye and ear • appreciate the importance of sensory receptors in coordination 	08

	5.6.8 Investigates the basic structure and functions of the human skin	<ul style="list-style-type: none"> • Basic layers of the human skin- epidermis, dermis • Hairs • Glands • Receptors • Functions of the skin 	<ul style="list-style-type: none"> • explain the structure and function of the human skin. • recognize the different functions of human skin • appreciate contribution of human skin in maintaining homeostasis 	03
5.7.0 Explores endocrinal regulation and homeostasis -	5.7.1 Analyses the role of human endocrine system	<ul style="list-style-type: none"> • Human endocrine system • Endocrine glands , their locations and functions. <ul style="list-style-type: none"> • Hypothalamus. • Pituitary gland • Thyroid gland • Parathyroid gland • Thymus gland • Adrenal glands • Islets of Langerhans • Pineal gland • Gonads • Feed back mechanism (with relevance to the endocrine system) <ul style="list-style-type: none"> • Negative • Positive • Diabetes (Type 1 and 2) • Hyperthyroidism and hypothyroidism 	<ul style="list-style-type: none"> • define endocrine glands and hormones • describe the human endocrine system with their locations & functions. • explain the feedback mechanism and its relevance to the endocrine system • discuss reasons for diabetes, hyperthyroidism and hypothyroidism and how those could be controlled • appreciate the contribution of endocrine system in coordination and homeostasis 	07

	<p>5.7.2 Investigates how a constant Internal environment is maintained within a range</p>	<ul style="list-style-type: none"> • Homeostasis <ul style="list-style-type: none"> • Internal & external environment • Homeostasis of man <ul style="list-style-type: none"> • Regulation of body temperature • Regulation of blood glucose level • osmoregulation • Feedback mechanism • Role of the liver in homeostasis 	<ul style="list-style-type: none"> • explain homeostasis with respect to the internal & external environment. • explain feedback mechanism of homeostasis • describe homeostasis of man in regulating body temperature, blood glucose level and osmoregulation • explain the role of the liver in homeostasis • recognize the importance of homeostasis for the survival of human life 	<p>06</p>
<p>5.8.0 Inquires into the reproductive process in animals</p>	<p>5.8.1 Inquires into different types of reproduction in animals</p>	<ul style="list-style-type: none"> • Different types of reproduction • Asexual, sexual reproduction <ul style="list-style-type: none"> • Asexual reproduction <ul style="list-style-type: none"> • Fission <ul style="list-style-type: none"> • Binary fission • Multiple fission • Budding • Fragmentation • Formation of spores (Sporulation) • Sexual reproduction <ul style="list-style-type: none"> • Gamete formation • Bisexuality and unisexuality • Fertilization <ul style="list-style-type: none"> • External & Internal • Parthenogenesis 	<ul style="list-style-type: none"> • list the different types of asexual reproduction with examples. • explain bisexuality, unisexuality, parthenogenesis, gametogenesis and fertilization. • compare sexual reproduction with asexual reproduction • accept that reproduction is an important process to ensure the survival of species 	<p>05</p>

	<p>5.8.2 Inquires structure and functions of male reproductive system</p>	<ul style="list-style-type: none"> • Structure & function of the male reproductive system <ul style="list-style-type: none"> • Scrotal sac • Testis (with microscopic anatomy) • Seminiferous tubules • Leydig cell • Sertoli cell • Epididymis • Vas deferens • Ejaculatory duct • Urethra and penis • Basic structure and function of sperm. • Main steps in spermatogenesis • Accessory glands related to the male reproductive system <ul style="list-style-type: none"> • Seminal vesicles • Prostate glands • Cowper's glands • Semen • Hormonal regulation of spermatogenesis, development and maintenance of male reproductive system 	<ul style="list-style-type: none"> • list the main structures and their functions of male reproductive system. • outline the major steps of spermatogenesis. • elaborate the structure and function of sperm <ul style="list-style-type: none"> • state the composition of semen. • state the importance of the accessory glands • draw a flow chart to elaborate the hormonal regulation of spermatogenesis. • identify the main components of male reproductive system using models/diagrams. 	<p>10</p>
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		<ul style="list-style-type: none"> • GnRH • FSH • LH • Inhibin • Testosterone • Study of the male reproductive system using models/diagrams 		
	5.8.3 Inquires in to structure and functions of female reproductive system.	<ul style="list-style-type: none"> • Structure & function of the female reproductive system • Ovaries (including the microscopic structure) • Germinal epithelium • Follicles <ul style="list-style-type: none"> • Primary • Graffian • Corpus luteum • Corpus albicans • Oogenesis, ovulation and its hormonal regulation • Structure & function of an ovum • Uterine ducts/ fallopian tubes/ oviducts • Uterus • Vagina • Menstrual cycle and its hormonal regulation (FSH, GnRH, LH, Progesterone, Oestrogen) 	<ul style="list-style-type: none"> • list the structures and functions of female reproductive system. • describe the major steps of oogenesis and the hormonal regulation of it. • elaborate the structure and function of human ovum. • illustrate the hormonal regulation and the structural changes that occur in menstrual cycle. • analyze the hormonal fluctuations in blood of women during menstrual cycle and pregnancy period using related graphs or bar charts • describe menopause. • identify the main components of female reproductive system using models /diagrams. 	10

