M I N I S T R Y O F E D U C A T I O N

Republic of Ghana

TEACHING SYLLABUS FOR APPLIED ELECTRICITY
(SENIOR HIGH SCHOOL 1 - 3)

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RATIONALE FOR TEACHING APPLIED ELECTRICITY

To meet the industrial and environmental demands posed by rapid technological advances in the country and in the world at large, it is important to create a large corps of students with interest in Applied Electricity since they will become the engineers and technicians who will form one of the main pillars of the industrial transformation of the country.

This body of students need to be educated and given practical training in the application of electrical and electronic engineering principles to the maintenance of equipment and the creation of innovative solutions to electrical and electronic problems facing the country now and in the future.

Applied Electricity provides students with broad understanding of the technology of the manufacture, installation, maintenance and repairs of domestic and industrial equipment using electrical and test apparatus correctly and safely. It is expected that more students will enrol in this course to enable the country to develop the envisaged large corps of electrical and electronic engineers for the country's growing industries.

The course offers enough knowledge and skills for students who would want to get into Electrical/Electronics vocations after completing Senior High School. The course also offers valuable foundation for higher professional studies at the tertiary level of education.

GENERAL AIMS

This syllabus is designed to help students to:

a. acquire knowledge and understanding of the basic concepts and principles of electricity.
b. acquire skills in maintenance and repair of electrical and electronic equipment and installations
c. apply practical skills in the judicious use of tools, equipment and materials.
d. acquire problem solving skills through use of design process.
e. observe safe working procedures and safety precautions.
f. apply moral principles in work situations in the field of Applied Electricity.

SCOPE OF CONTENT

The course provides adequate knowledge and skills for students to get into Electrical/Electronics vocations after completing Senior High School. The foundation provided in this course is also enough for advanced studies in tertiary institutions.The course covers the following topics:

1. Health, Safety and Protection
2. Introduction to Electricity
3. Direct Current Circuit Theory
4. Electric Field
5. Magnetic Field
6. Electromagnetism

7. Measurement and Instruments
8. Emission of Electrons and Thermionic Devices
9. Alternating Current Circuit Theory
10. Transformers
11. Semi-conductor Devices
12. Power Supply
13. Bipolar/Unipolar Transistor and Other Semi-conductor Devices
14. Amplifier
15. Electrical Energy Supply
16. Digital Electronics
17. Communication
18. Alternating Current Machines
19. Direct Current Machines
20. Electrical Wiring

PRE-REQUISITE SKILLS AND ALLIED SUBJECTS

Students offering Applied Electricity must be proficient in English, Mathematics and particularly in Physics.

ORGANIZATION OF THE SYLLABUS

The syllabus has been structured to cover three years of the Senior High School Programme, SHS 1 - 3. Each year's work consists of a number of sections with each section comprising a number of units. The syllabus contents and sequence are presented in the next two pages.

