

**THE UNITED REPUBLIC OF TANZANIA
MINISTRY OF EDUCATION AND VOCATIONAL TRAINING**



**BIOLOGY SYLLABUS FOR ADVANCED LEVEL
SECONDARY EDUCATION FORM V - VI**

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1.0 Introduction

Background Information

This Biology syllabus is a revised version which has been prepared to replace that of 1997. The revision process has been focusing on change of paradigm from that of content based to a competence based curriculum where the student is the main actor and the teacher is the facilitator. The student uses prior knowledge and experience to acquire new knowledge and skills by cooperating with others. In addition, this syllabus also takes into consideration current global changes, and the current social needs and demands. Moreover some basic content of the cross cutting issues have been integrated in relevant topics in this syllabus.

2.0 Aims and Objectives of Education in Tanzania

The general aims and objectives of education in Tanzania are to:

- a) guide and promote the development and improvement of the personalities of the citizens of Tanzania, their human resources and effective utilization of those resources to bringing about individual and national development;
- b) promote the acquisition and appreciation of the culture, customs and traditions of the people of Tanzania;
- c) promote the acquisition and appropriate use of literacy, social, scientific, vocational, technological, professional and other forms of knowledge, skills and attitudes for the development and improvement of the condition of man and society;
- d) develop and promote self-confidence and an inquiring mind, an understanding and respect for human dignity and human rights and readiness to work hard for self- advancement and national development;
- e) promote and expand the scope of acquisition, improvement and upgrading of mental, practical, productive and other skills needed to meet the changing needs of industry and the economy;
- f) enable every citizen to understand and uphold the fundamentals of the National Constitution as well as the enshrined human and civic rights, obligations and responsibilities;
- g) promote love and respect for work, self and wage employment and improved performance in the production and service sectors;
- h) inculcate principles of national ethic and integrity, national and international cooperation, peace and justice through the study, understanding and adherence to provisions of the National Constitution and other international basic charters;
- i) enable a rational use, management and conservation of the environment.

3.0 Aims and Objectives of Secondary Education

The aims and objectives of secondary education are to:

- a) consolidate and broaden the scope of baseline ideas, knowledge, skills and attitudes acquired and developed at the primary education level;
- b) enhance further development and appreciation of national unity, identity and ethic; personal integrity, respect for and readiness to work, human rights, cultural and moral values, customs, traditions and civic responsibilities and obligations;
- c) promote the development of competency in linguistic ability and effective use of communication skills in Kiswahili and at least one foreign language;
- d) provide opportunities for the acquisition of knowledge, skills, attitudes and understanding in prescribed or selected fields of study;
- e) prepare students for tertiary and higher education, vocational, technical and professional training;
- f) inculcate a sense and ability for self-study, self-confidence and self advancement in new frontiers of science and technology, academic and occupational knowledge and skills;
- g) prepare the students to join the world of work;
- h) prepare students to become responsible members of the society.

4.0 General Competences for the Subject

By the end of two year course the student should have the ability to:

- a) make appropriate use of biological knowledge, concepts, principles and skills in solving various problems in daily life;
- b) collect, analyze and interpret data from biological scientific investigations and present them in a logical manner using appropriate methods and technology to generate relevant information;
- c) demonstrate biological knowledge, skills and scientific technology in combating health related problems such as HIV/AIDS/STDs, malaria, tuberculosis and drug/substance abuse;
- d) access relevant information on biological science and related fields for self study and lifelong learning;
- e) conduct scientific experiments, observations, research and study visits;
- f) demonstrate creativity, curiosity, critical thinking, self confidence, interpersonal relationships, decision making and self independence in problem solving situations;
- g) demonstrate an understanding of biological terminologies and communicate effectively in spoken and written forms.

- h) demonstrate mastery of the fundamental concepts, principles and skills of biological sciences and use them for best utilization of their natural heritage to raise their standard of living;
- i) promote entrepreneurship skills in biological fields for development of individual and national economy;
- j) demonstrate inter and intra-personal and social skills (self discipline, punctuality, honesty, responsibility, obedience, cooperation, communication, high integrity) in everyday life;
- k) apply information and computer technology (ICT) in accessing and generating information in Biology.

5.0 General Objectives for the Subject

By the end of two year course, the student should be able to:

- a) apply scientific skills and procedures in analyzing and interpreting biological data;
- b) develop entrepreneurship skills in biological communication, creativity and problem solving;
- c) apply basic knowledge and appropriate biological skills in combating health related problems like HIV/AIDS/STDs, Malaria, Tuberculosis and Hepatitis;
- d) demonstrate an understanding and appreciation of the role, influence and importance of biological science in everyday life, at work, and in society in general;
- e) develop mastery of the fundamental concepts, principles and skills of biological science and use this for best utilization of their natural heritage to raise their standard of living;
- f) communicate effectively using appropriate biological terminologies.
- g) promote acquisition of biological knowledge and skills by accessing various sources of information;
- h) develop the ability and desire for self study, self confidence and self advancement in biological sciences and related fields;
- i) promote love for work, self and wage employment, self reliant and improved performance in the production and service sectors through application of biological skills and biological scientific technology.

6.0 Organization of the Subject Syllabus

This syllabus has a slightly different structure and organization compared to that of the 1996. The current syllabus content has been organized into six (6) columns namely; Topic and Sub – Topic, Specific Objectives, Teaching and Learning Strategies, Teaching and Learning Resources, Assessment and the Number of Periods. This content is preceded by class level competences and class level objectives for each form.

6.1 Class Level Competences

Class Level Competences have been derived from the general subject competences and objectives. Competences have been stated for each class level of Biology course.

6.2 Class Level Objectives

Class Level Objectives have been derived from class level competences. They are stated in general terms to indicate the scope of content to be covered within each level.

6.3 Content Matrix

The content matrix include topic/subtopic, specific objectives, teaching and learning strategies, teaching and learning resources, assessment and number of periods.

6.3.1 Topics/Sub-topics

The topics have been derived from the class level competences and objectives. Topics have been arranged in a logical order starting from simple to complex ones. The subtopics have been arranged to attain logical order and facilitate learning.

6.3.2 Specific Objectives

There are specific objectives suggested for every subtopic in the syllabus. These are benchmarks upon which the teacher targets to tailor his/her instruction to enable learners to meet the prescribed knowledge, skills and attitudes spelt out in each objective. The specific objectives are instructional contents that the teacher should use to operationalize the teaching and learning process for respective topics in the syllabus. The specific objectives also provide bases for assessment of learners' achievements.

6.3.3 Teaching and Learning Strategies

These are activities of the teacher and learners during the teaching and learning process of a particular subtopic. The teaching and learning strategies are focussed to ensure achievements of the respective specific objectives under each subtopic. However, caution is given that teachers should not adopt wholesale all the suggested teaching and learning strategies. They can formulate others in addition or replace some according to existing realities in their environment. Teachers are also advised to use participatory teaching and learning strategies as much as possible to help learners to demonstrate self esteem, confidence and assertiveness.

6.3.4 Teaching and Learning Resources

They include non consumable teaching aids and materials as well as consumable materials. The teaching and learning resources are those which are to be used during the teaching and learning process for each respective subtopic. Teachers can improvise teaching and learning resources other than those suggested in the syllabus where need arise.

6.3.5 Assessment

An assessment guide is given to teachers in the sixth column. It shows what and how to assess students with regard to the required knowledge, skills and attitudes to be developed for each specific objective and respective set of teaching/learning strategies.

6.3.6 Number of Periods

Column seven constitutes the suggested number of periods per each subtopic. The number of periods has been taken into consideration the length of the subtopic to be taught. Teachers are advised to strictly adhere to the framework of the allocated time so that teaching does not lag behind. Lost instructional time should always be compensated without fail.

7.0 Instructional Time

This syllabus is to be covered in two (2) academic years having approximately 194 instructional days per year including two weeks reserved for midyear and annual examinations. The number of periods for teaching this syllabus is ten (10) periods of forty (40) minutes each per week. The teacher is advised to make maximum use of time allocated for classroom interaction.

8.0 Assessment in the subject

There will be continuous assessment throughout the course. At the end of this course the student shall sit for National Examination conducted by the National Examination Council of Tanzania (NECTA). Continuous assessment shall carry 50% and the final National Examination will constitute the remaining 50%.

The student's final academic performance will be assessed on the following basis:

Type of Assessment	Assessment Measure	Frequency				Weight (%)	Total (%)
		Form V		Form VI			
		Term 1	Term 2	Term 1	Term 2		
1. Continuous assessment	1. Tests	2	2	2	-	10	
	2. Practical test	2	2	2	-	10	
	3. Research projects	-	1	-	-	5	
	4. Individual assignment	2	2	2	-	5	
	5. Field work	1	1	-	-	5	
	6. Term exam	1	1	1	-	15	
2. Final examination	National exam.	-	-	-	1	50	50
TOTAL MARKS							100



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FORM V

Class Level Competences

By the end of Form Five, the student should have the ability to:

- a) demonstrate skills on preparation and use of specimens for microscopic observations;
- b) use scientific procedures and practical skills in studying biology;
- c) group organisms according to their respective taxonomic hierarchy;
- d) demonstrate appropriate use of biological knowledge, concepts, principles and skills in which life activities are coordinated and regulated, metabolic energy are released, nutrients are made available for body use in plants and animals;
- e) carry out dissection of plants (flowers, stem and roots) and animals (frog/toad, cockroach, mice) and conduct biochemical tests;
- f) use Information and Computer Technology to access and generate biological information.

Class Level Objectives

By the end of Form Five course, the student should be able to:

- a) prepare specimens for microscopic observation;
- b) apply biological practical skills in studying biochemical and physiological processes in plants and animals;
- c) apply taxonomic principles in classifying and identifying organisms;
- d) acquire basic knowledge, concepts, skills and principles in evaluating the roles of various physiological processes in plants and animals;
- e) dissect plants (flowers, stems and roots), animals (cockroach, frog/toad and mice) and conduct biochemical tests;
- f) utilize various ICT facilities to search and generate biological information;
- g) use appropriate biological knowledge, concepts, skills and principles in managing health related problems such as HIV/AIDS, drug/substance abuse, respiratory infections, nutrition disorders and genetical disorders;
- h) communicate using proper biological terminologies in both written and spoken forms.

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
<p>1.0 CYTOLOGY</p> <p>1.1 Concept of cytology.</p>	<p>By the end of this sub-topic, the student should be able to:-</p> <p>a) explain the meaning of cytology.</p>	<p>(i) Students to brainstorm on the meaning of cytology.</p> <p>(ii) The teacher to lead plenary discussion on the meaning of cytology.</p>	<ul style="list-style-type: none"> • Diagrams • Photographs • Charts showing different types of cells and the importance of cytology. 	<p>Is the student able to explain the meaning of cytology?</p>	2
<p>b) explain the importance of studying cytology.</p>	<p>Students to discuss, in groups the importance of studying cytology and its relation with other fields.</p>	<p>Is the student able to explain the importance of studying cytology?</p>			
<p>1.2 Cell Theory.</p>	<p>By the end of this sub-topic, the student should be able to:-</p> <p>a) state the cell theory.</p>	<p>(i) The teacher to lead students to state the cell theory.</p> <p>(ii) Students to state cell theory.</p>	<p>Chart outlining the cell theory.</p>	<p>Is the student able to state the cell theory?</p>	
<p>b) explain the main ideas of the cell theory.</p>	<p>Students to discuss, in groups the main ideas of the cell theory.</p>	<p>Is the student able to explain the main ideas of cell theory?</p>			

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
1.3 Cell structure and function.	<p>By the end of this sub-topic, the student should be able to:-</p> <p>a) identify plant cell and animal cell.</p> <p>b) describe the characteristic features and functions of an animal and plant cells.</p>	<p>(i) The teacher to guide students to conduct microscopic observations of plant and animal cells (using epidermal cells of onion leaf, membrane of buccal cavity).</p> <p>(ii) Students in groups to observe diagrams/pictures/ microscopic slides/ photographs of cells and identify plant and animal cells.</p> <p>Students in groups to observe diagrams/pictures/ microscope slides/photographs of cells and discuss the characteristics and functions of plant and animal cells.</p>	<ul style="list-style-type: none"> • Microscope • Slides • Onion • Membrane of buccal cavity • Models of plant and animal cell • Photographs • Pictures. 	<p>Is the student able to identify a plant and animal cell?</p> <p>Is the student able to describe the characteristics features and functions of a plant and animal cells?</p>	2

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
1.3.1 Eukaryotic cells.	<p>By the end of this sub-topic, the student should be able to:-</p> <p>a) draw diagrams of plant and animal cells.</p>	<p>(i) The teacher to guide students to prepare and observe slides of plant and animal cells.</p> <p>(ii) Students to draw the plant and animal cells as observed under light microscope.</p>	<ul style="list-style-type: none"> • Light micro scope, • Slides, • Onion • Commelina sp. Leaf • Buccal cavity membrane. 	<p>Is the student able to draw and label plant and animal cells?</p>	2
	<p>b) describe the functions of the sub-cellular units (organelles) and adaptations to their roles.</p>	<p>i) Students in groups to observe charts/ diagrams of plant and animal cells and describe the functions of sub-cellular units of eukaryotic cells.</p> <p>ii) The teacher to lead plenary discussion on functions and adaptations of sub-cellular units.</p>	<ul style="list-style-type: none"> • Charts, diagrams, pictures, stains, • Scalpel/razor blade/knife. 	<p>Is the student able to describe the functions of sub-cellular units?</p>	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
1.3.2 Prokaryotic cell.	<p>By the end of this sub-topic, the student should be able to:-</p> <p>a) identify prokaryotic cell.</p> <p>b) explain functions of different parts of prokaryotic cells.</p> <p>c) compare structures of eukaryotic and prokaryotic cells.</p>	<p>(i) Students to observe mounted slides/diagrams of bacterial cell to identify general structures.</p> <p>(ii) The teacher to lead discussion on the general structure of bacterial cell.</p> <p>The teacher to guide students (in groups) to observe charts/diagrams of bacterial cells (prokaryotic cells) and discuss the functions of different parts.</p> <p>(i) Students to observe bacterial, plant cell/animal cell and compare their structure.</p> <p>(ii) The teacher to lead plenary discussion on the similarities and differences between eukaryotic and prokaryotic cells.</p>	<ul style="list-style-type: none"> Photographs/ Diagrams/ Pictures of bacterial cell. Microscope and slide of fixed Bacteria, plant cell and animal cell Charts showing bacterial cell, plant cell and animal cell. 	<p>Is the student able to identify prokaryotic cell?</p> <p>Is the student able to explain functions of different parts of prokaryotic cell?</p> <p>Is the student able to compare structures of eukaryotic and prokaryotic cells?</p>	2