		<ul style="list-style-type: none"> • Menopause • Study of the female reproductive system using models /diagrams. 		
	5.8.4 Inquires into the processes involved in fertilization up to birth	<ul style="list-style-type: none"> • Fertilization • Cleavage • Implantation • Foetal membranes ,placenta, and umbilical cord. • Pregnancy and its duration • Major foetal changes in each trimester • Mother's immune tolerance to the embryo • Process of parturition • Role of the positive feedback mechanism in parturition. • Lactation <ul style="list-style-type: none"> •Hormonal and nervous regulation of lactation •Composition of breast milk •Significance of breast feeding 	<ul style="list-style-type: none"> • define fertilization • explain the development of zygote and implantation • describe the structure and functions of fetal membranes ,placenta and umbilical cord. • explain pregnancy and its duration. • explain major foetal changes during pregnancy • explain the process and the positive feedback mechanism of parturition • explain regulation of lactation • state composition of milk • appreciate breast feeding 	05

	<p>5.8. 5 Develops an awareness on reproductive health.</p>	<ul style="list-style-type: none"> • Early signs of pregnancy • Pregnancy tests • Family Planning • Birth control methods <ul style="list-style-type: none"> • Female • Male • Abortions • Sexually transmitted infections <ul style="list-style-type: none"> • Gonorrhoea • Syphilis • Genital herpes • HIV/AIDS • Infertility • Modern reproductive technology <ul style="list-style-type: none"> • Hormone therapy • Surgery • Assisted reproductive technologies <ul style="list-style-type: none"> • In vitro fertilization • Intracytoplasmic sperm injection 	<ul style="list-style-type: none"> • state the early signs of pregnancy. • explain the basis of the pregnancy tests. • state the concept of family planning and its importance. • relate the effects of contraceptive methods on the normal physiological process • discuss harmful effects of illegal abortions • discuss infertility and assisted reproduction • list out the sexually transmitted infections • discuss how to avoid sexually transmitted infections 	<p>05</p>
<p>5.9.0 Inquires into the types of supporting systems and</p>	<p>5.9.1 Inquires into the structure and functions of the Skeletal systems and movement of animals.</p>	<ul style="list-style-type: none"> • Main types of skeletons of animals and their organization • Hydrostatic skeleton <ul style="list-style-type: none"> • Gastrovascular cavity • Pseudocoelom 	<ul style="list-style-type: none"> • state the main types of skeletons of animals. • describe the organization of hydrostatic skeleton with examples. • describe the organization of exoskeleton with examples 	<p>06</p>

<p>movement in organisms.</p>		<ul style="list-style-type: none"> • Interstitial fluid • Coelom • Exoskeleton <ul style="list-style-type: none"> • Chitinous exoskeleton • Calcium carbonate exoskeleton • Bony plates • Endoskeleton <ul style="list-style-type: none"> • Plates of Calcium carbonate • Bones • Cartilage • Common functions of skeleton <ul style="list-style-type: none"> • Support • Movement • Protection • Functions of the human skeletal system <ul style="list-style-type: none"> • Support • Protection • Movement • Storage & release of Calcium • Storage & release of Phosphates • Production of blood cells • Movement in land and air 	<ul style="list-style-type: none"> • describe the organization of endoskeleton with examples • relate the structure of the skeletal system with its functions • compare exoskeleton, endoskeleton and hydrostatic skeleton • explain how animals move through water and air • appreciate the skeletal system in relation to survival of organisms in their environment 	
	<p>5.9..2. Investigates the structure and functions of the axial skeleton of man.</p>	<ul style="list-style-type: none"> • Organization of the human skeletal system • Axial skeleton <ul style="list-style-type: none"> • Skull 	<ul style="list-style-type: none"> • describe the organization of the human skeleton. • list the main parts of the axial skeleton. 	<p>06</p>