STRUCTURE AND ORGANISATION OF THE SYLLABUS

SHS 1	SHS 2	SHS 3
APPLIED ELECTRICITY	**APPLIED ELECTRICITY**	**APPLIED ELECTRICITY**
SECTION 1: HEALTH, SAFETY AND PROTECTION (Pg. 1) Unit 1 Protective devices Unit 2 General safety Unit 3 Fire safety **SECTION 2: INTRODUCTION TO ELECTRICITY (Pg. 2)** Unit 1 Electronics and Electricity Unit 2 Nature of Electricity **SECTION 3: DIRECT CURRENT CIRCUIT THEORY (Pg. 4)** Unit 1 Resistors Unit 2 Insulators and Conductors Unit 3 Resistivity of a conductor Unit 4 Power and Energy **SECTION 4: MAGNETIC FIELD (Pg.7)** Unit 1 Fundamentals of magnetism Unit 2 B/H curve and Hysteresis loop **SECTION 5: ELECTRIC FIELD (Pg. 8)** Unit 1 Concept of electric field Unit 2 Capacitors **SECTION 6: ELECTROMAGNETISM (Pg. 10)** Unit 1 Electromagnetic field Unit 2 Induced emf Unit 3 Self and Mutual Induction	**SECTION 1: ALTERNATING CURRENT CIRCUIT THEORY (Pg. 12)** Unit 1 Generators Unit 2 R.L.C. Circuit Unit 3 Power in A.C. Circuits Unit 4 Star/Delta Connections **SECTION 2: TRANSFORMERS (Pg. 15)** Unit 1 Construction of Transformers Unit 2 Principles of operation of transformers Unit 3 Losses and temperature rise in transformers Unit 4 Efficiency of transformers Unit 5 Cooling of transformers Unit 6 Voltage Regulation **SECTION 3: SEMICONDUCTOR DIODES (Pg.18)** Unit 1 Semiconductor Theory Unit 2 Diodes **SECTION 4: POWER SUPPLY (Pg.20)** Unit 1 Power supply unit Unit 2 Rectification Unit 3 Voltage regulation and Stabilization Unit 4 Inverter **SECTION 5: BIPOLAR/ UNIPOLAR TRANSISTOR AND OTHER SEMICONDUCTOR DEVICES (Pg. 22)** Unit 1 Bipolar Transistor Unit 2 Unipolar Transistor Unit 3 Other semiconductor devices Unit 4 Integrated circuits **SECTION 6: AMPLIFIERS (Pg. 25)** Unit 1 Voltage Amplifiers Unit 2 Power Amplifiers Unit 3 Operational Amplifiers	**SECTION 1: DIGITAL ELECTRONICS(Pg. 31)** Unit 1 Binary numbers Unit 2 Logic gates **SECTION 2: COMMUNICATION (Pg. 33)** Unit 1 Electromagnetic waves Unit 2 Modulation **SECTION 3: ELECTRICAL ENERGY SUPPLY (Pg. 34)** Unit 1 Generating Station **SECTION 4: ALTERNATING CURRENT MACHINES (Pg. 35)** Unit 1 Alternators Unit 2 A.C. Motors **SECTION 5: DIRECT CURRENT MACHINES (Pg. 37)** Unit 1 D.C. Generators Unit 2 D.C. Motors **SECTION 6: ELECTRICAL WIRING (Pg. 39)** Unit 1 Wiring Unit 2 Protection Unit 3 Earthling

SHS 1	SHS 2	SHS 3
APPLIED ELECTRICITY	**APPLIED ELECTRICITY**	**APPLIED ELECTRICITY**
	SECTION 7: MEASUREMENTS AND INSTRUMENTS (Pg. 27) Unit 1 Moving coil instrument Unit 2 Moving iron instrument Unit 3 Digital Multimeter Unit 4 Cathode Ray Oscilloscope **SECTION 8: EMISSION OF ELECTRONS AND THERMIONIC DEVICES (Pg. 29)** Unit 1 Electron emission Unit 2 Thermionic Devices Unit 3 Cathode Ray-Tube (CRT)	

TIME ALLOCATION

Time allocation for APPLIED ELECTRICITY is as follows (each period is 40 minutes).

Year	No. of periods per week	No. of teaching weeks/year	Total periods in a year	Total hours in a year
1	6	36	216	144
2	6	36	216	144
3	6	24	144	96
Total	18	96	576	384

SUGGESTIONS FOR TEACHING THE SYLLABUS

Practical activity is strongly emphasized in order that students would be able to see, handle and use the materials, processes and equipment used in the electrical/electronic industry. Most of the teaching should take place in an adequately equipped workshop or laboratory, and should take the form of practical and experimental work requiring active student participation rather than passive observation.

Materials, Equipment and Recommended Books: Lists of materials and equipment for teaching electricity are provided at the end of the syllabus. Also provided is a list of reference books.

General objectives

General Objectives have been listed at the beginning of each section of the syllabus. The general objectives specify the skills and behaviours the student should acquire after learning the units of a section. Read the general objectives very carefully before you start teaching the section. After teaching all the units of the section, go back and read the general objectives again to be sure you have covered the objectives adequately in the course of your teaching.

Sections and Units

The syllabus has been planned on the basis of section and units. Each year's work has been divided into sections. A section consists of a fairy homogeneous body of knowledge within the subject. Within each section are Units. A unit consists of a more related body of knowledge and skills. The teacher is expected to consider the total number of sections and associated number of units prescribed for the year and plan the lessons for each term such that the work in all the Sections and Units for each particular class will be adequately completed by the end of the school year. Each section of the syllabus is structured in five columns. They are as follows:

- Units
- Specific Objectives
- Content
- Teaching and Learning Activities
- Evaluation

A description of the contents of each column is as follows:

COLUMN 1 - UNITS

The Units in Column 1 are divisions of the major topics of the section. You are expected to follow the unit topics according to the linear order in which they have been presented. However, if you find out at some point that teaching and learning in your class will be more effective if you branched to another unit before coming back to the unit in the sequence, you are encouraged to do so.