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
1.3.3 Cell Differentiation.	By the end of this sub-topic, the student should be able to:- a) explain the concept of cell differentiation and its significance.	Students in groups to observe charts/preserved specimens of plant and animal tissues and discuss the meaning and significance of cell differentiation.	<ul style="list-style-type: none"> • Preserved specimens, • Diagrams of plants and animal cells • Charts of cells. 	Is the student able to explain the concept of cell differentiation and its significance?	2
1.4 Organic constituents of Cells. 1.4.1 Carbohydrates.	By the end of this sub-topic, the student should be able to:- a) identify constituents of carbohydrates. b) categorize carbohydrates.	(i) The teacher to guide students to discuss in groups the constituents of carbohydrates. (ii) Students to identify the elemental constituents of carbohydrates.	<ul style="list-style-type: none"> • Samples food substances (sugar cane, carrot, ripened fruits, cassava, potato. • Corn flour • Charts. 	Is the student able to identify constituents of carbohydrate? Is the student able to categorize carbohydrates?	6

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	c) carry out investigation on properties of carbohydrates.	The teacher to guide students to carry out investigation on properties of carbohydrates.	<ul style="list-style-type: none"> • Maize/corn flour • Glucose • Cane sugar • Beaker • Stirrer. 	Is the student able to carry out investigations on properties of carbohydrates?	
	d) carry out bio chemical tests for reducing sugar, non reducing sugar and starch.	<p>(i) Students to carry out biochemical tests for carbohydrates (reducing and non reducing sugars and starch) and discuss the results.</p> <p>(ii) The teacher to lead plenary discussion on the biochemical tests for reducing sugars, non reducing sugars and starch.</p>	<ul style="list-style-type: none"> • Glucose, fruits, cane sugar, maize/corn flour • Benedict's solution, • Dilute HCl, NaOH solution, • Source of heat, • Test tubes and holders <p>NB: Fehling's solution should not be used because it's poisonous.</p>	Is the student able to carry out biochemical tests for reducing sugar, non reducing sugar, and starch?	
	e) explain the functions of carbohydrates in organisms.	<p>(i) Students to brainstorm on the functions of carbohydrates in organisms.</p> <p>(ii) The teacher to lead a plenary discussion on functions of carbohydrates in organisms.</p>		Is the student able to explain the functions of carbohydrates in organisms?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
1.4.2 Lipids.	<p>By the end of this sub-topic, the student should be able to:-</p> <p>a) outline the constituent of lipids.</p> <p>b) categorize lipids.</p> <p>c) explain the properties of lipids.</p>	<p>(i) The teacher to guide students to search information in the library and internet on constituents of lipids based on their organic structure.</p> <p>(ii) The teacher to lead plenary discussion on constituent of lipids.</p> <p>(i) Students to brainstorming on categories of lipids (simple, compound and derived) and give examples.</p> <p>(ii) The teacher to lead plenary discussion on categories of lipids.</p> <p>(i) The teacher to guide students to investigate the physical properties of lipids.</p> <p>(ii) Students to carryout experiments to investigate the properties of lipids.</p>	<ul style="list-style-type: none"> • Diagrams, • Charts that show organic structure of lipids, fats and oils • Food substances containing oil fats, • Beakers, • Test tubes, and holder, • Sudan III solution test tube rack, • Droppers • Source of heat. 	<p>Is the student able to outline the constituent of lipids?</p> <p>Is the student able to categorize lipids?</p> <p>Is the student able to explain the properties of lipids?</p>	6

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	<p>d) carry out biochemical tests for lipids.</p>	<p>(i) The teacher to guide students to carry out biochemical tests for lipids (fats and oils). (ii) Students to carry out biochemical tests for lipids and discuss the results.</p>		<p>Is the student able to carry out biochemical food tests for lipids?</p>	
	<p>e) explain the roles of lipids in organisms.</p>	<p>(i) Students to brainstorm the roles of lipids in organisms. (ii) The teacher to lead plenary discussion on the roles of lipids in organisms.</p>	<ul style="list-style-type: none"> • Diagrams, • Charts showing the roles of lipids in organisms. 	<p>Is the student able to explain the roles of lipids in organisms?</p>	
<p>1.4.3 Proteins.</p>	<p>By the end of this sub-topic, the student should be able to: a) identify the constituents of proteins.</p>	<p>(i) Students to discuss in groups the constituents of proteins. (ii) The teacher to lead plenary discussion on the constituents of proteins.</p>	<p>Charts, diagrams showing constituents of proteins.</p>	<p>Is the student able to identify the constituents of proteins?</p>	<p>6</p>

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) categorize proteins.	(i) Students to brainstorm categories of proteins (based on structure, composition and functions) and giving examples. (ii) The teacher to lead plenary discussion on categories of proteins.	Food samples eg beans, meat, milk, eggs etc) Chart outlining the properties of protein. • Copper Sulphate solution • NaOH, • Egg albumin, • Beans, groundnuts, test tubes.	Is the student able to categorize proteins?	
	c) explain the properties of proteins.	(i) Using guided questions, students in groups to discuss the properties of proteins. (ii) The teacher to guide students to carry out experiments to investigate properties of proteins.		Is the student able to explain the properties of proteins?	
	d) carry out biochemical tests for proteins.	The teacher to guide students to carry out biochemical tests for proteins.		Is the student able to carry out biochemical food tests for proteins?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
1.4.4 Enzymes.	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) investigate the factors governing enzyme activity.</p> <p>b) explain the properties of enzymes.</p>	<p>(i) The teacher to guide students to carry out chemical tests on enzyme activities.</p> <p>(ii) The teacher using students' observations and results to lead a plenary discussion on factors governing enzyme activity.</p> <p>(i) The teacher to guide students to carry out experiments to investigate properties of enzymes.</p> <p>(ii) Using guided questions, students to discuss properties of enzymes.</p>	<ul style="list-style-type: none"> • Enzymes sources eg saliva, • Test tubes, • Starch, • NaHCO₃ • Dilute HCl. • Source of heat • Thermometer • Water baths • Ice. 	<p>Is the student able to investigate the factors governing enzyme activity?</p> <p>Is the student able to explain properties of enzymes?</p>	5

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
1.4.5 ATP	<p>c) categorize enzymes on the basis of nature of substrate and type of reaction catalysed.</p> <p>By the end of this sub-topic, the student should be able to:</p> <p>a) state chemical composition of ATP.</p> <p>b) outline formation of ATP.</p> <p>c) explain the role of ATP in organisms.</p>	<p>(i) Students to discuss in groups categories of enzymes based on nature of substrate and the reaction catalysed plenary discussion.</p> <p>(ii) The teacher to lead plenary discussion on categories of enzymes.</p> <p>(i) Using charts/diagrams students in groups to discuss the chemical composition of ATP.</p> <p>(ii) The teacher to guide a plenary discussion on the composition on the composition of ATP.</p> <p>The teacher to guide students to discuss in groups the formation of ATP.</p> <p>(i) Students to brainstorm the roles of ATP in organisms.</p> <p>(ii) The teacher to lead plenary discussion on the roles of ATP in organism.</p>	<ul style="list-style-type: none"> • Illustrated diagrams, • Prepared charts, • Projector, • Slides showing composition of ATP. 	<p>Is the student able to categorize enzymes on the basis of nature of substrate and type of reaction catalysed?</p> <p>Is the student able to state chemical composition of ATP?</p> <p>Is the student able to outline formation of ATP?</p> <p>Is the student able to explain the role of ATP in organisms?</p>	2

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
1.5 Other constituents of the cell: water.	By the end of this sub-topic, the student should be able to: a) explain the properties of water.	(i) Students to carry out library search on properties of water. (ii) The teacher to lead a plenary session on properties of water.	<ul style="list-style-type: none"> • Water, charts, • Salt/sugar • Burner, • Beaker, • Illustrations, • Diagrams. 	Is the student able to explain the properties of water?	2
b) describe the role of water in organisms.	(i) Students in groups to discuss the role of water in organisms. (ii) The teacher to lead plenary discussion basing on student's responses.	Is the student able to describe the role of water in organisms?			
2.0 PRINCIPLES OF CLASSIFICATION 2.1 Classification systems.	By the end of this sub-topics, the student should be able to: a) identify types of classification systems.	(i) The teacher to guide students to carry out practical exercise on grouping of living and non-living things. (ii) The teacher to guide students to classify living things using artificial and natural systems of classification.	Variety of living and non-living organisms.	Is the student able to identify types of classification systems (artificial and natural)?	4

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) outline the basis of classifying organisms under each system. c) explain the merits and demerits of each system.	The teacher to guide students in groups to discuss the bases of classifying organisms. (i) Students to brainstorm on the merits and demerits of artificial and natural system of classification. (ii) The teacher to lead plenary session on the merits and demerits of artificial and natural system of classification.		Is the student able to outline the bases of classifying organisms under each classification system?	
2.2 Categories of classification	By the end of this sub-topic, the student should be able to: a) explain the meaning of ranks as used in classification.	Students in groups using guided questions to discuss and present the meaning of ranks as used in classification.	Chart of classification ranks.	Is the student able to explain the meaning of ranks as used in classification?	1

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) explain the importance of ranks in classification.	(i) Using questions and answers the teacher to lead students to discuss the importance of ranks of classification.		Is the student able to explain the importance of ranks of classification?	
2.3 Nomenclature	By the end of this sub-topic, the student should be able to: a) explain the terms nomenclature and binomial nomenclature.	(i) Students to brainstorm the meaning of nomenclature and binomial nomenclature. (ii) The teacher to lead plenary discussion on the meaning of nomenclature and binomial nomenclature.	<ul style="list-style-type: none"> • Charts, • Illustrations, • Different organisms with scientific names. 	Is the student able to explain the terms nomenclature and binomial nomenclature?	3
	b) outline the rules used in binomial nomenclature.	The teacher to guide students using question/answers to discuss the rules used in binomial nomenclature.		Is the student able to outline the rules used in binomial nomenclature?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	<p>c) explain the significance of scientific naming of organisms.</p>	<p>(i) Students in groups to conduct library search on significance of scientific naming of organisms. (ii) The teacher to lead plenary discussion on the significance of naming organisms.</p>		<p>Is the student able to explain the significance of scientific naming of organisms?</p>	
	<p>d) apply the rules of binomial nomenclature.</p>	<p>(i) Students to carry out practical exercises to name organisms. (ii) The teacher to guide students to apply rules of binomial nomenclature in naming organisms.</p>		<p>Is the student able to apply the rules used in binomial nomenclature?</p>	
2.4 Taxonomic keys.	<p>By the end of this sub-topic, the student should be able to: a) explain the concept of taxonomic keys.</p>	<p>Using questions and answers students to discuss in groups the meaning and importance of taxonomic keys in classifying organisms.</p>	<ul style="list-style-type: none"> • Charts, simple constructed keys, published keys for plants and animals. • Charts displaying indented and bracketed keys, A variety of organisms (live or preserved). 	<p>Is the student able to explain the concept of taxonomic keys?</p>	4

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	<p>b) distinguish between indented and bracketed keys.</p>	<p>(i) The teacher to lead students in exploring different types of keys (indented and bracketed). (ii) Students to discuss in groups the differences between indented and bracketed keys.</p>	<ul style="list-style-type: none"> Photographs of selected organisms. Prepared identification keys of plants and animals. 	<p>Is the student able to distinguish between indented and bracketed keys?</p>	
	<p>c) construct simple keys.</p>	<p>The teacher to guide students in groups to construct simple keys using a list of selected organisms.</p>		<p>Is the student able to construct simple keys?</p>	
	<p>d) use keys to identify organisms.</p>	<p>(i) The teacher to guide students in carrying out exercise of using keys to classify organisms. (ii) Using guiding questions students to identify unknown organisms using keys.</p>		<p>Is the student able to use keys to identify organisms?</p>	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
<p>3.0 NATURAL GROUPS OF ORGANISMS</p> <p>3.1 Viruses.</p>	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) describe the characteristic features of viruses.</p> <p>b) draw the diagram to show structure of viruses.</p>	<p>(i) Students in groups to observe diagrams/charts/photographs of virus and discuss its main characteristics/ features.</p> <p>(ii) The teacher to lead plenary discussion on the characteristics/ features of viruses.</p> <p>(i) Students in groups to observe charts/ diagrams/ photographs of viruses and discuss the structures of plant and animal viruses.</p> <p>(ii) Student to draw well labelled diagrams of selected plant and animal viruses, HIV and bacteriophage.</p>	<p>Charts/Diagrams of viruses.</p>	<p>Is the student able to describe the characteristic features of viruses?</p> <p>Is the student able to draw the structure of viruses?</p>	<p>3</p>

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	<p>c) outline the main events of viral replication.</p>	<p>(i) The teacher to guide students to observe charts/diagrams/picture of bacteriophage and discuss the main events of viral replication. (ii) The teacher to lead plenary discussion on the main events of viral replication.</p>	<ul style="list-style-type: none"> • Charts showing events of viral replication. • Video on viral replication. 	<p>Is the student able to outline the main events of viral replication?</p>	
	<p>d) identify problems associated with the classification of viruses.</p>	<p>(i) Students to brainstorm on problems associated with classification of viruses. (ii) The teacher to lead plenary discussion and conclusion. viruses. (iii) The teacher to lead plenary discussion and conclusion.</p>		<p>Is the student able to identify problems associated with classification of viruses?</p>	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	e) explain advantages and disadvantages of viruses.	(i) Students to carry out library search and discuss in groups the advantages and disadvantages of virus drawing examples from daily life experiences. (ii) The teacher to lead discussion on the effect of HIV.	<ul style="list-style-type: none"> • Videos • Charts • Diagrams • Illustrations. 	Is the student able to explain the advantages and disadvantages of viruses?	
3.2 Kingdom Monera 3.2.1 Division Eubacteria.	By the end of this sub-topic, the student should be able to: a) describe the general and distinctive features of the division.	(i) Students in groups to visualize charts micrographs of bacteria and blue - green algae (cyanobacteria) to identify general and distinctive features of the division. (ii) The teacher to lead a plenary discussion of general and distinctive features of the division.	<ul style="list-style-type: none"> • Photographs of Bacteria • Micrographs • Charts • Diagram • Photographs of Bacteria. 	Is the student able to describe the general and distinctive features of the division Eubacteria?	6

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	<p>b) classify bacteria on the basis of morphology and gram stain test.</p>	<p>(i) Students to observe charts/diagrams/photos of bacteria and classify them on the basis of morphology and gram stain. (ii) The teacher to lead plenary discussion on the theory behind gram stains test (gram positive and gram negative bacteria).</p>		<p>Is the student able to classify bacteria on the basis of morphology and gram stain test?</p>	
	<p>c) draw the structure of typical bacterium.</p>	<p>(i) Students in groups to observe charts/models/photographs and discuss the structure of bacteria. (ii) Students to draw the structure of a typical bacterium.</p>		<p>Is the student able to draw the structure of a typical bacterium?</p>	
	<p>d) explain the reproduction of bacteria.</p>	<p>(i) Students to carry out library search on the reproduction of bacteria. (ii) The teacher to lead plenary discussion on the reproduction of bacteria.</p>		<p>Is the student able to explain the reproduction of bacteria?</p>	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	e) account for advantages and disadvantages of members of Kingdom Monera.	(i) Students to brainstorm on the advantages and disadvantages of the Kingdom Monera. (ii) The teacher to lead plenary discussion on the advantages and disadvantages of Kingdom Monera.		Is the student able to account for advantages and disadvantages of members of kingdom monera?	
3.3 Kingdom Protoctista 3.3.1 Phylum Rhizopoda.	By the end of this sub-topic, the student should be able to: a) describe general and distinctive features of the phylum. b) draw structure of <i>Entamoeba</i> .	(i) Students in groups to observe charts /pictures/specimens of organisms belong to the phylum Rhizopoda and discuss the general and distinctive features of the phyla. (ii) The teacher to lead a plenary discussion and conclusion. (i) Students in groups to observe charts/diagrams/models/specimens of <i>Entamoeba</i> and describe its structure.	<ul style="list-style-type: none"> • Charts • Pictures • Specimens • Diagrams. 	Is the student able to describe the general and distinctive features of the phylum Rhizopoda? Is the student able to draw structure of <i>Entamoeba</i> ?	2