		<ul style="list-style-type: none"> • Cranium • Vertebral column <ul style="list-style-type: none"> • Four curvatures & main areas • Types of vertebrae (Types and number) <ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • describe significant parts and functions of skull • explain curvatures of vertebral column • describe the structure of typical vertebra • compare different types of vertebrae • identify the gross structure of human skull & vertebral column with reference to their functions • relate the structure of axial skeleton to maintain upright posture • discuss the organization of human axial skeleton to maintain upright posture 	
	5.9.3. Investigates the structure and functions of the appendicular skeleton of man.	<ul style="list-style-type: none"> • Appendicular skeleton • General structure of appendicular skeleton and its functions <ul style="list-style-type: none"> • General structure of the pectoral girdle in relation to its functions • General structure of the pelvic girdle in relation to its functions. <ul style="list-style-type: none"> • Pelvis of the male & female 	<ul style="list-style-type: none"> • describe the organization of human appendicular skeleton • relate the structure of pectoral and pelvic girdles to their functions • describe how upper limb is adapted for a range of movements-including grasping and manipulation • explain the differences between 	06

		<ul style="list-style-type: none"> • General structure of the upper limb in relation to wide range of movements • General structure of the lower limb in relation to strength, erect body position (posture), bearing of body weight and walking. • Arches of foot • Disorders and abnormalities <ul style="list-style-type: none"> • Osteoarthritis. • Osteoporosis • Slipped disc • Study of the human pectoral and pelvic girdles and appendicular skeleton using specimens /models/diagrams. 	<ul style="list-style-type: none"> • male and female pelvises • describe how lower limb is adapted for posture, bearing of body weight and walking • explain osteoporosis and osteoarthritis • list the components of the appendicular skeleton and state the function of each of them • identify the importance of correct posture for healthy maintenance of skeletal system 	
	<p>5.9..4 Investigates on the main types of joints and mechanism of skeletal muscle movement</p>	<ul style="list-style-type: none"> • Main types of joints <ul style="list-style-type: none"> • Ball and socket • Hinge • Pivot • Features of muscle tissue • Structure of the sarcomere and basic mechanism of skeletal muscle movement • Basic concept of the sliding filament theory 	<ul style="list-style-type: none"> • describe functioning of main types of joints and their importance • state features of muscle tissue • explain the structure of the sarcomere & basic mechanism of skeletal muscle movement. • explain the basic concepts of the sliding filament theory. • appreciate the way muscles are adapted to perform their functions 	<p>04</p>

Unit 06- Genetics

(22 Periods)

Competency	Competency level	Content	Learning outcomes	Number of periods
6. 1.0 Explores the basic principles of genetics for applications	6.1.1 Inquires the Scientific basis of Mendel's Experiments	<ul style="list-style-type: none"> • Mendelian Heredity (Mendelism) • Mendel's Experiments <ul style="list-style-type: none"> • Monohybrids • Monohybrid test crosses • Mendel's first law • Dihybrids • Dihybrid test crosses • Mendel's second law • Multiple factor crosses • Success of Mendel's experiments 	<ul style="list-style-type: none"> • explain the terms , F1 and F2 generations, contrasting characters, gene, allele, genotype, phenotype , recessive, dominant, pure breeding, pure line, homozygous, heterozygous, monohybrid, monohybrid test cross, dihybrids , dihybrid test cross, multiple test cross • state Mendel's first law and second law. • describe mono hybrid cross and dihybrid cross • predict ratios of genotypes and phenotypes of multiple factor crosses • describe the reasons for the success of Mendel's experiments • appreciate that patterns of inheritance could be predicted by using mathematical ratios 	07

	6.1.2 Examines the patterns of inheritance of Mendelian characters in human.	<ul style="list-style-type: none"> • Common human Mendelian characteristics • Pedigree charts 	<ul style="list-style-type: none"> • state common Mendelian characters in human • analyze and predict results of Mendelian inheritance in human families by using pedigree charts • appreciate that inheritance of Mendelian characters can be predicted by using pedigree charts 	04
	6.1.3 Uses concepts and principles to explain genetic patterns that deviate from Mendel's laws.	<ul style="list-style-type: none"> • Non Mendelian inheritance <ul style="list-style-type: none"> • Incomplete dominance • Co dominance • Polyallelism • Gene interaction • Epistasis (dominant and recessive) • Polygenic Inheritance • Gene linkage • Human sex determination • Human sex linked characteristics • Concept of epigenetics 	<ul style="list-style-type: none"> • describe non-Mendelian inheritance • describe some non-Mendelian inheritance such as incomplete dominance, co-dominance, polyallelism, gene interaction, polygenic inheritance and gene linkage • analyze the F2 phenotype ratios with non-Mendelian patterns • explain human sex determination • state human sex linked characteristics • appreciate the way incomplete 	04