COLUMN 2 - SPECIFIC OBJECTIVES

Column 2 shows the specific objectives for each Unit. The specific objectives begin with numbers such as 1.3.5 or 2.2.1. These numbers are referred to as "Syllabus Reference Numbers." The first digit in the syllabus reference number refers to the section; the 2nd digit refers to the unit, while the 3rd digit refers to the rank order of the specific objective. For instance, 1.3.5 means: Section 1 (of the appropriate year's syllabus). Unit 3 (of Section 1) and Specific Objective 5 of Unit 3 of Section 1.

COLUMN 3 - THE CONTENT

The 3rd column of the syllabus presents a selected body of information that you will need to use in teaching the particular Unit. In some cases, the content presented is quite exhaustive; in others, the content is skeletal for you to add more details.

COLUMN 4 - TEACHING AND LEARNING ACTIVITIES (T/LA)

Teaching and Learning Activities that will ensure maximum student participation in the lessons are presented in Column 4. Avoid rote learning and drill-oriented methods and rather emphasize participatory teaching and learning in your lessons. Emphasize the cognitive, affective and psychomotor domains of knowledge in your instructional system wherever appropriate. You are encouraged to re-order the suggested teaching and learning activities and also add to them where necessary in order to achieve optimum student learning.

COLUMN 5 - EVALUATION

Suggestions and exercises for evaluating the lessons of each unit are indicated in Column 5. Evaluation exercises can be in the form of oral questions, quizzes, assignments, homework, project work, etc. Ask questions and set tasks and assignments, etc. that will challenge students to apply their knowledge to issues and problems as we have already said above and that will engage them in developing solutions and developing positive attitudes towards the subject.

PROFILE DIMENSIONS

Profile dimensions describe the underlying behaviours or abilities students are expected to acquire as a result of having gone through a period of instruction. Each of the specific objectives in this syllabus contains an action verb that specifies the type of learning or skill that the student should acquire by the end of the instructional period. A specific objective as follows: The student will be able to describe …etc. contains an action verb "describe" that indicates what the student will be able to do after teaching and learning have taken place. Being able to "describe" something after the instruction has been completed means that the student has acquired "knowledge". Being able to explain, summarise, give examples, etc. means that the student has understood the lesson taught. Similarly, being able to develop, plan, construct etc, means that the student has learnt to create, innovate or synthesize knowledge. Each of the action verbs in the specific objectives of the syllabus describes the behaviour the student will be able to demonstrate after the instruction. "Knowledge", "Application", etc. are dimensions that should be the prime focus of teaching, learning and assessment in schools.

Applied Electricity is a practical subject and the learning required is best achieved by practical application of skills learnt. The profile dimensions required in this subject and their respective weights are as follows:

Knowledge and Understanding	20%
Application of Knowledge	30%
Attitudes and Practical Skills	50%

The weights show the relative emphasis that the teacher should give in the teaching, learning and testing processes. Combining the three dimensions in the teaching and learning process will ensure that Applied Electricity is taught and studied not only at the cognitive level, but will also lead to the acquisition of practical skills in the subject.
The explanation of the key words involved in each of the profile dimensions is as follows:

Knowledge and Understanding (KU)

Knowledge	The ability to: remember, recall, identify, define, describe, list, name, match, state principles, facts and concepts. Knowledge is simply the ability to remember or recall material already learned and constitutes the lowest level of learning.
Understanding	The ability to: explain, summarize, translate, rewrite, paraphrase, give examples, generalize, estimate or predict consequences based upon a trend. Understanding is generally the ability to grasp the meaning of some material that may be verbal, pictorial, or symbolic.