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
3.3.2 Phylum Zoomastigna.	c) explain the adaptations of <i>Entamoeba</i> to its mode of life.	(ii) The teacher to guide students to draw a well labelled diagram of <i>Entamoeba</i> . (i) Students in groups to observe charts/diagrams/specimens of <i>Entamoeba</i> and discuss its adaptation. (ii) he teacher to lead a plenary discussion basing on students responses, make clarification and conclusion.	<ul style="list-style-type: none"> • Charts • Pictures • Diagrams • Specimens. 	Is the student able to explain the adaptations of <i>Entamoeba</i> to its mode of life?	2
	By the end of this sub-topic, student should be able to: a) describe the general and distinctive features of the phylum. b) describe the structure of <i>Trypanosoma</i> .	The teacher to guide students to observe charts/models/pictures/specimens and discuss in groups the general and distinctive features of organisms under the phylum Zoomastigna. Students in groups to observe charts/specimens/models/diagrams of Trypanosoma and discuss their structures.		Is the student able to describe the general and distinctive features of the phylum? Is the student able to describe the structure of <i>Trypanosoma</i> ?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	c) explain the adaptation of <i>Trypanosoma</i> to its mode of life.	The teacher to guide students to draw a well labelled diagram of <i>Trypanosoma</i> . The teacher to guide students in a plenary session to discuss the adaptation of <i>Trypanosoma</i> to its life.		Is the student able to explain the adaptation of <i>Trypanosoma</i> to its life?	
3.3.3 Phylum Apicomplexa.	By the end of this sub-topic, student should be able to: a) describe the general and distinctive features of the phylum. b) draw the structure of <i>Plasmodium</i> .	(i) Students in groups to observe charts/ diagram/ pictures/ microscope slides/ specimens of organisms under the Phylum Apicomplexa and discuss their general and distinctive features. (ii) The teacher to lead a plenary discussion on the general and distinctive features of the phylum. (i) Students in groups to observe diagrams/pictures or prepared slides of <i>Plasmodium</i> and discuss its structures.	<ul style="list-style-type: none"> • Charts • Pictures • Diagrams • Microscope • Slides • Microscope • Specimens of • Mosquitoes • Charts showing life cycle of <i>Plasmodium</i> • Library facility. 	Is the student able to describe the general and distinctive features of the phylum Apicomplexa? Is the student able to draw the structure of <i>Plasmodium</i> ?	3

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	<p>(ii) Students to draw a well labelled diagram of <i>Plasmodium</i>.</p> <p>(i) Students in groups to observe diagrams/charts and discuss the adaptation of <i>Plasmodium</i> to its mode of life.</p> <p>(ii) The teacher to lead a plenary discussion on the adaptation of <i>Plasmodium</i> to its mode of life.</p> <p>(i) Students to carry out library search on the life cycle of <i>Plasmodium</i>.</p> <p>(ii) The teacher to lead a plenary discussion on the life cycle of <i>Plasmodium</i>.</p>	<p>(ii) Students to draw a well labelled diagram of <i>Plasmodium</i>.</p> <p>(i) Students in groups to observe diagrams/charts and discuss the adaptation of <i>Plasmodium</i> to its mode of life.</p> <p>(ii) The teacher to lead a plenary discussion on the adaptation of <i>Plasmodium</i> to its mode of life.</p> <p>(i) Students to carry out library search on the life cycle of <i>Plasmodium</i>.</p> <p>(ii) The teacher to lead a plenary discussion on the life cycle of <i>Plasmodium</i>.</p>		<p>Is the student able to state the adaptation of <i>Plasmodium</i> to its mode of life?</p> <p>Is the student able to explain the life cycle of <i>Plasmodium</i>?</p>	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
3.3.4 Phylum Euglenophyta.	By the end of this sub-topic, student should be able to: a) describe the general and distinctive features of the phylum.	(i) Students to observe charts and micrographs of <i>Euglena</i> and discuss the general and distinctive features of the phylum. (ii) Students to draw a well labelled diagram of <i>Euglena</i> .	<ul style="list-style-type: none"> • Specimens • Slides • Microscope • Charts • Diagrams. 	Is the student able to describe the general and distinctive features of the phylum Euglenophyta?	2
	b) state the adaptation of <i>Euglena</i> to its mode of life.	(i) Students in groups to observe charts/diagrams / specimen of <i>Euglena</i> and discuss its adaptation. (ii) The teacher to lead a plenary discussion on the adaptation of <i>Euglena</i> to its mode of life.		Is the student able to state the adaptation of <i>Euglena</i> to its mode of life?	
3.3.5 Phylum Oomycota.	By the end of this sub-topic, the student should be able to: a) describe the general and distinctive features of the phylum.	(i) Students to observe charts/diagrams/specimens of <i>Phytophthora</i> and discuss the general and distinctive features of the phylum. (ii) The teacher to lead a plenary discussion on the general and distinctive features of the phylum.	<ul style="list-style-type: none"> • Charts • Diagrams of phytophthora. 	Is the student able to describe the general and distinctive features of the phylum?	2

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) draw the structure of <i>Phytophthora</i> .	Students to observe charts/diagrams/specimens of <i>Phytophthora</i> and draw their structures.		Is the student able to draw the structure of <i>Phytophthora</i> ?	
	c) state the adaptation of <i>Phytophthora</i> to its mode of life.	The teacher to lead a group discussion and plenary presentation on the adaptation of <i>Phytophthora</i> to its mode of life.		Is the student able to state the adaptation of <i>Phytophthora</i> to its mode of life?	
3.3.6 Phylum Chlorophyta.	By the end of this sub-topic, student should be able to: a) describe the general and distinctive features of the phylum.	Teacher to guide students to observe microscope slides/specimens/charts/ diagrams, and discuss the general and distinctive features of the phylum.	<ul style="list-style-type: none"> • Microscope • Slides • Pictures of spirogyra. 	Is the student able to describe the general and distinctive features of the phylum?	2
b) draw the structure of <i>Spirogyra</i> .	(i) Students in groups to visualize charts and diagrams of <i>Spirogyra</i> and discuss their structures. (ii) Students to draw a well labelled diagram of <i>Spirogyra</i> .	Is the student able to draw the structure of the <i>Spirogyra</i> ?			

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
3.3.7 Advantages and disadvantages of the Kingdom Protoctista.	<p>c) state the adaptation of the <i>Spirogyra</i> to its mode of life.</p>	<p>(i) Students in groups to discuss the adaptation of <i>Spirogyra</i> to its mode of life.</p> <p>(ii) The teacher to lead plenary discussion on the adaptation of <i>Spirogyra</i> to its mode of life.</p>		<p>Is the student able to state the adaptation of the <i>Spirogyra</i> to its mode of life?</p>	
3.3.7 Advantages and disadvantages of the Kingdom Protoctista.	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) explain with examples advantages and disadvantages of the kingdom Protoctista.</p>	<p>The teacher to guide students to discuss with examples the advantages and disadvantages of organisms belong to the kingdom Protoctista.</p>		<p>Is the student able to explain with examples advantages of the kingdom Protoctista to humans?</p>	2

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
3.4 Kingdom Fungi 3.4.1 Phylum Zygomycota.	By the end of this sub-topic, student should be able to: a) describe the general and distinctive features of the phylum. b) draw the structure of <i>Mucor/Rhizopus</i> . c) explain the adaptation of <i>Mucor/Rhizopus</i> to its mode of life.	(i) Student to observe microscope slides/ charts/ diagrams and discuss the general and distinctive features of the phylum. (ii) The teacher to lead a plenary discussion on the general and distinctive features of the phylum. The teacher to guide students to observe diagram/chart of <i>Mucor/Rhizopus</i> and draw its structure. Student to observe microscope slides/ charts/diagrams / specimen of <i>Mucor/Rhizopus</i> and discuss its adaptations.	<ul style="list-style-type: none"> • Charts • Diagrams • Microscope • Slides • Specimens of <i>Rhizopus</i>. 	Is the student able to describe the general and distinctive features of the phylum? Is the student able to draw the structure of <i>Mucor/Rhizopus</i> ? Is the student able to explain the adaptation of <i>Mucor/Rhizopus</i> to its mode of life?	2

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
3.4.2 Phylum Ascomycota.	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) describe the general and distinctive features of the phylum.</p> <p>b) draw the structure of Saccharomyces.</p> <p>c) describe the adaptations of <i>Saccharomyces</i> to its mode of life.</p>	<p>Using guiding questions students to observe charts/diagram/ microscope slides of organisms under the Phylum Ascomycota and discuss their general and distinctive features.</p> <p>Students to observe charts/diagrams of <i>Saccharomyces</i> and draw their structures.</p> <p>(i) Using guiding questions, students to discuss in groups the adaptations of <i>Saccharomyces</i> to its mode of life.</p> <p>(ii) The teacher to lead plenary discussion on the adaptations of <i>Saccharomyces</i> to its mode of life.</p>	<ul style="list-style-type: none"> • Charts • Diagram • Microscope slides • Specimen of yeast • Diagrams • Charts • Yeast. 	<p>Is the student able to describe the general and distinctive features of the phylum?</p> <p>Is the student able to draw the structure of <i>Saccharomyces</i>?</p> <p>Is the student able to describe the adaptations of <i>Saccharomyces</i> to its mode of life?</p>	2

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
3.4.3 Phylum Basidiomycota.	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) describe the general and distinctive features of the phylum.</p> <p>b) draw the structure of <i>Agaricus</i>.</p> <p>c) state the adaptation of <i>Agaricus</i> to its mode of life.</p>	<p>Using guiding questions students in groups to observe microscope slides/ charts/ diagrams of organisms under phylum Basidiomycota and discuss their general and distinctive features.</p> <p>Students to observe diagrams / charts /pictures of <i>Agaricus</i> and draw its structure.</p> <p>The teacher to guide students to discuss the adaptations of <i>Agaricus</i> to its mode of life.</p>	<ul style="list-style-type: none"> • Microscope • Slides • Charts/diagrams showing structures of mushroom. <p><i>Agaricus</i> Pictures on the uses and effects of fungi.</p>	<p>Is the student able to describe the general and distinctive features of the phylum?</p> <p>Is the student able to draw the structure of <i>Agaricus</i>?</p> <p>Is the student able to state the adaptation of <i>Agaricus</i> to its mode of life?</p>	2
3.4.4 Advantages and disadvantages of the kingdom Fungi.	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) explain the advantages and disadvantages of kingdom Fungi.</p>	<p>(i) Students to carry out library search on advantages and disadvantages of organisms belong to kingdom Fungi.</p>		<p>Is the student able to explain the advantages and disadvantages of kingdom Fungi?</p>	2

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
3.4.4 Advantages and disadvantages of the kingdom Fungi.	By the end of this sub-topic, the student should be able to: a) explain the advantages and disadvantages of kingdom Fungi.	(ii) The teacher to lead plenary discussion on advantages and disadvantages of the kingdom Fungi. (i) Students to carry out library search on advantages and disadvantages of organisms belong to kingdom Fungi. (ii) The teacher to lead plenary discussion on advantages and disadvantages of the kingdom Fungi.		Is the student able to explain the advantages and disadvantages of kingdom Fungi?	2
3.5 Kingdom Plantae 3.5.1 Division Bryophyta.	By the end of this sub-topic, the student should be able to: a) describe the general and distinctive feature of the division.	Students in groups to observe charts/pictures/specimens and discuss the general and distinctive features of the phylum.	<ul style="list-style-type: none"> • Variety of plants • Charts • Pictures • Diagrams • Specimen of <i>Funaria</i>. 	Is the student able to describe general and distinctive features of the division?	2

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	<p>b) describe the structure of <i>Funaria</i>.</p>	<p>(i) Students in groups to observe charts/diagram/specimen of <i>Funaria</i> and discuss its structures. (ii) The teacher to guide students to draw a well labelled diagram of <i>Funaria</i>.</p>	<ul style="list-style-type: none"> • Charts • Picture • Diagram • specimen of <i>Funaria</i>. 	<p>Is the student able to describe the structure of <i>Funaria</i>?</p>	
	<p>c) state the adaptation of <i>Funaria</i> to its mode of life.</p>	<p>(i) Students in groups to discuss the adaptation of <i>Funaria</i> to its mode of life. (ii) The teacher to guide students in a plenary session and give conclusion.</p>	<ul style="list-style-type: none"> • Chart • Pictures • Diagram • Specimen of <i>Dryopteris</i>. 	<p>Is the student able to state the adaptation of <i>Funaria</i> to its mode of life?</p>	
<p>3.5.2 Division Filicinophyta (Pteridophyta).</p>	<p>By the end of this sub-topic, the student should be able to: a) describe the structure of <i>Dryopteris</i>.</p>	<p>(i) Students in groups to observe charts/diagram picture/micrographs/specimen of <i>Dryopteris</i> and discuss its structure.</p>		<p>Is the student able to explain the structure of <i>Dryopteris</i>?</p>	<p>3</p>

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		(ii) Students to draw well labelled diagram of <i>Dryopteris</i> .		Is the student able to explain the structure of <i>Dryopteris</i> ?	3
	b) state the adaptations of <i>Dryopteris</i> to its mode of life.	The teacher to guide students in groups to observe diagram/specimens of <i>Dryopteris</i> and discuss its adaptation to its mode of life.		Is the student able to state the adaptations of <i>Dryopteris</i> to its mode of life?	
3.5.3 Division Coniferophyta (Conifers).	By the end of this sub-topic, student should be able to: a) describe the structure of <i>Pinus</i> .	(i) Students in groups to observe pictures, diagrams, real plants (<i>Pinus</i>) and discuss its structure. (ii) The teacher to lead a plenary session on the structure of <i>Pinus</i> .	<ul style="list-style-type: none"> • <i>Pinus sp</i> • Diagrams • Plant • Specimens • Pictures • Photographs. 	Is the student able to draw the structure of <i>Pinus</i> ?	2
	b) state the adaptation of <i>Pinus</i> to its mode of life.	The teacher to lead a plenary discussion on the adaptation of <i>Pinus</i> to its mode of life.		Is the student able to state the adaptation of <i>Pinus</i> to its mode of life?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
3.5.4 Division Angiospermophyta (flowering plants).	<p>By the end of this sub- topic, the student should be able to:</p> <p>a) state the classes of the division Angiospermophyta.</p> <p>b) describe the flower structure.</p>	<p>Using questions and answers the teacher to guide students to observe charts/diagrams/ real plants and state the classes of the division to students classes of the division Angiospermophyta.</p> <p>(i) The teacher to guide students to observe the structure of flowers and investigate the position of floral whorls and symmetry.</p> <p>(ii) The teacher to guide students to draw the structure of the generalised flower.</p>	<ul style="list-style-type: none"> • Charts • Picture • Diagram • Specimens of angiosperms. <ul style="list-style-type: none"> • Various flowers • Scalpels/ razor blade. 	<p>Is the student able to state classes of the division Angiospermophyta?</p> <p>Is the student able to describe the flower structure?</p>	5