			<p>dominance, co dominance, polyallelism, gene interaction, polygenetic inheritance contribute to variations</p> <ul style="list-style-type: none"> • analyze the sex-linked characteristics in inheritance in human families using pedigree charts • Outline the concept of epigenetics 	
	6.1.4 Investigates evolution of life by using changes in gene frequencies.	<ul style="list-style-type: none"> • Population genetics <ul style="list-style-type: none"> • Hardy -Weinberg equilibrium 	<ul style="list-style-type: none"> • explain Hardy-Weinberg equilibrium • explain how changes in gene frequency leads to evolution 	04
	6.1.5 Explore the basic concepts in plant and animal breeding	<ul style="list-style-type: none"> • Plant and animal breeding <ul style="list-style-type: none"> • Artificial selection • In breeding and Out breeding • Hybrids • Interspecific breeding • Polyploidy • Mutagenesis • Genetic modification 	<ul style="list-style-type: none"> • explain the importance of plant and animal breeding with examples • state some breeding techniques in plants and animals • explain the genetic principles of breeding techniques • compare advantages and disadvantages of natural and artificial breeding methods • appreciate the plant and animal breeding techniques to obtain improved varieties 	03

Unit 7– Molecular Biology & Recombinant DNA Technology
(42 Periods)

Competency	Competency Level	Content	Learning outcomes	No. of Periods
7.1.0 Investigate the molecular basis of genetic materials	7.1.1 Examines the structures and functions of genetic materials	<ul style="list-style-type: none"> • Structure of DNA and RNA • Architecture of chromosomes • Basic characteristics of DNA replication mechanism • Overview of DNA repair mechanisms 	<ul style="list-style-type: none"> • explain the basic structure of DNA and RNA molecules • explain the properties of DNA • describe the architecture of chromosomes • distinguish prokaryotic chromosome from eukaryotic chromosome • explain the mechanism of DNA replication and its importance • distinguish the differences between eukaryotic and prokaryotic replications • state the significance of DNA repairing • explain the characteristics of DNA as a hereditary molecule of the cell 	06
	7.1.2 Examine genes and how they work	<ul style="list-style-type: none"> • The nature of genes • Chromosomal theory • The genetic code and codon • Exons, introns and other non-coding areas of chromosomes 	<ul style="list-style-type: none"> • Explain the basic structure of prokaryotic and eukaryotic genes • list their differences • explain the relationship of gene 	09

		<ul style="list-style-type: none"> • Overview of gene expression • Role of DNA and RNA and enzymes involved in protein synthesis • One-gene/one-polypeptide hypothesis • Mechanism of protein synthesis • Control of gene expression • Fate of proteins (trafficking and degradation) 	<ul style="list-style-type: none"> • with chromosomes • explain the characteristics of genetic code • discuss the role of DNA, RNAs and enzymes involved in protein synthesis • name the steps found in protein synthesis (process of transcription and translation) • explain the role of regulatory proteins in gene expression • discuss the negative (repressive) and positive (activator) control of transcription • appreciate the value of chromosomal theory • Appreciate the central dogma of molecular biology • appreciate the trafficking and degradation of proteins within the cell 	
	7.1.3 Examine the molecular basis of mutations	<ul style="list-style-type: none"> • Causes of mutation and Mutagens • Types of mutations; Gene mutations Chromosomal mutations • Human genetic disorders 	<ul style="list-style-type: none"> • Explain the term mutation • explain the causative factors of mutations • state the types of mutations with examples • explain the significance of mutation in evolution 	07

		<p>created by mutations</p> <ul style="list-style-type: none"> Genetic counseling in solving of some genetic disorders Role of mutations in evolution 	<ul style="list-style-type: none"> discuss human genetic disorders created by mutations discuss significance of genetic counseling in avoiding some human genetic problems 	
7.2.0 Gets updated on gene technology	7.2.1 Gets updated on tools, techniques and methods of gene technology	<ul style="list-style-type: none"> DNA manipulation and <i>in vitro</i> experiments <ul style="list-style-type: none"> Principles of DNA isolation Enzymes reacting with DNA (nucleases, ligases, polymerases) Agarose Gel Electrophoresis DNA probes, hybridization Recombinant DNA technology & cloning of genes <ul style="list-style-type: none"> Vectors (Bacterial plasmids/ Phage/ yeast artificial) DNA libraries Use of Reverse transcriptase Use of Marker genes DNA delivery systems and methods <ul style="list-style-type: none"> (Transformation/ Transduction/ <i>Agrobacterium</i>/ Gene guns) 	<ul style="list-style-type: none"> discuss the major steps in DNA isolation discuss the role of enzymes used in gene technology explain the principle of agarose gel electrophoresis explain the principle of nucleic acid hybridization and use of probes outline the steps in gene/DNA fragment cloning explain the methods used in gene transfer technology 	09