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	c) distinguish between half flower and floral diagrams.	(i) The teacher to guide student to prepare the L.S of the flower. (ii) Students to observe and investigate the structure of the half flower and discuss the differences between half flower and floral diagram.	<ul style="list-style-type: none"> • Hand len • Hibiscus flower, • Bean flower • Maize /elephant grass flower. 	Is the student able to distinguish between half flower and floral diagrams?	
	d) construct floral diagram of <i>Hibiscus</i> , Bean, elephant grass and maize flower.	The teacher to guide student to construct the floral diagram of <i>Hibiscus</i> , bean flower, elephant grass, maize and present to plenary session.		Is the student able to construct floral diagram of <i>Hibiscus</i> , bean flower, elephant grass and maize?	
	e) describe floral formular, symbol and floral formular presentation.	(i) The teacher guide student to interpret symbols used in representing floral formula.	<ul style="list-style-type: none"> • Charts • Diagrams. 	Is the student able to describe floral formular, symbol and floral formular presentation?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
3.5.5 Advantages and disadvantages of Kingdom Plantae.	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) explain with examples the advantages of the Kingdom Plantae to human.</p> <p>b) explain disadvantages of the Kingdom Plantae to human.</p>	<p>(ii) The teacher to guide students to write the floral formula of <i>Hibiscus</i>, bean, elephant grass and maize flower and present in a plenary session.</p> <p>(i) Students to brainstorm on the advantages of the kingdom plantae to human beings.</p> <p>(ii) The teacher to lead plenary discussion on the advantages of the kingdom plantae to human beings.</p>	<ul style="list-style-type: none"> • Charts • Diagram • Pictures. 	<p>Is the student able to explain with examples the advantages of the Kingdom Plantae to human?</p>	2
				<p>Is the student able to explain disadvantages of the Kingdom Plantae to human?</p>	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
<p>3.6 Kingdom Animalia</p> <p>3.6.1 Phylum Platyhelminthes</p>	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) describe the structure of <i>Taenia/Fasciola</i>.</p> <p>b) state the adaptation of <i>Taenia</i> to its parasitic mode of life.</p> <p>c) explain with examples the advantages and disadvantages of the phylum platyhelminthes.</p>	<p>(i) Students in groups to observe charts/ diagram/ specimens of <i>Taenia/Fasciola</i> and describe its structure.</p> <p>(ii) Students to draw a well labelled diagram of <i>Taenia/Fasciola</i>.</p> <p>Students in groups to observe charts/diagram/ specimens of <i>Taenia</i> and discuss its adaptation to its parasitic mode of life.</p> <p>(i) Students to brainstorm on the advantages and disadvantages of the phylum Platyhelminthes.</p> <p>(ii) The teacher to lead plenary discussion on the advantages and disadvantages of the phylum Platyhelminthes.</p>	<ul style="list-style-type: none"> • Charts • Diagram • Picture • Models. <ul style="list-style-type: none"> • Preserved specimens of <i>Taenia/ Fasciola</i> • Hand lens. <ul style="list-style-type: none"> • Diagrams • Charts • Pictures. 	<p>Is the student able to describe the structure of <i>Taenia/Fasciola</i>?</p> <p>Is the student able to State the adaptation of <i>Taenia</i> to its parasitic mode of life?</p> <p>Is the student able to explain with examples the advantages and disadvantages of the phylum platyhelminthes?</p>	<p>2</p>

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
3.6.2 Phylum Aschelminthes (Nematoda).	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) describe the structure of <i>Ascaris</i>.</p> <p>b) state the adaptive features of <i>Ascaris</i> to its mode of life.</p> <p>c) explain the advantages and disadvantages of the phylum Aschelminthes.</p>	<p>(i) The teacher to guide students to observe charts/diagrams/models/specimen of <i>Ascaris</i> and describe its structure.</p> <p>(ii) Students to draw a well labelled diagram of <i>Ascaris</i>.</p> <p>(i) Students to carry out library search on adaptive features of <i>Ascaris</i>.</p> <p>(ii) The teacher to lead plenary discussion on adaptive features of <i>Ascaris</i>.</p> <p>(i) The teacher to invite a health specialist to discuss on the disadvantages of <i>Ascaris</i>.</p> <p>(ii) The teacher to guide students to discuss in groups the advantages and disadvantages of the phylum Aschelminthes.</p>	<ul style="list-style-type: none"> • Models/ • Charts/ • Pictures • Diagram • Specimens of <i>Ascaris</i>. 	<p>Is the student able to describe the structure of <i>Ascaris</i>?</p> <p>Is the student able to state the adaptive features of <i>Ascaris</i> to its mode of life?</p> <p>Is the student able to explain the advantages and disadvantages of phylum Aschelminthes?</p>	2

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
3.6.3 Phylum Annelida.	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) describe the structure of earthworm.</p> <p>b) explain the adaptive features of Earthworm to its mode of life.</p> <p>c) explain with examples advantages and disadvantages of Annelida.</p>	<p>(i) The teacher to guide students in groups to observe charts/diagram/ picture/ specimen of earthworm and discuss its structure.</p> <p>(ii) Students to draw a well labelled diagram of the earthworm.</p> <p>Students in groups to observe charts/diagrams/pictures/specimens of earth worm and discuss its adaptation features.</p> <p>(i) Students to brainstorm the advantages and disadvantages of the phylum Annelida and give examples.</p> <p>(ii) The teacher to lead a plenary discussion on the advantages and disadvantages of the phylum Annelida.</p>	<ul style="list-style-type: none"> • Charts • Pictures • Diagrams • Specimens of Earthworms. 	<p>Is the student able to describe the structure of earthworm?</p> <p>Is the student able to explain the adaptive features of earthworm to its mode of life?</p> <p>Is the student able to explain with examples advantages and disadvantages of Annelida?</p>	2

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
3.6.4 Phylum Arthropoda.	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) state classes of the phylum Arthropoda.</p> <p>b) describe distinctive features of each class of the phylum arthropoda.</p> <p>c) describe the structure of crab, spider, millipedes, centipedes and cockroach.</p>	<p>(i) Students in groups to observe charts/ pictures/ specimens of arthropods and group them according to their similarities and differences.</p> <p>(ii) The teacher to guide students to state the classes of arthropods.</p> <p>(i) Students to observe specimens of arthropods and describe the distinctive features of each class.</p> <p>(ii) The teacher to guide students to discuss in groups the distinctive features of each class of the phylum arthropoda.</p> <p>(i) The teacher to guide students to describe the structure of crab, spider, millipedes, centipedes and cockroach.</p>	<ul style="list-style-type: none"> • Charts • Pictures • Diagrams • Photographs Varieties of Arthropods, crab, spider, millipedes, centipedes and cockroach. • Hand lens • Models. 	<p>Is the student able to state classes of the phylum Arthropoda?</p> <p>Is the student able to describe distinctive features of each class of the phylum arthropoda?</p> <p>Is the student able to describe the structure of crab, spider, millipedes, centipedes and cockroach?</p>	6

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		(ii) Students to draw well labelled diagrams of crab, spider, millipedes, centipedes and cockroach.			
d) explain adaptive features of the mentioned Arthropoda.		Students in groups using guiding questions to observe charts /pictures /specimens of arthropods and discuss their adaptive features.		Is the student able to explain adaptive features of Arthropoda?	
3.6.4.1 Systems of Arthropods	By the end of this sub-topic, the student should be able to: a) dissect and display the digestive and reproductive systems of cockroach.	(i) The teacher to guide students to dissect cockroach to display its digestive and reproductive systems. (ii) Students to observe the dissected specimen and draw well labelled diagrams of digestive and reproductive systems of the dissected cockroach.	<ul style="list-style-type: none"> • Live Cockroach • Chloroform • Dissecting dish • Dissecting kit • Hand lens • Water. 	Is the student able to dissect and display the digestive and reproductive systems of cockroach?	4

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	<p>b) describe structures of digestive and reproductive systems of the cockroach.</p>	<p>(i) Students to observe specimens of the dissected cockroach and describe the displayed structures of digestive and reproductive systems. (ii) The teacher to lead plenary discussion on structures of digestive and reproductive systems of cockroach.</p>		<p>Is the student able to describe structures of digestive and reproductive systems of the cockroach?</p>	
	<p>c) explain advantages and disadvantages of the phylum arthropoda.</p>	<p>(i) Students to brainstorm on advantages and disadvantages of the phylum arthropoda. (ii) The teacher to lead plenary discussion on the advantages and disadvantages of the phylum arthropoda.</p>		<p>Is the student able to explain advantages and disadvantages of the phylum arthropoda?</p>	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
3.6.5 Phylum Chordata.	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) explain with examples classes of the phylum Chordata.</p> <p>b) describe the structures of Tilapia, Pigeon, Toad/Frog, Lizard and Mouse or any other small mammal.</p>	<p>(i) Students in groups using guiding questions to observe charts/pictures/specimens of chordates and group them according to their similarities and differences.</p> <p>(ii) The teacher to guide students to discuss in groups the classes of the phylum Chordata.</p> <p>(i) Students in groups to observe charts/pictures / specimens of Tilapia, Pigeon Toad/Frog, Mouse or any other small mammal, Lizard and describe their structure.</p> <p>(ii) Students to draw well labelled diagrams of Tilapia, Pigeon Toad/Frog, Mouse or any other small mammal and Lizard.</p>	<ul style="list-style-type: none"> • Pictures/ diagrams/ preserved specimen of representative organisms under phylum Chordata. • Tilapia, Pigeon, Toad/ Frog, Mouse or any other small mammal and Lizard. 	<p>Is the student able to explain with examples the classes of the phylum Chordata?</p> <p>Is the student able to describe the structure of Tilapia, Pigeon Toad/Frog, Mouse or any other small mammal and Lizard?</p>	12

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	<p>c) dissect Toad/frog and Mouse or small mammal to display viscera, digestive, urinogenital and nervous system.</p>	<p>(i) The teacher to guide students to carry out dissection of toad/frog and mouse or small mammal to display viscera, digestive, urinogenital and nervous systems.</p> <p>(ii) Students to dissect and draw diagrams of the dissected toad/frog, mouse or any small mammal to display viscera, digestive, urinogenital and nervous systems.</p>	<ul style="list-style-type: none"> • Live Toad/frog/ Mouse • Chloroform • Dissecting dish • Dissecting kit • Charts • Diagram of chordates. 	<p>Is the student able to dissect toad/frog, mouse or small mammal to display viscera, digestive urinogenital and nervous system?</p>	
	<p>d) explain advantages and disadvantages of the phylum chordata.</p>	<p>(i) Student to brainstorm on advantages and disadvantages of the phylum chordata.</p> <p>(ii) The teacher to lead a plenary discussion on advantages and disadvantages of the phylum chordata.</p>		<p>Is the student able to explain the advantages and disadvantage of the phylum chordata?</p>	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
<p>4.0 COORDINATION</p> <p>4.1 Nervous coordination in Mammals.</p>	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) describe the structure of the nervous tissue.</p> <p>b) explain the adaptive features of nervous tissues.</p>	<p>(i) The teacher to guide student to observe charts/pictures/diagrams microscope slides of neurones (nerve cells) / Neuroglia cells, and discuss their structure.</p> <p>(ii) Students to draw well labelled diagrams of nervous tissue.</p> <p>Using guiding questions students to observe charts/ microscope slides, diagrams/ pictures and discuss the adaptive features of the nervous tissues to their roles.</p>	<ul style="list-style-type: none"> • Charts • Diagrams • Pictures. 	<p>Is the student able to describe the structure of the nervous tissue?</p> <p>Is the student able to explain the adaptive features of nervous tissues?</p>	<p>2</p>

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
4.1.1 Nerve Impulses.	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) explain the concept of resting potential, action potential, polarization depolarization and repolarization of nerve cells.</p> <p>b) describe the formation and conduction of nerve impulses.</p>	<p>(i) Using guiding questions students in groups to visualize charts/diagrams/pictures of nerve cells and discuss the concept of resting potential, action potential, polarization depolarization and repolarization of nerve cells.</p> <p>(ii) The teacher to lead plenary discussion on the meaning of resting potential, action potential, depolarization and repolarization of nerve cells.</p> <p>(i) Using guiding questions students to visualize charts/diagrams of nerve cells and discuss the formation and conduction of nerve impulses.</p>	<ul style="list-style-type: none"> • Charts • Pictures • Photographs • Diagrams • Illustrations of nervous tissues. 	<p>Is the student able to explain the concept of resting potential, action potential, polarization, depolarization and repolarization of nerve cells?</p> <p>Is the student able to describe the formation and conduction of nerve impulses?</p>	5

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	<p>(ii) The teacher to lead plenary discussion on formation and conduction of nerve impulses.</p> <p>(i) Using guiding questions students in group to discuss and present the characteristics of nerve impulses.</p> <p>(ii) The teacher to lead plenary discussion on the characteristics of nerve impulses.</p> <p>d) explain synaptic transmission of nerve impulses.</p>	<p>(ii) The teacher to lead plenary discussion on formation and conduction of nerve impulses.</p> <p>(i) Using guiding questions students in group to discuss and present the characteristics of nerve impulses.</p> <p>(ii) The teacher to lead plenary discussion on the characteristics of nerve impulses.</p> <p>Students in groups to observe diagrams showing synaptic transmission of nerve impulses and discuss synaptic transmission of nerve impulses.</p>		<p>Is the student able to outline the characteristics of nerve impulses?</p> <p>Is the student able to explain synaptic transmission of a nerve impulse?</p>	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
4.1.2 Receptors.	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) identify main types of receptors and their function in the mammalian body.</p> <p>b) explain the mammalian eye accommodation.</p>	<p>(i) Students to brainstorm on the main types of receptors, location and their role in the mammalian body.</p> <p>(ii) The teacher to lead a plenary discussion on main types of receptors, location and their roles.</p> <p>(i) Students in groups to visualise charts/ pictures/ diagrams/ models of the mammalian eye and discuss the accommodation of the eye.</p> <p>(ii) The teacher to lead a plenary discussion on how the mammalian eye accommodation occurs.</p>	<p>Chart on types of receptors.</p> <ul style="list-style-type: none"> • Chart • Picture • Diagram • Model of the mammalian eye. 	<p>Is the student able to identify main types of receptors and their roles in the mammalian body?</p> <p>Is the student able to explain accommodation of the mammalian eye?</p>	2