	7.2.2 Gets updated on DNA analysis	<ul style="list-style-type: none"> • Various techniques used in DNA analysis (methods are not expected) <ul style="list-style-type: none"> - Restriction maps - DNA sequencing - DNA fingerprints - PCR 	<ul style="list-style-type: none"> • explain a restriction map and their applications • state the importance of having the information of sequence of a DNA fragment/gene • applications of DNA fingerprints • explain the steps in a PCR cycle • appreciate PCR as an accelerated process of DNA analysis 	07
	7.2.3 Updates on the applications of gene technology	<ul style="list-style-type: none"> • Genetically modified organisms and their uses in; <ul style="list-style-type: none"> • Agriculture • Medicine • Industry • Health, environmental and socio economic concerns of using genetically modified organisms • Cartagena protocol, national biosafety framework 	<ul style="list-style-type: none"> • define a genetically modified (GM) organism • explain the use of genetically modified organisms in medicine, agriculture and industry • discuss possible socio economic problems concerning the use of GM organisms • appreciate the significance of international protocols and bio safety framework in the safety of mankind. • appreciate as gene technology as a field of excitements and controversies • appreciate the applications of gene technology in different fields 	04

Unit 8-Environmental Biology
(44 periods)

Competency	Competency Level	Content	Learning outcomes	No. of Periods
8.1.0 Engages in a biological analysis on relationships between organisms and their environment.	8.1.1 Investigates components of an ecosystem	Introduction to Environmental Biology : <ul style="list-style-type: none"> • Importance • Organizational levels of the environment • abiotic and biotic components 	<ul style="list-style-type: none"> • explain the importance of studying environmental biology • define levels of organization of the environment • list the major biotic and abiotic components and state their importance 	02
	8.1.2 Investigates major processes of an ecosystem	Structure and function of ecosystems: <ul style="list-style-type: none"> • Concept of niche and habitat • Food webs • biotic interactions • Material and Energy flow 	<ul style="list-style-type: none"> • identify relationships among abiotic and biotic components (biotic- biotic, biotic- abiotic components) • construct food chains and food webs in a given ecosystem • describe flow of energy and materials 	03
8.2.0 Explores the heterogeneous nature of the biotic component of global and local environment	8.2.1 Investigates main biomes of, the world	<ul style="list-style-type: none"> • Biomes • Main terrestrial biomes of the world • Distribution • Characteristics 	<ul style="list-style-type: none"> • list major terrestrial biomes in the world • describe their distribution in the world • distinguish different biomes using their major characteristic features 	06

	8.2.2 Investigates ecosystems of Sri Lanka	<ul style="list-style-type: none"> • Major ecosystems in Sri Lanka • Terrestrial <ul style="list-style-type: none"> • Forests <ul style="list-style-type: none"> • Lowland rain forests • Dry monsoon forests • Montane forests • Thorn forests • Grasslands <ul style="list-style-type: none"> • Savanna • Patana • Inland wetland ecosystems <ul style="list-style-type: none"> • Rivers and streams • Reservoirs • Marshes and swamps • Villus • Coastal ecosystems <ul style="list-style-type: none"> • Lagoons and estuaries • Mangroves • Coral reefs • Sea shore • Sand dunes • Sea grass beds • Salt marshes 	<ul style="list-style-type: none"> • state different types of ecosystems in Sri Lanka • list characteristic features of ecosystems in Sri Lanka • identify locations of each type of ecosystem. • state dominant plant species in the given ecosystems • appreciate diversity of ecosystems in Sri Lanka 	12
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<p>8.3.0 Explore biodiversity as a component of the environment</p>	<p>8.3. 1 Explores biodiversity and threats due to human actions</p>	<ul style="list-style-type: none"> • Biodiversity • Defining three levels of biodiversity • Values of biodiversity Commercial and non commercial goods, environment, recreational, ethical , services etc with examples • Threats to biodiversity and species extinctions <ul style="list-style-type: none"> • Main mechanisms of biodiversity loss • Different categories of threatened organisms • Biodiversity Hotspots • Following categories with suitable examples from Sri Lanka <ul style="list-style-type: none"> • Endemic species • Indigenous species • Exotic species • Migratory species • Relict species • Flagship species • Keystone species • Invasive species 	<ul style="list-style-type: none"> • define biodiversity, ecosystem diversity, species diversity and genetic diversity . • explain what biodiversity hotspots are • describe goods and services provided by biodiversity • define the main five ways that biodiversity is lost giving examples in Sri Lanka: habitat loss and fragmentation, overexploitation, pollution, introduction of invasive alien species, climate change • discuss extinction as a natural process, but the rate been greatly increased by human activity • define threatened species according to the Red Data Book (only the vulnerable, endangered and critically endangered and extinct in the wild categories with an example for plant and animal each) 	<p>07</p>
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8.4.0 explores global issues related to environment	8.3.2 Gets updated on the global environmental problems	<ul style="list-style-type: none"> • Contributory factors and Impacts of Global environmental problems <ul style="list-style-type: none"> • Global warming and climate change • Depletion of the Ozone layer • Desertification • Acid rain 	<ul style="list-style-type: none"> • list major global environmental issues • describe the contributory factors for global warming , depletion of the Ozone layer, acid rains, desertification, climatic change and their impacts 	06
8.4.0 Explores methods of Biodiversity and environmental conservation	8.4.1 Investigates how biodiversity and environment can be conserved at global and national level	<ul style="list-style-type: none"> • Two basic ways of biodiversity conservation (In situ and ex- situ conservation) practices with examples • Main outcomes of the following international agreements <ul style="list-style-type: none"> • CITES • Convention of biological diversity (CBD) <ul style="list-style-type: none"> • Ramsar Convention • Marpol convention • Montreal protocol • Kyoto protocol • Basel convention • Key National Legislations <ul style="list-style-type: none"> • Fauna and flora protection Ordinance • National Environment Act 	<ul style="list-style-type: none"> • describe <i>In-situ</i> and <i>Ex- situ</i> conservation practices with example • demonstrate the knowledge and understanding of global agreements and key national legislations, their administration 	05

Unit 9-Microbiology

(50 periods)

Competency	Competency Level	Content	Learning outcomes	No. of Periods
9.1.0 Investigate diversity and handling of micro-organisms	<ul style="list-style-type: none"> • 9.1 .1 Explores the diversity and nature of micro-organisms 	<ul style="list-style-type: none"> • Definition of micro-organisms • Types of microorganisms • Bacteria ,Archaea and Cyanobacteria • Unicellular protista <ul style="list-style-type: none"> • Fungi • Other agents studied under microbiology <ul style="list-style-type: none"> • Mollicutes (mycoplasmas and phytoplasmas) • Viruses • viroids • Prions • 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 • Morphological, nutritional and physiological diversity of microorganisms • Nature of virus, viroids and prions as disease causing agents 	<ul style="list-style-type: none"> • describe the nature of microbial world. • state the taxonomic diversity of microorganisms. • describe the morphological, nutritional & physiological diversity of microorganisms. 	10

	9.1.2 explores some basic laboratory techniques in microbiology	<ul style="list-style-type: none"> • Methods of sterilization • Preparation of culture media • Preparation of culture media (NA and PDA) and inoculation with a sample of toddy/yoghurt/root nodule • Staining of bacteria found in toddy or yoghurt using a simple stain • Methods of sterilization of water , culture media, glassware, heat labile substances and inoculating Needles • Use of alcohol and other disinfectants to control microbial populations 	<ul style="list-style-type: none"> • prepare culture media (NA/ PDA), inoculate with a sample of toddy / yoghurt and stain microorganisms found in toddy / yoghurt/root nodule • apply techniques in sterilization of different materials • develop the skills of techniques related in handling , observing and controlling microorganisms under laboratory conditions 	
9.2.0 Investigates microorganisms as human pathogens	9.2.1 Explores the concepts, principles relevant to infectious diseases	<ul style="list-style-type: none"> • Microorganisms and diseases • The nature , distribution and functions of the normal micro biota living in human body • Following terms in relation to infectious diseases <ul style="list-style-type: none"> • Pathogenicity • Pathogen • Host • Parasite • Relationship between the host and 	<ul style="list-style-type: none"> • discuss the nature , distribution and role of normal micro biota in human body • explain the terms in relation to infectious diseases • describe important characteristics of a microorganisms in causing a disease • explain virulence factors . • discuss degree of virulence on invasiveness and toxigenicity • state the role of enzymes and toxins on invasiveness 	09