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	<p>c) describe the structure of retina and the physiology of seeing.</p>	<p>(i) Students in groups to examine charts/diagram/picture/model of the mammalian eye and discuss its structure. (ii) The teacher to lead plenary discussion on the physiology of seeing.</p>	<ul style="list-style-type: none"> • Chart • Picture • Diagram • Model of the mammalian ear. 	<p>Is the student able to describe the structure of retina and the physiology of seeing?</p>	4
	<p>d) describe the structure of Membranous labyrinth of the mammalian inner ear.</p>	<p>The teacher to guide students to visualize charts/diagrams/pictures/models of membranous labyrinth of the mammalian inner ear and describe their structure.</p>		<p>Is the student able to describe the structure of Membranous labyrinth of mammalian innerear?</p>	
	<p>e) elaborate mechanisms of hearing and body balance in mammals.</p>	<p>(i) Students to brainstorm on mechanism of hearing and body balance in mammals. (ii) The teacher to lead plenary discussion on mechanism of learning and body balance basing on students responses.</p>		<p>Is the student able to elaborate mechanisms of hearing and body balance in mammals?</p>	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
4.3 Hormonal Coordination in Mammals.	By the end of this sub-topic, the student should be able to: a) explain the feedback mechanism of hormonal coordination.	(i) Students to brainstorm on the meaning of feedback mechanism of hormonal coordination. (ii) The teacher to lead plenary discussion on feedback mechanism of hormonal coordination using specified examples.	<ul style="list-style-type: none"> • Chart • Diagrams • Illustrations. 	Is the student able to explain the feedback mechanism of hormonal co-ordination?	2
	b) describe the interaction between hormonal and nervous system.	Using guided questions students in groups to discuss the interaction between hormonal and nervous system.	<ul style="list-style-type: none"> • Charts • Diagrams. 	Is the student able to describe the interaction between hormonal and nervous systems?	
4.4 Coordination in Plants.	By the end of this sub-topic, the student should be able to: a) explain the concept of tactic movements.	(i) The teacher to guide students to perform practical exercises to investigate tactic movements in plants. (ii) Students in groups to discuss the concept of tactic movements.	<ul style="list-style-type: none"> • Charts • Diagrams • Picture. 	Is the student able to explain the meaning and importance of tactic movements?	2

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
4.4.1 Tactic Movements.	b) identify types of tactic movements in plants.	(i) The teacher to guide students to observe and investigate tactic movements in control and experimental plants. (ii) Students in groups to identify types of tactic movement in plants.	<ul style="list-style-type: none"> • Seedling • Plant pots • Soil • Water • Box. 	Is the student able to identify types of tactic movements in plants?	
4.4.2 Nastic Movement.	By the end of this sub-topic, the student should be able to: a) explain the concept of nastic movement. b) outline types of phytohormones and their roles.	(i) The teacher to guide students to conduct an experiment to investigate nastic movements in plants (ii) Students in groups to discuss the meaning and importance of nastic movement. (i) Students in groups to discuss and outline types and roles of Phytohormones in plants.	<ul style="list-style-type: none"> • Charts • Pictures • <i>Mimosa pudica</i>. 	Is the student able to explain the meaning and importance of Nastic movement? Is the student able to outline types and roles of phytohormones?	4

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		(ii) The teacher to guide students to carry out experiments to investigate the role of auxin and gibberellins on plant growth.			
	c) explain the application of natural and synthetic phytohormones in crop production and control of weeds.	(i) Students using guided questions to discuss on application of natural and synthetic phytohormones in daily life. (ii) The teacher to lead a plenary discussion on the application of phytohormones in crop production and weeds control.	<ul style="list-style-type: none"> • Pictures • Photographs • Charts • Diagrams. 	Is the student able to explain the application of natural and synthetic phytohormones in crop production and control of weeds?	
5.0 NUTRITION 5.1 Food Manufacturing in Plants (Photosynthesis). 5.1.1 Light Reaction.	By the end of this sub-topic, the student should be able to: a) explain the concept of light reaction.	(i) The teacher to guide students to brainstorm on the meaning and importance of light reaction.	<ul style="list-style-type: none"> • Charts • Illustrations 	Is the student able to explain the concept of light reaction?	4

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		(ii) Students in groups to visualize charts showing steps of photosynthesis and discuss the role of light in the formation of ATP and NADPH ₂ .			
	b) explain the concept of photophosphorylation.	The teacher to guide students to discuss in groups the meaning and importance of photophosphorylation.	<ul style="list-style-type: none"> • Charts • Diagrams • Pictures. 	Is the student able to explain the concept of photophosphorylation?	
	c) distinguish between cyclic and non-cyclic photophosphorylation.	(i) The teacher to guide students in groups to observe and discuss illustrations of cyclic and non-cyclic photophosphorylation. (ii) Students to differentiate cyclic and non-cyclic photophosphorylation.	<ul style="list-style-type: none"> • Charts • Diagrams • Pictures. 	Is the student able to differentiate cyclic and non-cyclic photophosphorylation?	
	d) explain the role of water as a source of hydrogen.	(i) Students in groups to observe diagrams/charts and discuss the role of water as a source of hydrogen.	<ul style="list-style-type: none"> • Charts • Diagrams • Pictures. 	Is the student able to explain the role of water as a source of hydrogen?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
5.1.2 Dark reaction.	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) explain the meaning of dark reaction and the events which take place during dark reaction.</p> <p>b) outline the roles of ribulose biphosphate (RubP) and NADP₂.</p>	<p>(ii) The teacher to lead a plenary discussion on role of water.</p> <p>(i) The teacher to guide students to observe charts and discuss the meaning of dark reaction.</p> <p>(ii) The teacher to guide students to observe charts/diagrams and discuss the events which takes place during dark reaction (i.e Calvin cycle).</p> <p>Students in groups using guidings questions to observe charts/diagrams/ illustrations of dark reaction and discuss the role of ribulose diphosphate as a carbon dioxide acceptor and NADP₂.</p>	<ul style="list-style-type: none"> • Charts • Diagrams • Illustrations. 	<p>Is the student able to explain the meaning of dark reaction and the events which take place during reaction?</p> <p>Is the student able to outline the roles of ribulose biphosphate (RubP) and NADP₂</p>	4

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	c) describe the main steps involved in the conversion of phosphoglyceric acid into sugar.	The teacher to guide students in groups to observe charts, discuss and the main steps involved in the conversion of phosphoglyceric acid to sugar.		Is the student able to describe the main steps involved in the conversion of phosphoglyceric acid into sugar?	
5.1.3 C ₃ and C ₄ Plants.	By the end of this sub-topic, the student should be able to: a) explain the meaning of C ₃ and C ₄ plants. b) distinguish between C ₃ and C ₄ Plants. c) describe the C ₄ pathway (Hatch Slack pathway).	(i) Using questions and answers the teacher to guide students to discuss the meaning of C ₃ plants and C ₄ plants. (i) Students to differentiate between C ₃ and C ₄ plants. (ii) The teacher to lead a plenary discussion on differences between C ₃ and C ₄ plants. (i) The teacher to guide students in groups to discuss the C ₄ pathway (Hatch Slack Pathway). (ii) Using charts and diagrams students to describe the C ₄ pathway.		Is the student able to explain the meaning of C ₃ and C ₄ plants? Is the student able to distinguish between C ₃ and C ₄ plants? Is the student able to describe the C ₄ pathway (Hatch Slack pathway)?	2

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
5.1.4 Factors affecting rate of Photosynthesis.	By the end of this sub-topic, the student should be able to: a) explain factors affecting rate of photosynthesis.	(i) The teacher to guide students to conduct experiment to investigate factors affecting the rate of photosynthesis. (ii) Students to summarize findings and present experimental reports.	Chart showing factors affecting the rate of photosynthesis.	Is the student able to explain the factors affecting the rate of photosynthesis?	2
5.2 Digestion in Mammals.	By the end of this sub-topic, the student should be able to: a) describe the structure of epithelial, tissues, glandular tissues and relate them to their digestive roles.	(i) Students in groups to observe models/ pictures /models of the mammalian gut and discuss the structure of epithelial tissues, glandular tissues and relate them to their digestive roles. (ii) The teacher to lead a plenary discussion on roles of different tissues in the digestive system of mammals.	<ul style="list-style-type: none"> • Microscope • Slides • Charts • Diagrams. 	Is the student able to describe the structure of epithelial tissues, glandular tissues and relate them to their digestive roles?	6

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) identify types and sources of digestive juices.	The teacher to guide students to discuss in groups the types and sources of digestive juices produced from different parts of the mammalian gut.	<ul style="list-style-type: none"> • Charts • Substrate • Digestive juices • Models • Pictures 	Is the student able to identify types and sources of digestive juices?	
	c) explain the composition of digestive juices.	Students in groups to discuss the composition of each type of digestive juices.	<ul style="list-style-type: none"> • Charts • Diagrams. 	Is the student able to explain the composition of digestive juices?	
	d) explain the sensory and/or hormonal control of the secretion of the digestive juices.	<p>(i) Using guiding questions students in groups to observe charts/diagrams showing sensory and hormonal control of the secretions of the digestive juices.</p> <p>(ii) The teacher to lead plenary discussion on the sensory and hormonal control of digestive juices secretion.</p>		Is the student able to explain the sensory and/or hormonal control of the secretion of the digestive juices?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
<p>6.0 GASEOUS EXCHANGE AND RESPIRATION</p> <p>6.1 Gaseous Exchange in Mammals.</p>	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) describe the internal structure of mammalian lung.</p> <p>b) explain the factors which govern efficient gaseous exchange at respiratory surface.</p> <p>c) outline the ways in which oxygen and carbon dioxide are transported in the body of vertebrates.</p>	<p>Students in groups to observe charts/pictures/diagrams/ photographs of internal structure of mammalian lung and discuss the roles of the alveoli.</p> <p>The teacher to lead plenary discussion on factors governing efficiency of gaseous exchange at the respiratory surface.</p> <p>Students in groups using guiding questions to observe charts/video/ diagrams and discuss ways in which oxygen and carbon dioxide are transported in the body of vertebrates.</p>	<ul style="list-style-type: none"> • Charts • Diagrams Pictures/ Video • Photographs of mammalian lungs. <ul style="list-style-type: none"> • Diagrams • Charts. 	<p>Is the student able to describe the internal structure of mammalian lung?</p> <p>Is the student able to explain factors which govern efficient gaseous exchange at respiratory surface?</p> <p>Is the student able to outline ways in which oxygen and carbon dioxide are transported in the body of vertebrates?</p>	4

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	d) describe the adaptation to oxygen up take shown by mountain climbers/dwellers, divers and mammalian foetus in their respective environment.	Students in groups to conduct a library search and discuss the adaptation to oxygen uptake (as shown by mountain climbers/dwellers, divers and the mammalian foetus in their respective environment.	<ul style="list-style-type: none"> • Photographs • Charts 	Is the student able to describe the adaptation to oxygen up take shown by mountain climbers/dwellers, divers and mammalian foetus in their respective environment?	
6.2 Gaseous exchange in Plants.	By the end of this sub-topic, the student should be able to: a) describe the internal structure of a leaf. b) explain the mechanism of gaseous exchange in plants.	The teacher to guide students in groups to discuss the internal structure of a leaf. (i) The teacher to guide students to conduct an experiment to investigate the presence of stomata on leaves. (ii) Students in groups to observe charts/diagrams and discuss the mechanism of gaseous exchange in plants.	<ul style="list-style-type: none"> • <i>Commelina sp.</i> • Microscope • Microscopic slides • Slides cover. 	Is the student able to describe the internal structure of a leaf? Is the student able to explain the mechanism of gaseous exchange in plants?	2

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
6.3 Respiration.	c) outline factors which contribute to efficient gaseous exchange in plants.	The teacher to guide students in groups to discuss factors which contribute to efficient gaseous exchange in plants.	<ul style="list-style-type: none"> • Knife /razor blade • Forceps 	Is the student able to outline factors which contribute to efficient gaseous exchange in plants?	
6.3.1 Concept of respiration.	By the end of this sub-topic, the student should be able to: a) explain the concept of respiration.	(i) Students to brainstorm on the concept of respiration. (ii) The teacher to lead plenary discussion on the concept of respiration.	<ul style="list-style-type: none"> • Charts • Diagrams. 	Is the student able to explain the concept of respiration?	6
6.3.2 Glycolysis.	By the end of this sub-topic, the student should be able to: a) describe types of respiratory substrates and their energy values. b) explain the process of glycolysis.	(i) Students to brainstorm on the respiratory substrate. (ii) The teacher to lead plenary discussion on types of respiratory substrates and their energy values. (i) Students in groups using guiding questions to discuss the meaning and main steps of glycolysis. (ii) Students to illustrate main steps of glycolysis.	<ul style="list-style-type: none"> • Charts • Diagrams • Video on glycolysis process. 	Is the student able to state types of respiratory substrates and their energy values? Is the student able to explain the process of glycolysis?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
6.3.3 Kreb's Cycle.	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) explain the concept of kreb's cycle.</p>	<p>The teacher to guide students in groups to discuss the concept of kreb's cycle.</p>	<ul style="list-style-type: none"> • Charts • Diagrams • Video on kreb's cycle process. 	<p>Is the student able to explain the concept of kreb's cycle?</p>	6
	<p>b) describe the fate of pyruvic acid under aerobic and anaerobic respiration.</p>	<p>(i) Students in groups to discuss the fate of pyruvic acid under aerobic and anaerobic respiration.</p> <p>(ii) The teacher to guide plenary discussion on fate of pyruvic acid under aerobic and anaerobic respiration.</p>		<p>Is the student able to describe the fate of pyruvic acid under aerobic and anaerobic respiration?</p>	
	<p>c) explain the events of the electron transport chain in the formation of ATP.</p>	<p>The teacher to guide students to observe a chart showing electron transport chain and discuss the formation of ATP.</p>	<ul style="list-style-type: none"> • Charts • Video clips 	<p>Is the student able to explain the events of the electron transport chain in the formation of ATP?</p>	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	<p>d) compute the total yield of ATP when glucose respired aerobically and anaerobically.</p>	<p>(i) Students in groups to observe chart showing electron transport chain and compute the total yield of ATP when glucose is respired aerobically and anaerobically.</p> <p>(ii) The teacher to lead plenary/discussion on total yield of ATP during aerobic and an aerobic respiration.</p>	<ul style="list-style-type: none"> • Charts • Video clips on the electron transport chain. 	<p>Is the student able to compute the total yield of ATP when glucose is respired aerobically and anaerobically?</p>	
	<p>e) outline the respiratory pathway using lipids and protein.</p>	<p>(i) Students to search information on respiratory pathway using lipids and protein substrates.</p> <p>(ii) The teacher to lead plenary discussion on respiratory pathway using lipid and protein.</p>		<p>Is the student able to outline the respiratory pathway using lipids and protein substrate?</p>	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
6.3.4 Basal Metabolic rate (BMR).	By the end of this sub-topic, the student should be able to: a) explain the meaning of BMR.	(i) The teacher to guide students to brainstorm on the meaning of basal metabolic rate. (ii) The teacher to lead plenary discussion on the meaning of basal metabolic rate.	<ul style="list-style-type: none"> Charts Diagrams on basal metabolic rate. 	Is the student able to explain the meaning of BMR?	2
	b) describe the factors which cause variation of the BMR of an individual.	Using guiding questions students to discuss factors which cause variation in Basal Metabolic Rate among organisms (individual).		Is the student able to describe the factors which cause variation of the BMR of an individual?	
7.0 REGULATION (HOMEOSTASIS)	By the end of this sub-topic, the student should be able to: a) explain the concept of (regulation) homeostasis.	The teacher to lead plenary discussion on the concept of homeostasis citing examples of their experiences (hot day and cold day).	<ul style="list-style-type: none"> Charts Graphs on homeostatic mechanism. 	Is the student able to explain the concept of regulation (homeostasis)?	2
7.1 Concept of Regulation.	b) identify components of homeostatic mechanism.	Students in groups to discuss with examples the major components of homeostatic mechanism.		Is the student able to identify components of homeostatic mechanism?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	c) explain the feedback mechanism of homeostatic control.	(i) The teacher to guide students in groups to discuss with examples the feedback mechanism of homeostatic control.		Is the student able to explain the feedback mechanism of homeostatic control?	
7.2 Temperature Regulation.	By the end of this sub-topic, the student should be able to: a) explain the concept of body temperature.	Students in groups to discuss the meaning and importance of body temperature.	<ul style="list-style-type: none"> • Charts • Models. 	Is the student able to explain the concept of body temperature?	3
	b) describe the mechanism of temperature regulation in endotherms.	(i) The teacher to lead plenary discussion on the mechanism of temperature regulation in endotherms. (ii) With reference to specific examples of endotherms students in groups to describe the mechanism of temperature regulation.	<ul style="list-style-type: none"> • Diagrams • Photographs showing response to changes in temperature. 	Is the student able to describe the mechanism of temperature regulation in endotherms?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	<p>c) explain the role of the hypothalamus in temperature regulation.</p>	<p>(i) Students in groups to discuss the role of hypothalamus in temperature regulation and give examples taken from daily life experiences. (ii) The teacher to lead a plenary discussion on the effects of overheating and overcooling of mammalian body.</p>		<p>Is the student able to explain the role of the hypothalamus in temperature regulation?</p>	
	<p>d) Explain adaption of mammals to cold and hot climatic conditions.</p>	<p>(i) Using guiding questions students to discuss on general features of mammals living in cold and hot climatic conditions. (ii) The teacher to lead plenary discussion on adaptation of mammals to cold and hot climatic conditions.</p>		<p>Is the student able to explain adaptation of mammals cold and hot climatic condition?</p>	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
7.3 Excretion	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) identify major excretory products in vertebrates.</p> <p>b) describe the structure of the mammalian nephron.</p> <p>c) outline the mechanism of formation and removal of urea in mammals.</p>	<p>Using questions and answers the teacher to guide students to identify excretory products and discuss their nature and source.</p> <p>(i) Students to search information from books/library/internet on structure and role of different parts of nephron.</p> <p>(ii) Student to discuss structure and roles of different parts of the mammalian nephron.</p> <p>(iii) Students to draw a well-labelled diagram of mammalian nephron.</p> <p>Students in groups to observe diagrams/charts/ models and discuss the formation and removal of urea in mammals.</p>	<ul style="list-style-type: none"> • Diagrams • Charts • Models • Photographs. <ul style="list-style-type: none"> • Charts • Model of a kidney • Diagrams • The internet. <ul style="list-style-type: none"> • Models • Photographs • Diagrams. 	<p>Is the student able to identify the major excretory products in vertebrates?</p> <p>Is the student able to describe the structure of the mammalian nephron?</p> <p>Is the student able to outline the mechanism of formation and removal of urea in mammals?</p>	4

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
7.4 Osmoregulation.	<p>d) explain the common disorders of the urinary system in humans.</p>	<p>(i) The teacher to invite a guest speaker (medical personnel) to talk on common disorders of the urinary system in human beings. (ii) The teacher to guide students to discuss on the effect and prevention of common disorders of urinary systems in human beings</p>	<ul style="list-style-type: none"> • Charts • Photographs • Resource person. 	<p>Is the student able to explain the common disorders of the urinary system in human beings?</p>	
	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) explain the mechanism of osmoregulation in marine elasmobranches.</p>	<p>Using guiding questions, students in groups to discuss the mechanism and importance of osmoregulation in marine elasmobranches.</p>	<ul style="list-style-type: none"> • Diagrams • Photographs • Charts showing the mechanism of osmoregulation in fish and mammals. 	<p>Is the student able to explain the mechanism of osmoregulation in marine elasmobranches</p>	4

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	<p>b) describe mechanism of osmoregulation in Mammals.</p>	<p>(i) Students to search information on the mechanisms of osmoregulation in mammals. (ii) The teacher to lead plenary discussion on mechanism of osmoregulation in Mammals.</p>		<p>Is the student able to describe mechanism of osmoregulation in Mammals?</p>	
	<p>c) describe the counter current multiplier system in the loop of Henle.</p>	<p>(i) The teacher to lead discussion on the meaning and role of counter current multiplier system in the loop of Henle. (ii) Students to describe the counter current multiplier system in the loop of Henle.</p>	<p>Charts showing the loop of Henle.</p>	<p>Is the student able to describe the role of counter current multiplier system in the loop of Henle?</p>	
	<p>d) describe hormonal control of osmoregulation.</p>	<p>The teacher to guide students through questions and answers to discuss hormonal control of osmoregulation.</p>		<p>Is the student able to describe hormonal control of osmoregulation?</p>	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	<p>e) outline various ways by which mammals are adapted to arid and semi- arid conditions.</p>	<p>(i) Students to brainstorm on environmental challenges facing mammals (focusing on arid and semi- arid conditions) and how mammals have been able to cope with.</p> <p>(ii) The teacher to lead plenary discussion on adaptations of mammals to arid conditions.</p>	<p>Pictures to show semi – arid and arid areas.</p>	<p>Is the student able to outline various ways by which mammals are adapted to arid and semi-arid conditions?</p>	

FORM SIX

Class Level Competences

By the end of Form Six the student should have the ability to:

- a) demonstrate skills on preparation and use of biological specimens for microscopic observations;
- b) use scientific procedures and practical skills in studying biology;
- c) demonstrate appropriate use of biological knowledge, concepts, principles and skills in relation to physiological, anatomical, ecological and evolutionary processes;
- d) perform simple breeding experiment with garden pea and fruit fly to show how characters are inherited;
- e) use Information and Computer Technology to access and generate biological information;
- f) use proper spoken and written English language in communicating biological information for example in writing projects;
- g) demonstrate an understanding of contemporary biological and health related issues;
- h) demonstrate appropriate use of genetic principles to improve animal and crop production.

Class Level Objectives

By the end of Form Six course the student should be able to:

- a) explore the relationship between mitosis and growth patterns in organisms;
- b) develop practical skills in studying growth processes, genetics, evolution and ecology;
- c) analyse the relationship between meiosis, the process of gamete formation and reproduction;
- d) explore the origin of life, evolution of new species and evidences which support organic evolution;
- e) appreciate the use of principles of genetics in improving animals and plant breeds.
- f) dissect plants (flowers, stems and roots), animals (cockroach, frog/toad and mice) and conduct biochemical tests;
- g) utilize various ICT facilities to search and generate biological information;
- h) apply appropriate biological skills in managing health related problems such as HIV/AIDS, reproduction and genetical disorders.

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
<p>1.0 TRANSPORTATION</p> <p>1.1 Transportation in plants.</p>	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) identify vascular tissues in plants.</p> <p>b) describe vascular tissues in plants and how they are adapted to their function.</p> <p>c) distinguish between passive and active transport in plants.</p>	<p>The teacher to guide students to observe the structures of Vascular/ conducting tissues using charts/diagram/picture/microscope slides.</p> <p>Using guiding questions, students to discuss in groups and present in a plenary session the adaptation of vascular tissues.</p> <p>(i) Students to brainstorm on the differences between passive and active transport.</p> <p>(ii) The teacher to lead plenary discussion on passive and active transport in plants.</p>	<ul style="list-style-type: none"> • Microscopes slides • Microscope • Charts • Diagrams showing vascular tissues. 	<p>Is the student able to identify vascular tissues in plants?</p> <p>Is the student able to describe vascular tissue in plants and how they are adapted to their function?</p> <p>Is the student able to distinguish between passive and active transport in plants?</p>	3

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
1.1.1 Movement of materials across the root.	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) describe paths of movement of water and mineral salts across the root (symplasmic, vacuolar and apoplasmic).</p> <p>b) explain the role of Casparian strip.</p>	<p>(i) The teacher to guide students to observe charts /diagrams/ showing movement of water and mineral salts across the root and discuss the movement of water and mineral salts across the root.</p> <p>(ii) Using guiding questions, students to describe the symplasmic, vacuolar and apoplasmic pathway.</p> <p>(i) Students to observe chart/diagram/picture and discuss the role of casparian strip</p> <p>(ii) Students to draw the casparian strip.</p>	<p>Diagram/charts showing movement of water and mineral salts across the root.</p> <p>• Charts • Picture • Diagram • Microscope • Microscope slides.</p>	<p>Is the student able to describe paths of movement of water and mineral salts across the root (symplasmic, vacuolar and apoplasmic?)</p> <p>Is the student able to explain the role of Casparian strip?</p>	3

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
1.1.2 Upward movement of water and mineral salts.	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) explain the path of upward transport of water and mineral salts.</p> <p>b) describe the forces governing the upward movement of water and mineral salts.</p>	<p>Students in groups using guiding questions to discuss the path of upward movement of water and mineral salts.</p> <p>(i) The teacher to guide students to perform an experiment on capillarity.</p> <p>(ii) The teacher to lead plenary discussion on forces governing upward movement of water and mineral salts (capillarity, root pressure and transpiration pull).</p>	<ul style="list-style-type: none"> • Beaker • Transparent plastic tube • Seedlings. 	<p>Is the student able to explain the path of upward transport of water and mineral salts?</p>	6
	<p>c) outline the mechanism of stomata opening and closing (basing on Osmotic pressure differences theory).</p>	<p>(i) The teacher to guide students to conduct an experiment of opening and closing of stomata.</p>	<ul style="list-style-type: none"> • Leaf e.g <i>Commelina</i> • Microscope slide • Slide cover • Charts showing opening and closing of stomata. 	<p>Is the student able to outline the mechanism of stomata opening and closing (basing on Osmotic pressure differences theory)?</p>	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		(ii) Students to discuss in groups the mechanism of closing and opening of stomata.			
	d) explain the effects of transpiration in plants.	(i) Students to brainstorm on the effects of transpiration in plants. (ii) The teacher to lead plenary discussion on the effects of transpiration in plants.	<ul style="list-style-type: none"> • Charts • Photographs • Diagrams showing the effect of transpiration in plants. 	Is the student able to explain the effects of transpiration in plants?	
	e) distinguish between transpiration and guttation.	The teacher to guide students to discuss in groups the differences between transpiration and guttation.		Is the student able to distinguish between transpiration and guttation?	
1.1.3 Translocation of Manufactured Food.	By the end of this sub-topic, the student should be able to: a) identify the path of manufactured food.	The teacher to guide students to observe chart/diagram and identify the path of manufactured food along phloem.	<ul style="list-style-type: none"> • Charts • Diagrams • Pictures. 	Is the student able to identify the path of manufactured food?	3

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) explain mechanism of transport of manufactured food materials.	(i) Students in groups to visualize charts/illustrations and discuss the transport of manufactured food in plants. (ii) The teacher to lead a plenary discussion on mechanism of transport of manufactured food in plants.	<ul style="list-style-type: none"> • Microscope • Slides • Plant tissues • Diagrams • Charts. 	Is the student able to explain the mechanism of transport of manufactured food in plants?	
1.2 Transport in Vertebrates.	By the end of this sub-topic, the student should be able to: a) describe the structure of cardiac muscles.	(i) Students to observe charts /diagram /pictures microscope slides of cardiac muscle and discuss their structures. (ii) The teacher to guide students to describe the adaptations of cardiac muscles to their functions.	<ul style="list-style-type: none"> • Charts • Picture • Diagram of cardiac muscles • Microscope slides • microscope. 	Is the student able to describe the structure of cardiac muscles as related to their function?	6

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	<p>b) distinguish between open and closed circulatory systems.</p>	<p>Students in groups to observe charts/diagram/microscope slides and discuss with examples, open and closed circulatory systems.</p>	<ul style="list-style-type: none"> • Diagram • Charts/Models showing open and closed circulatory systems. 	<p>Is the student able to distinguish between open and closed circulatory systems?</p>	
	<p>c) differentiate between single and double circulatory systems.</p>	<p>(i) Students visualize charts/diagram of single and double circulatory systems eg. fish, human and discuss their differences.</p>	<ul style="list-style-type: none"> • Diagrams • Models/Charts showing circulatory systems of fish and human. 	<p>Is the student able to differentiate between single and double circulatory systems?</p>	
	<p>d) explain the differences between foetal and adult blood circulation.</p>	<p>(i) Students to search information on foetal and adult blood circulation of mammals. (ii) The teacher to guide students to differentiate between foetal and adult blood circulation.</p>	<ul style="list-style-type: none"> • Charts • Diagrams • Models/charts showing foetal and adult blood circulation. 	<p>Is the student able to explain the differences between foetal and adult blood circulation?</p>	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
<p>2.0 GROWTH AND DEVELOPMENT</p> <p>2.1 Mitosis</p>	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) explain the events that take place during mitotic stages.</p>	<p>(i) The teacher to guide students to observe stages of mitosis in cells.</p> <p>(ii) Using guiding questions students in groups to observe chart/video/ diagrams and discuss the events that take place during mitotic stages.</p>	<ul style="list-style-type: none"> • Charts • Diagram • Video • Models • Fixed slides showing events taking place during mitotic stages. 	<p>Is the student able to explain the events that take place during mitotic stages?</p>	<p>3</p>
<p>b) illustrate stages of mitosis in plant and animal cells.</p>	<p>Students to illustrate stages of mitosis in plant and animals cells.</p>	<p>Is the student able to illustrate stages of mitosis in plant and animal cells?</p>	<p>Is the student able to describe various patterns of growth in plants and animals?</p>	<p>2</p>	
<p>2.2 Growth Patterns</p>	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) describe various patterns of growth in plants and animals.</p>	<p>(i) Students in groups to observe charts/diagrams and discuss various patterns of growth in plants and animals.</p> <p>(ii) The teacher to lead a plenary discussion on patterns of growth in plants and animals.</p>	<p>Charts/Diagrams showing various patterns of growth in plants and animals.</p>	<p>Is the student able to describe various patterns of growth in plants and animals?</p>	<p>2</p>

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) interpret various types of growth curves.	(i) Students in groups to plot and interpret various types of growth curves. (ii) The teacher to guide students to interpret growth curves.		Is the student able to interpret various types of growth curves?	
2.3 Growth and Development in Plants 2.3.1 Primary and secondary growth in Angiosperms.	By the end of this sub-topic, the student should be able to: a) explain the role of apical meristem in primary growth. b) describe the role of lateral meristem in secondary growth.	(i) The teacher to guide students to conduct a practical observation of apical meristematic tissue. (ii) Students in groups to observe diagram/pictures/video and discuss apical meristematic tissues and discuss its roles in primary growth. (i) Students in groups to conduct a practical observation of lateral meristematic tissues.	<ul style="list-style-type: none"> • Microscope • Prepared slides • Specimens of meristematic tissues • Diagrams • Real plants • Charts showing meristematic tissues. 	Is the student able to explain the role of apical meristem in primary growth? Is the student able to describe the role of lateral meristem in secondary growth?	4