		<p>the parasite/pathogen</p> <ul style="list-style-type: none"> • Characteristics of the pathogens • Virulence • Virulent factors that increase the pathogenicity • Dependence of virulence on invasiveness and toxigenicity • Role of enzymes and toxins on invasiveness -Phospholipase, lecithinase ,Hyaluronidase • Toxigenicity <ul style="list-style-type: none"> • Endotoxins • Exotoxins • Exotoxin producing bacteria and role of exotoxins in pathogenicity (Cytotoxins, Enterotoxins , Neurotoxins) • Portals of entry of pathogens into the human body <ul style="list-style-type: none"> • Respiratory tract • Genito -urinary tract • Gastrointestinal tract • Wounds on skin 	<ul style="list-style-type: none"> • state the portals of entry of pathogens into the human body. • recognize the nature of pathogenic microorganisms in causing infectious diseases • explain differences between endotoxins and exotoxins • state the scientific name of the selected causal agents • discuss the ways of prevention of infectious diseases 	
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		<ul style="list-style-type: none"> • Diseases of the important organs (only the following causal agents, symptoms are not required) • Skin <ul style="list-style-type: none"> • Chickenpox • Rubella • Measles • Eye <ul style="list-style-type: none"> • Conjunctivitis (bacteria/ virus) • Nervous system <ul style="list-style-type: none"> • Bacterial meningitis • Tetanus • Rabies • Cardiovascular system <ul style="list-style-type: none"> • Rheumatic fever • Respiratory system <ul style="list-style-type: none"> • Tuberculosis • Pneumonia • Influenza • Digestive system <ul style="list-style-type: none"> • Hepatitis • Food poisoning • Cholera • Typhoid • Urinary system <ul style="list-style-type: none"> • Leptospirosis • Reproductive system 	
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		<ul style="list-style-type: none"> • Gonorrhoea • Genital herpes • Immune system • AIDS 		
	9.2.2 Explores the methods of controlling microbial population	<ul style="list-style-type: none"> • Methods of controlling microbial diseases. <ul style="list-style-type: none"> • Use of disinfectants • Use of antiseptics • Immunization • Curative methods of microbial diseases <ul style="list-style-type: none"> • Antibiotics • Other chemotherapeutics 	<ul style="list-style-type: none"> • describe the role of disinfectants and antiseptics in controlling microbial diseases. • differentiate between disinfectants and antiseptics • state the role of antibiotics in controlling microbial diseases. • appreciate the importance of hygiene practices in day to day life in controlling infectious diseases • appreciate the artificial methods of immunization in controlling infectious diseases 	05
9.3.0 Investigates the use of micro – organisms in industry, agriculture , Environment and contribution	9.3.1 Investigates and explores the use of microorganisms in industry, agriculture and Environment	<ul style="list-style-type: none"> • Use of microorganisms in industry, agriculture and environment • Use of microorganisms in commercial products that are useful for humans • Advantages of using microbial processes over chemical processes • Basic principles of metabolic processes of microorganisms 	<ul style="list-style-type: none"> • explain the advantages of employing microbes in commercial products • explain the basic principles of metabolic processes of microorganisms for product formation • state the industrial applications of microorganisms • distinguish industries based on microbes, microbial products and 	06

<p>of soil micro-organisms for agriculture</p>		<p>for product formation</p> <ul style="list-style-type: none"> • Microorganisms used in industry • Applications of microorganisms in industry • Single cell proteins, alcohol and alcoholic beverages, vinegar, dairy products, organic acids, metal extractions, vitamins, vaccines, enzymes, antibiotics, insulin, human growth hormones, retting, bio-gas production, biofuel, bakery products • Applications of microorganisms in environment • Bio-remediation, waste treatment • Applications of microorganisms in Agriculture • Biofertilizers (mycorrhiza phosphate solubilization, rhizobium inoculation, plant growth substances), • Biopesticides/ bio control agents • composting 	<p>processes</p> <ul style="list-style-type: none"> • state the applications of microorganisms in environmental management • state the applications of microorganisms in agriculture • appreciate the microbial processes over chemical processes in industry 	
	<p>9.3.2 Uses the functions of soil micro-organisms to maintain soil health</p>	<ul style="list-style-type: none"> • Nature, distribution and roles of soil microbes • Chemical and Physical environment of soil as a healthy media for growth of microorganisms • Role of microorganisms in cyclic process of minerals 	<ul style="list-style-type: none"> • describe the nature , distribution and roles of soil microbes. • explain the natural role of microorganisms as decomposers in recycling of minerals • elaborate the specific role of microorganisms in Nitrogen cycle and 	<p>06</p>

		<ul style="list-style-type: none"> • Mineralization • Carbon cycle • Nitrogen cycle • Soil microbes relevant to plant growth • Microbial function in Rhizosphere • Interactions of soil microorganisms associated with roots 	<p>Carbon cycle, mineralization</p> <ul style="list-style-type: none"> • describe the interactions of soil microorganisms relevant to plant growth • describe the role of microorganisms in improving of soil quality • appreciate the decomposition role in microorganisms 	
9.4. 0 Utilizes the microbiological concepts and principles to maintain the quality of water	9.4.1 Uses the microbiological concepts and principles in potable water and waste water management	<ul style="list-style-type: none"> • Microbiology of potable water, and waste water . • Natural sources of drinking water and possible contamination methods. • Diseases that are transmitted by water. • microbes as indicators of fecal contamination. • Steps in water treatment in urban water treatment plant • Waste water- domestic and industrial waste water • Adverse effects of discharging large amounts of waste water into natural water resources • Principles and main steps in treatment of industrial waste water 	<ul style="list-style-type: none"> • discuss the natural sources and possible contamination methods of drinking water • list main contaminants of water • list the diseases transmitted by water • state the importance of coliform as an indicator of fecal contamination • outline the steps in water treatment in an urban water treatment plant • explain the effects of discharging waste water into natural water resources • outline the principles and main steps in treatment of industrial waste water • appreciate the importance of waste water treatment methods to avoid water pollution and their impact 	06