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		(ii) Students in groups to discuss the lateral meristematic tissue and its roles in secondary growth.			
	c) explain the origin of lateral branches and lateral roots.	(i) The teacher to guide students to visit outside environment to observe real plants and discuss the origin of lateral branches and lateral roots.		Is the student able to explain the origin of lateral branches and lateral roots?	
2.3.2 Seed dormancy and viability.	By the end of this sub-topic, the student should be able to: a) explain the concept of seed dormancy and viability.	(i) Students to observe seeds and brainstorm the meaning of seed dormancy, viability and its significance. (ii) The teacher to lead plenary discussion on the concept of seed dormancy and viability.	Variety of seeds.	Is the student able to explain the concept of seed dormancy and viability?	3
	b) describe types and causes of seed dormancy.	Using guiding questions students in groups to discuss types and causes of seed dormancy.		Is the student able to describe the types of seed dormancy and their causes?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
3.0 REPRODUCTION 3.1 Meiosis.	c) suggest ways of overcoming seed dormancy.	Through questions and answers the teacher to guide students to discuss in a plenary session ways of overcoming seed dormancy.		Is the student able to suggest ways of overcoming seed dormancy?	
	d) propose factors that govern seed viability.	Students in groups to discuss and presents the factors which govern seed viability.		Is the student able to propose factors that govern seed viability?	
	By the end of this sub-topic, the student should be able to: a) account for the events which take place during meiosis.	(i) Students to observe charts/ diagrams/ microscopic slides showing stages of meiosis in plant and animal cells. (ii) Students in groups to discuss and present in plenary session the events that take place during meiosis in plant and animal cells.	<ul style="list-style-type: none"> • Charts • Diagrams • Microscopic slides showing stages of meiosis. 	Is the student able to account for the events which take place during meiosis stages?	4
	b) illustrate stages of meiosis in plants and animal cells.	Students to illustrate stages of meiosis in plants and animal cells.		Is the student able to illustrate stages of meiosis in plants and animal cells?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	c) explain the significance of meiosis in sexually reproducing organisms.	Students in groups to discuss significance of meiosis in sexually reproducing organisms.		Is the student able to give the significance of Meiosis in sexually reproducing organisms?	
	d) explain the similarities and differences between meiosis and mitosis.	(i) Students in groups to observe charts/ diagrams/ microscope slides showing stages of mitosis and meiosis. (ii) Using guiding questions students to compare and contrast meiosis and mitosis.	<ul style="list-style-type: none"> • Charts/ diagrams showing meiosis and mitosis • Microscopic slides on meiosis and mitosis • Microscope. 	Is the student able to explain the similarities and differences between meiosis and mitosis?	
	e) relate meiosis to gametogenesis in both plants and animals.	Using guiding questions students in groups to discuss how meiosis relates with gametogenesis in plants and animals.		Is the student able to relate meiosis to gametogenesis in plants and animals?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
<p>3.2 Reproduction in Plants</p> <p>3.2.1 Fertilization</p>	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) describe the events leading to fertilization.</p> <p>b) explain the concept of double fertilization.</p> <p>c) account for the changes which occur in the flower after fertilization.</p>	<p>Using guiding questions students in groups to discuss and present in plenary session the events leading to fertilization.</p> <p>The teacher to guide students to discuss in groups and presents in a plenary session the concept of double fertilization and its consequences.</p> <p>Students to observe charts/diagram/microscopes slides and discuss in groups the changes which lead to the formation of fruit.</p>	<ul style="list-style-type: none"> • Charts/ diagrams/ showing the process of fertilization • Microscope slides • Microscope. <p>Charts showing changes which occur after fertilization Microscopic slides microscope.</p>	<p>Is the student able to describe the events leading to fertilization?</p> <p>Is the student able to explain the concepts of double fertilization?</p> <p>Is the student able to account for the changes which occur in the flower after fertilization?</p>	3

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
3.2.2 Fruit and Seed Development	By the end of this sub topic, the student should be able to: a) explain the events which lead to the formation of endospermic and non-endo spermic seed.	The teacher to guide students to discuss and presents the formation of endospermic and non- endospermic seed.	Charts showing diagrams of endospermic and non-endospermic seeds.	Is the student able to explain the events which lead to the formation of endospermic and non-endospermic seed?	3
3.2.3 Life Cycles of Selected Plants	By the end of this sub-topic, the student should be able to: a) explain the concept of alternation of generation.	(i) Students in groups to brainstorm on the concept of alternation of generation. (ii) The teacher to lead plenary discussion on the concept of alternation of generation.	<ul style="list-style-type: none"> • Charts • Diagrams • Illustrations 	Is the student able to explain the concept of alternation of generation?	2
	b) describe the generalized life cycles of Bryophytes, Pteridophytes and angiosperms.	(i) Students in groups to visualize charts/diagram of generalized life cycles of Bryophytes, Pteridophytes and angiosperms.		Is the student able to describe the generalized life cycles of bryophytes, pteridophytes and angiosperms?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
3.3 Reproduction in Animals 3.3.1 Menstruation and Oestrus cycle		(ii) The teacher to lead plenary discussion on the generalized life cycle of bryophytes, pteridophytes and angiosperms.			
	By the end of this sub-topic, the student should be able to: a) explain the concept of menstruation and Oestrus cycle.	(i) Students to brain storm the meaning of menstruation and oestrus cycle. (ii) The teacher to lead plenary discussion on the meaning and importance of menstruation and oestrus cycle.	Charts showing menstruation and oestrus cycle.	Is the student able to explain the concept of menstruation and Oestrus cycle?	3
	b) illustrates the stages of menstrual and oestrus cycle. c) explain hormones controlling menstrual and oestrus cycles.	Students visualize charts/diagram/picture/models showing stages of menstrual and oestrus cycle and illustrate stages of menstrual and oestrus cycle. Students to use guiding questions in groups to discuss and present hormones controlling menstrual and oestrus cycle and its role.		Is the student able to illustrates the stages of menstrual and Oestrus cycle? Is the student able to explain hormones controlling menstrual and oestrus cycles?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
d) distinguish menstruation from Oestrus cycle.	Students in groups to discuss the differences between menstruation and oestrus cycle.	Charts / diagrams on oestrus and menstrual cycle.	Is the student able to distinguish between menstruation and Oestrus cycle?		
3.3.2 Fertilization and Zygote Development in Mammals.	By the end of this sub-topic, the student should be able to: a) explain the events which compromise the mechanism of fertilization.	(i) Students to brainstorm on the events which compromise mechanism of fertilization. (ii) The teacher to guide students to discuss in groups and present in plenary session on events which compromise mechanism of fertilization.	<ul style="list-style-type: none"> • Charts • Video • Microscope • Fixed microscope slides showing mechanism of fertilization. 	Is the student able to explain the events which compromise the mechanism of fertilization?	6
b) explain the importance of fertilization.	Using guiding questions students to discuss the importance of fertilization.			Is the student able to explain the importance of fertilization?	
c) describe the developmental changes which take place in a zygote up to gastrula stage.	(i) Students to observe charts/slides/video film/models showing developmental changes which take place in zygote up to gastrula.			Is the student able to describe the developmental changes which take place in a zygote up to gastrula stage?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		(ii) The teacher to lead students in groups to discuss and present in plenary session the developmental changes which take place from zygote to gastrula stage.			
d) explain the embryonic membranes and their roles.		(i) Students in groups to observe diagrams/charts/video film/microscopic slides and discuss the embryonic membrane and its role. (ii) The teacher to lead students to discuss in groups the embryonic membrane and its roles.	<ul style="list-style-type: none"> • Charts • Diagrams • Video • Microscope • Slides. 	Is the student able to explain the embryonic membranes and their roles?	
3.3.3 Birth.	By the end of this sub-topic, the student should be able to: a) account for the events that lead into birth.	(i) Students to brainstorm on events that lead into birth. (ii) The teacher to guide students to discuss and present in plenary session the events that lead into birth.	<ul style="list-style-type: none"> • Charts • Diagrams. 	Is the student able to account for the events that lead into birth?	2

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
3.3.4 Life Cycles of Selected Animals.	b) explain the causes of multiple births.	Students in groups to discuss and present in plenary the causes of multiple births.	<ul style="list-style-type: none"> • Charts • Diagrams. 	Is the student able to explain the causes of multiple births?	
	By the end of this sub-topic, the student should be able to: a) explain the concept of metamorphosis.	(i) Students to observe charts/ diagrams/preserved specimen showing metamorphosis. (ii) The teacher to guide students to discuss in groups the meaning and importance of metamorphosis.	<ul style="list-style-type: none"> • Charts • Diagrams. 	Is the student able to explain the concept of metamorphosis?	2
	b) distinguish between complete and incomplete metamorphosis.	Students to observe charts/ diagrams/preserved specimens of selected animals and discuss the differences between complete and incomplete metamorphosis.	Preserved specimens of selected animals.	Is the student able to distinguish between complete and incomplete metamorphosis?	
c) illustrate the life cycles of housefly, cockroach, toad/frog and mouse.	The teacher to guide students to illustrate the life cycle of housefly, toad/frog and mouse.	<ul style="list-style-type: none"> • Preserved specimens • Charts/diagrams showing life cycles of housefly, cockroaches, toad/ frog and mouse. 	Is the student able to illustrate the life cycle of housefly, cockroach, toad/frog and mouse?		

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
<p>4.0 GENETICS</p> <p>4.1 Hereditary Materials</p>	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) show that hereditary materials are located in the nucleus.</p>	<p>(i) Students in groups to observe charts/microscope slides/photographs of hereditary materials.</p> <p>(ii) The teacher to lead students to discuss and present in plenary the evidence that hereditary materials are located in the nucleus.</p>	<ul style="list-style-type: none"> • Charts • Models • Microscope slides • Photographs showing hereditary materials. 	<p>Is the student able to show that hereditary materials are located in the nucleus?</p>	3
	<p>b) describe properties of genetic materials.</p>	<p>Students using guiding questions to discuss in groups and present in plenary session the general properties of genetic materials.</p>	<ul style="list-style-type: none"> • Charts/models/ • Video showing genetic materials. • Models of DNA and RNA. 	<p>Is the student able to describe properties of genetic materials?</p>	
	<p>c) enumerate types of genetic materials.</p>	<p>(i) Students to brainstorm on the types of genetic materials.</p> <p>(ii) The teacher to lead a plenary discussion on types of genetic materials.</p>		<p>Is the student able to enumerate types of genetic materials?</p>	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	d) describe the chemical composition of genetic materials.	(i) Students to observe charts/ diagrams/ models of genetic materials. (ii) The teacher to lead students to discuss in group and present in plenary the chemical composition of genetic materials.		Is the student able to describe the chemical composition of genetic materials?	
4.1.1 RNA	By the end of this sub-topic, the student should be able to: a) identify types of RNA. b) describe structure of each type of RNA.	Students in groups to observe models/ pictures/ photograph of genetic materials and identify the types of Ribonucleic Acid (tRNA, rRNA and mRNA). (i) Students in groups to observe diagram/ model/ photographs of structures of tRNA, rRNA and mRNA. (ii) The teacher guide students to draw the structures of tRNA, rRNA and mRNA.	<ul style="list-style-type: none"> • Models • Picture/ video, • Photographs showing types of RNA. <ul style="list-style-type: none"> • Models • Diagram • Photographs showing types of RNA. 	Is the student able to identify types of RNA? Is the student able to describe structures of each type of RNA?	2

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
4.1.2 DNA	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) describe the structure of DNA molecule.</p> <p>b) explain the mechanism of DNA replication and its significance.</p> <p>c) explain the concept of genetic code.</p>	<p>(i) Students in groups to observe models/ pictures/ photograph of genetic materials and discuss the structure of DNA molecule.</p> <p>(ii) Students to draw structure of DNA molecule.</p> <p>(i) Students in groups to observe charts/ diagram/ photograph of DNA and discuss the mechanism of DNA replication.</p> <p>(ii) The teacher to lead students to discuss in groups the significance of DNA replication.</p> <p>The teacher to guide students to discuss in groups and present in plenary session the meaning and characteristics of genetic code.</p>	<ul style="list-style-type: none"> • Models • Diagram • Photograph showing DNA molecule. <ul style="list-style-type: none"> • Photograph/ video • Models of DNA. <ul style="list-style-type: none"> • Photograph • Models • Charts • Diagrams showing the structure of genetic code. 	<p>Is the student able to describe the structure of DNA molecule?</p> <p>Is the student able to explain the mechanism of DNA replication and its significance?</p> <p>Is the student able to explain the concept of genetic code?</p>	6

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
4.2 Mendelian Principle of Inheritance	<p>d) describe the process of protein synthesis.</p>	<p>(i) Students to observe charts/pictures/photographs showing the process of protein synthesis. (ii) The teacher to guide students to discuss in groups and present in plenary the stages of protein synthesis.</p>	<ul style="list-style-type: none"> • Charts • Pictures Photograph showing the process of protein synthesis. 	<p>Is the student able to describe the process of protein synthesis?</p>	
4.2 Mendelian Principle of Inheritance	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) explain factors which contributed to Mendel's success in his breeding experiments.</p>	<p>(i) Student in groups to search information on factors which contributed to Mendel's success in his breeding experiments. (ii) The teacher to lead students to present their findings in a plenary session.</p>	<p>Mature pea or bean plant.</p>	<p>Is the student able to explain factors which contributed to Mendel's success in his breeding experiments?</p>	10

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	<p>b) carry out monohybrid and dihybrid experiments to demonstrate Mendel's 1st and 2nd law of Inheritance.</p>	<p>(i) The teacher to guide students to carry out Mendel's' first and second laws of Inheritance. (ii) Students in groups to discuss Mendel's 1st and 2nd Law of Inheritance basing on observations made during the experiments.</p>	<ul style="list-style-type: none"> • Pea plants/ maize plant • Maize cob • Video showing experiments demonstrating Mendel's 1st and 2nd laws of inheritance. 	<p>Is the student able to carry out monohybrid and dihybrid experiments to demonstrate Mendel's 1st and 2nd law of Inheritance?</p>	
	<p>c) explain the concept of dominance and recessiveness.</p>	<p>(i) The teacher to organise a study visit to a Research centre/institute to observe expressed and suppressed characters among organisms. (ii) Students in groups to discuss the concepts of dominance and recessiveness.</p>		<p>Is the student able to explain the concept of dominance and recessiveness?</p>	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	d) Illustrate and interpret monohybrid and dihybrid crosses.	(i) Students in groups to discuss the meaning of monohybrid and dihybrid crosses. (ii) The teacher to guide students to illustrate and interpret monohybrid and dihybrid crosses.	<ul style="list-style-type: none"> • Charts • Diagrams which shows monohybrid and dihybrid crosses. 	Is the student able to illustrate and interpret monohybrid and dihybrid crosses?	
4.3 Non-Mendelian Inheritance.	By the end of this sub-topic, the student should be able to: a) explain the concept incomplete dominance and co-dominance.	(i) The teacher to organise a study visit for students to observe expressed and suppressed characters among organisms. (ii) The teacher to guide students to carry out plenary incomplete and co-dominance crosses. (iii) Students in groups to discuss the concept of incomplete dominance and co-dominance.	Video/ charts showing organisms expressing incomplete dominance and co-dominance characters.	Is the student able to explain the concept of incomplete dominance and co-dominance?	3

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) describe gene interactions.	(i) Students to brainstorm on the meaning of interactions. (ii) The teacher to lead plenary discussion on the meaning of interactions. (iii) Students to illustrate gene interaction crosses.	<ul style="list-style-type: none"> • Charts • Illustrations • Diagrams. 	Is the student able to describe gene interactions?	
	c) explain with examples multiple allele inheritance.	(i) Students in groups to observe illustrations and discuss multiple allele inheritance. (ii) The teacher to lead plenary discussion multiple allele inheritance.		Is the student able to explain with examples multiple allele inheritance?	
4.4 Mutation	By the end of this sub-topic, the student should be able to: a) explain the concept of mutation.	(i) Students to brainstorm the meaning of mutation. (ii) The teacher to lead a plenary discussion on the meaning of mutation.	<ul style="list-style-type: none"> • Charts/Video showing the effects of mutation in organisms • Diagrams/ video/ charts showing different types of mutation • Charts / videos showing the advantages and disadvantages of genetic engineering. 	Is the student able to explain the concept of mutation?	2

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) explain causes and effects of mutation.	The teacher to guide students to discuss in groups the causes and effects of mutation in organisms.		Is the student able to explain causes and effects of mutation?	
	c) account for different types of mutation.	(i) Students to brainstorm on the types of mutation. (ii) The teacher to lead plenary discussion on types of mutation.		Is the student able to account for different types of mutation?	
	d) explain the concept of genetic engineering.	The teacher to guide students to discuss in groups the concept of genetic engineering.		Is the student able to explain the concept of genetic engineering?	
	e) Explain merits and demerits of genetic engineering.	(i) Students to search information on the merits and demerits of genetic engineering. (ii) The teacher to lead a plenary discussion on the merits and demerits of genetic engineering.		Is the student able to explain the merits and demerits of genetic engineering?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
<p>5.0 EVOLUTION</p> <p>5.1 Theories of the Origin of Life.</p>	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) explain the origin of life.</p>	<p>(i) Students in groups to observe photographs/diagrams/video and discuss the origin of life as postulated, by theories of special creation, spontaneous generation, cosmozoic origin and naturalist theory and give examples.</p> <p>(ii) The teacher to lead a plenary discussion on origin of life</p>	<ul style="list-style-type: none"> • Photographs • Diagram • Films/video which show evolution of organisms. 	<p>Is the student able to explain the origin of life?</p>	<p>2</p>
<p>b) outline strengths and weaknesses of each theory of the origin of life.</p>	<p>Using guiding questions students in groups to discuss the strengths and weaknesses of each theory of the origin of life.</p>	<p>The teacher to explain to students the mechanism of organic evolution according to Lamarckism, Darwinism and Neo-Darwinism theories and give examples of Darwin and Lamarck theories.</p>	<ul style="list-style-type: none"> • Photographs • Diagram • Films/video which show the process of evolution. 	<p>Is the student able to outline the strengths and weaknesses of each theory of origin of life?</p>	<p>4</p>
<p>5.2 Theories of Organic Evolution.</p>	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) explain the mechanism of organic evolution.</p>	<p>Is the student able to explain the mechanism of organic evolution according to: Lamarckism Darwinism Neo-Darwinism?</p>	<p>Is the student able to explain the mechanism of organic evolution according to: Lamarckism Darwinism Neo-Darwinism?</p>	<p>Is the student able to explain the mechanism of organic evolution according to: Lamarckism Darwinism Neo-Darwinism?</p>	<p>4</p>

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
<p>b) give strengths and weaknesses of each theory of organic evolution.</p>	<p>The teacher to guide students to discuss in groups and present in plenary the strengths and weaknesses of each theory of organic evolution.</p>			<p>Is the student able to give strengths and weaknesses of each theory of organic evolution?</p>	
<p>5.3 Evidence for Evolution.</p> <p>5.3.1 Palaeontology.</p>	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) identify types of fossils.</p> <p>b) explain how fossil records support organic evolution.</p>	<p>(i) Students in groups to observe pictures/charts of fossils and identify their types.</p> <p>(ii) The teacher to lead a plenary discussion on types of fossils.</p> <p>(i) The teacher to guide students to visit a museum of natural history to observe different types of fossils.</p> <p>(ii) Students using guiding questions to discuss how fossils records support the theory of organic evolution.</p>	<ul style="list-style-type: none"> • Pictures • Diagrams • Photographs of fossils Museums of natural history. 	<p>Is the student able to identify types of fossils?</p> <p>Is the student able to explain how fossil records support the theory of organic evolution?</p>	<p>2</p>

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
5.3.2 Comparative Morphology and Anatomy.	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) explain the concept of analogous, homologous and vestigial organs as applied to vertebrates and angiosperms.</p> <p>b) justify how homologous, analogous and vestigial organs support evolution.</p>	<p>(i) The teacher to guide students to conduct a practical observation of homologous, analogous and vestigial organs in vertebrates and angiosperm (prothalia cell of pinus, pollen grain, figworts, scrofilan flower stamens).</p> <p>(ii) Students to discuss in groups the meaning and significance of analogous, homologous and vestigial organs.</p> <p>(i) Students in small groups to observe displayed charts / diagrams and discuss how homologous, analogous and vestigial organs support evolution.</p>	<ul style="list-style-type: none"> • Models • Diagrams • Chart Showing analogous, homologous and vestigial organs in vertebrates and angiosperms. 	<p>Is the student able to explain with examples the concept of analogous, homologous and vestigial organs as applied to vertebrates and angiosperms?</p> <p>Is the student able to justify how homologous, analogous and vestigial organs support evolution?</p>	3

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		(ii) The teacher to lead a class discussion and summarize main points on how homologous, analogous and vestigial organs support evolution.			
	c) distinguish between divergent and convergent evolution.	Students in groups to visualize pictures and discuss the differences between divergent and convergent evolution.		Is the student able to distinguish between divergent and convergent evolution?	
5.3.3 Comparative Biochemistry	By the end of this sub-topic, the student should be able to: a) enumerate chemical substances which occurs in chlorophyll and haemoglobin.	Using questions and answers the teacher to guide students to observe charts/ diagrams and discuss the chemical substances which occur in chlorophyll and haemoglobin.	<ul style="list-style-type: none"> • Charts • Diagrams showing chlorophyll/ haemoglobin. 	Is the student able to enumerate chemical substances which occur in chlorophyll and haemoglobin?	2

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	<p>b) describe physiological processes of common occurrence among groups of organisms.</p>	<p>Using questions and answers the teacher to guide students to discuss the physiological processes of common occurrence among groups of organisms.</p>	<ul style="list-style-type: none"> • Charts • Diagrams. 	<p>Is the student able to describe physiological processes of common occurrence among groups of organisms?</p>	
	<p>c) explain how the similarity of chemical constituents and physiological processes among groups of organisms support organic evolution.</p>	<p>Using guiding questions students in groups to observe charts/diagrams and discuss how the chemical constituents and physiological processes support organic evolution.</p>		<p>Is the student able to explain how the chemical constituents and physiological processes among groups of organisms support organic evolution?</p>	
<p>5.3.4 Biogeography.</p>	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) describe the concept of biogeography.</p>	<p>(i) Student to brainstorm the meaning and importance of biogeography (ii) The teacher to lead plenary discussion on the concept of biogeography.</p>	<ul style="list-style-type: none"> • Diagrams • Chart • Maps. 	<p>Is the student able to describe the concept of biogeography?</p>	<p>1</p>

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
5.3.5 Selective Breeding	<p>b) explain how the occurrence and distribution of organisms in oceanic islands and continents support organic evolution.</p> <p>By the end of this sub-topic, the student should be able to:</p> <p>a) explain the concept of selective breeding.</p>	<p>Students in groups to observe diagrams and maps and discuss how occurrence and distribution of organisms in oceanic islands and continents support organic evolution.</p> <p>(i) The teacher to guide students to brainstorm on the meaning and importance of selective breeding in organisms and give examples.</p> <p>(ii) The teacher to lead a plenary session on the meaning and importance of selective breeding.</p>	<ul style="list-style-type: none"> • Diagrams • Charts • Maps. 	<p>Is the student able to explain how the occurrence and distribution of organisms in oceanic island and continents support organic evolution?</p>	1
	<p>b) describe selective breeding as evidence for organic evolution.</p>	<p>The teacher to guide students to observe diagrams and discuss in groups the selective breeding as evidence for organic evolution.</p>	<ul style="list-style-type: none"> • Diagrams • charts showing selective breeding. 	<p>Is the student able to describe the concept of selective breeding?</p>	
				<p>Is the student able to describe selective breeding as evidence for organic evolution?</p>	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
5.4 Speciation.	By the end of this sub-topic, the student should be able to: a) explain the concept of speciation.	(i) Students in groups to observe pictures/video and discuss the meaning and importance of speciation. (ii) The teacher to lead a class discussion on concept of speciation.	<ul style="list-style-type: none"> • Illustrations • Diagrams • Video • Charts showing mechanisms of speciation. 	Is the student able to explain the concept of speciation?	2
	b) describe types of speciation.	The teacher to guide students to discuss in groups types of speciation.		Is the student able to describe types of speciation?	
	c) explain the mechanisms that brings about speciation.	(i) Students using guided questions to discuss the mechanisms of speciation. (ii) The teacher to lead plenary discussion on mechanisms of speciation.		Is the student able to explain the mechanisms that brings about speciation?	
6.0 ECOLOGY 6.1 Concept of Ecology	By the end of this sub-topic, the student should be able to: a) explain the concept of ecology.	(i) The teacher to guide students through questions/ answers to discuss the concept of ecology using daily life experiences and examples.	<ul style="list-style-type: none"> • Charts • Diagrams. 	Is the student able to explain the concept of ecology?	1

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		(ii) The teacher to lead a plenary discussion on the meaning and importance of ecology.			
6.2 Ecosystem.	By the end of this sub-topic, the student should be able to: a) explain the concept of ecosystem.	(i) Students to brainstorm on the meaning of ecosystem. (ii) The teacher to lead a plenary discussion on the meaning and importance of ecosystem.	<ul style="list-style-type: none"> • Charts/ video showing ecosystem. • Charts/ photographs/ video showing energy flow, nutrient circulation and ecological niche. 	Is the student able to explain the concept of ecosystem?	4
	b) identify components of ecosystem and how they interact.	The teacher to guide students to list components of ecosystems and show how they interact with each other.		Is the student able to identify components of ecosystem and how they interact?	
	c) explain the concept of energy flow, nutrient circulation and ecological niche.	(i) Students to carry out library search on energy flow, nutrient circulation and ecological niche. (ii) The teacher to guide students to discuss the meaning and importance of energy flow, nutrient circulation and ecological niche.		Is the student able to explain the concept of energy flow, nutrient circulation and ecological niche?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	<p>d) outline the relationship of trophic levels in terms of energy flow.</p> <p>e) interpret ecological pyramids and their limitation.</p>	<p>Students in groups to illustrate the relationship of trophic levels in relation to energy flow and give examples.</p> <p>(i) Students to discuss the meaning of ecological pyramids and their limitations. (ii) The teacher to guide students to interpret ecological pyramids.</p>	<ul style="list-style-type: none"> • Chart • Maps • Video showing trophic levels. 	<p>Is the student able to outline the relationship of trophic levels in terms of energy flow?</p>	
6.3 Methods of Studying Ecology	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) explain the concept of sampling.</p>	<p>(i) Using guided questions students to explore the meaning and need for sampling. (ii) The teacher to lead plenary discussion on the meaning and importance of sampling.</p>	<p>Charts/ video showing different methods of sampling.</p>	<p>Is the student able to explain the concept of sampling?</p>	5

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	<p>b) describe systematic, random and stratified sampling.</p>	<p>(i) The teacher to lead a plenary discussion on different methods of sampling as well as their advantages and disadvantages. (ii) Students to discuss in groups the advantages and disadvantages of the sampling methods.</p>		<p>Is the student able to describe systematic, random and stratified sampling?</p>	
	<p>c) explain the use of transects and quadrants in sampling flora and fauna.</p>	<p>(i) Students to carry out library search on the use of quadrants and transects in sampling. (ii) The teacher to guide students to conduct a practical exercise on sampling of plants/animals (iii) Students in groups to summarize main ideas on the use of transects and quadrants.</p>	<ul style="list-style-type: none"> • Sampling equipments; tape measures, quadrants, notebooks, pencil. • Areas of natural vegetation/wild animal population. 	<p>Is the student able to explain the use of transects and quadrants in sampling flora and fauna?</p>	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
d) collect and analyze ecological data.	(i) The teacher to demonstrate the analysis of ecological data (frequency, density, abundance). (ii) Students to collect and analyse data collected during sampling exercise (density, frequency, abundance).	<ul style="list-style-type: none"> • Calculators • Notebooks • Computer 	Is the student able to collect and analyze ecological data?		
6.4 Population Dynamics	<p>By the end of this sub-topic, the student should be able to:</p> <p>a) explain the concept of population as an ecological unit.</p> <p>b) describe types of communities (biomes) and their global distribution.</p>	<p>(i) The teacher to guide students in groups to brainstorm the meaning of population.</p> <p>(ii) The teacher to lead a plenary discussion on the meaning of population as an ecological unit.</p> <p>(i) Students to search information from various sources on major biomes of the world and their distribution.</p>	Is the student able to explain the concept of population as an ecological unit?	Is the student able to describe types of communities (Biomes) and their global distribution?	10

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		(ii) The teacher to lead a plenary discussion on biomes and their global distribution.			
	c) outline for factors affecting population growth and distribution.	(i) Students in groups to discuss factors affecting population growth and distribution. (ii) Students to present their group tasks and participate in plenary discussion.	<ul style="list-style-type: none"> Charts/diagrams on population growth and distribution. 	Is the student able to outline factors affecting population growth and distribution?	
	d) interpret different patterns of population growth.	The teacher to guide students in groups to discuss and interpret different growth patterns and their interpretation.	<ul style="list-style-type: none"> Charts/ diagrams showing different types of growth curves. 	Is the student able to interpret different patterns of population growth?	
	e) explain the concept of population explosions and their consequences.	(i) Using guiding questions students to search library for information on meaning and consequences of population explosions. (ii) The teacher to lead a class discussion on consequences of population explosions.	Video/ Charts showing population exploitation and their consequences.	Is the student able to explain the concept of population explosions and their consequences?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	f) explain the concept and process of ecological succession.	(i) Using guiding questions, students to visit areas where natural succession (at different stages) is evident. (ii) The teacher to lead class discussion on features observed in the field.	Field visit to areas undergoing ecological succession (eg abandoned fields at different age).	Is the student able to explain the concept and process of ecological succession?	