<p>9.5.0 Explores the impact of microbes on food</p>	<p>9.5.1 Contributes to the prevention of diseases that are caused by spoiled food</p>	<ul style="list-style-type: none"> • Microorganisms and food • Food spoilage by microorganisms • Presence of nutritious matter and water in foods help microbial growth • Physical, chemical and biological changes taking place in food by the growth of heterotrophic microorganisms • External factors affecting food spoilage (temperature, oxygen supply, humidity) • Internal factors affecting food spoilage –pH value, moisture content, amount of nutrients, biological structure of food • Food borne diseases by bacteria <ul style="list-style-type: none"> • Food borne infections • Food intoxication • Infections caused by food • Typhoid – <i>Salmonella typhi</i> • Dysentery –<i>Shigella</i> • Cholera – <i>Vibrio cholera</i> • Food intoxication <ul style="list-style-type: none"> • Intoxication by <i>Staphylococcus aureus</i> • Intoxication by <i>Clostridium botulinum</i> • By Fungi- <ul style="list-style-type: none"> • Aflatoxin-<i>Aspergillus flavus</i> 	<ul style="list-style-type: none"> • explain why food is easily spoiled by microorganisms • explain the physical and chemical changes in food spoilage • describe the effects of food spoilage on human health • appreciate the importance of food preservation methods 	<p>08</p>
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Unit 10 -Applied Biology
(24 periods)

Competency	Competency Level	Content	Learning outcomes	No. of Periods
10.1.0 Uses biological concepts and principles to promote the living standards	10.1.1 Investigates ornamental fish culture systems	<ul style="list-style-type: none"> • Ornamental fish cultivation <ul style="list-style-type: none"> • Species that are used • Maintenance of an aquarium • Common diseases • Environmental impact of ornamental fish culture 	<ul style="list-style-type: none"> • identify the importance of aquaculture • describe the methods of aquaculture • explain general characters of species that could be cultured • list species of fish ,prawns and plants used in aquaculture • describe the methods of aquaculture • develop an interest in preparing an aquarium • appreciate the diversity of ornamental fish 	05
	10.1.2 Investigates on opportunities related to horticultural practices	<ul style="list-style-type: none"> • Nursery management • Protected agriculture • Tissue culture • Floriculture 	<ul style="list-style-type: none"> • discuss issues in nursery management • describe methods of protected agriculture • explain tissue culture • explain important methods used in floriculture 	05
	10.1.3 Uses biological knowledge and understanding in minimizing damage caused By vector -borne diseases	<ul style="list-style-type: none"> • Dengue, filaria <ul style="list-style-type: none"> • identification of vector • Breeding sites • Symptoms of disease • Controlling measures 	<ul style="list-style-type: none"> • describe the methods of transmission of filaria and dengue • describe symptoms of infection • appreciate the importance of keeping the environment clean to prevent infection 	05

	<p>10.1.4 Utilizes the knowledge on food preservation and postharvest losses for successful applications in day to day life</p>	<ul style="list-style-type: none"> • Food preservation <ul style="list-style-type: none"> • Importance of food preservation • Principles of food preservation • Postharvest loss <ul style="list-style-type: none"> • Causes for postharvest loss • Minimizing postharvest loss(during harvesting, transporting ,storing and domestic processing) 	<ul style="list-style-type: none"> • explain the concept and importance of food preservation • elaborate the principles of methods in preserving food • discuss causes for postharvest loss • describe methods to minimize postharvest loss 	<p>05</p>
	<p>10.1.5 Gets updated in applications of emerging technologies related to biology</p>	<ul style="list-style-type: none"> • Applications of modern technology in biology • Nano biology • Stem cell therapy • Human Genome project and genomes of other organisms 	<ul style="list-style-type: none"> • State what nano technology is • state the applications of nanotechnology in biology • state what stem cells are and list their sources • state the outcomes and applications of human genome project • state advantages of stem cell therapy and potential uses 	<p>04</p>

4.0 Teaching - Learning Strategies

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

- Allow the students to acquire hands on experience.
- Direct students to acquire knowledge and information through reliable sources wherever necessary.

5.0 School policy and programmes

- The teacher has the liberty to follow any suitable teaching learning method to achieve the relevant learning outcomes.
- It is expected that the theoretical components of each unit will be dealt with the relevant practical components, **which are given in italics**.
- 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.
- With a view to extending learning beyond the classroom activities 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 chemistry
 - field trips to places where applications of chemistry can be observed and preparation of reports subsequently
 - organizing school exhibitions and competitions
 - organizing guest lectures on relevant topics by resource persons
 - producing school publications
 - organizing events such as debates, science days, etc.
- School management is responsible in providing services such as lab equipments, computer facilities, etc. and assistance within the school and from outside resources.
- In order to develop school policy and programmes it would be desirable to form a committee comprising relevant teachers and students.
- Most importantly, the school should serve as a role model to be followed by the students.

- 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

Assessment and Evaluation should conform to the standards set by the Department of Examinations. However, school-based assessment should also be part and parcel as it paves way to give direct feedback to learners.

For Comments