Application of Knowledge (AK)

Ability to use knowledge or apply knowledge, as implied in this syllabus, has a number of learning/behaviour levels. These levels include application, analysis, innovation or creativity, and evaluation. These may be considered and taught separately, paying attention to reflect each of them equally in your teaching. The dimension "Use of Knowledge" is a summary dimension for all four learning levels. Details of each of the four sub-levels are as follows:

Application	The ability to: apply rules, methods, principles, theories, etc. to concrete situations that are new and unfamiliar. It also involves the ability to produce, solve, operate, demonstrate, discover etc.
Analysis	The ability to: break down materials into their component parts; to differentiate, compare, distinguish, outline, separate, identify significant points etc, recognize unstated assumptions and logical facilities, recognize inferences from facts etc.
Innovation/Creativity	The ability to synthesize or put parts together to form a new whole. It involves the ability to combine, compile, compose, devise, suggest a new idea or possible ways, plan, revise, design, organize, create, and generate new solutions. The ability to create or innovate is the highest form of learning. The world becomes more comfortable because some people, based on their learning, produce new ideas and new ways, design and create new things.
Evaluation	The ability to: appraise, compare features of different things and make comments or judgments, contrast, criticize, justify, support, discuss, conclude, make recommendations etc. Evaluation refers to the ability to judge the worth or value of some materials, ideas etc., based on some criteria. Evaluation is a constant decision making activity. We generally compare, appraise and select throughout the day. Every decision we make involves evaluation. Evaluation is a high level ability just as application, analysis and innovation or creativity since it goes beyond simple knowledge acquisition and understanding.

Practical Skills (PS)

Practical skills involve pre-imaging to solve practical problems, demonstration of manipulative skills, using tools/equipment and materials to carry out practical operations. The teaching and assessment of practical skills should involve projects and creative practical tasks.

"Practical Skills" is given 50 per cent of the teaching, learning and testing time to emphasize the point that Applied Electricity involves acquisition of practical skills at the SHS level. The remaining 50 per cent can be allocated to the theoretical aspect involving acquisition of knowledge and understanding.

Skills required for effective practical work are the following:

1. Handling Tools/Equipment/Materials
2. Observation
3. Perception
4. Creativity
5. Communication

Tools/Equipment/Material Handling: Students should be able to handle and use tools/equipment/materials properly for practical work to acquire the needed manipulative skills.

Observation: The student should be able to use his/her senses to make accurate observation of skills and techniques during demonstrations. The student in this case should be able to imitate the techniques he/she has observed for performing other tasks.

Perception: The student should be able to respond to his/her environment using all the senses i.e. seeing, hearing, smelling, touching and tasting. The student should be encouraged to apply these senses to every project he/she undertakes.

Originality/Creativity: Students should be encouraged to be creative or original and be able to use new methods in carrying out projects. Encourage them to be original in the creation of solutions in Applied Electricity and not copy existing work. You can help them to be creative and original by encouraging any little creative effort, technique and product they may develop.

Communication: Students should be guided to develop effective oral and written communication skills necessary for group work, reporting and appreciation etc.

The action verbs provided under the various profile dimensions should help you to structure your teaching such as to achieve the set objectives. Select from the action verbs provided for your teaching, in evaluating learning before, during and after the instruction.

FORM OF ASSESSMENT

It is important that both instruction and assessment be based on the profile dimensions of the subject. In developing assessment procedures, select specific objectives in such a way that you will be able to assess a representative sample of the syllabus objectives. Each specific objective in the syllabus is considered a criterion to be achieved by the students. When you develop a test that consists of items based on a representative sample of the specific objectives taught, the test is referred to as a "Criterion-

Referenced Test." In many cases, a teacher cannot test all the objectives taught in a term or in a year, The assessment procedure used i.e. class tests, homework, projects and examinations must be developed in such a way that it will consist of a sample of the important objectives taught over a period. The example on the next page shows the recommended examination structure for Applied Electricity.

END OF TERM EXAMINATION

The chart on the next page shows the mode of assessment and weighting to be followed by teachers at the end of every term. There will be two papers in the examination: PAPER 1 (Theory) and PAPER 2 (Practical).

Section A of Paper 1 is an objective type (section) testing knowledge and understanding of Applied Electricity. Section B consists of structured questions testing application of knowledge. Paper 2 test practical skills in Applied Electricity.

END OF TERM EXAMINATION CHART

DIMENSION	PAPER 1 (THEORY)		PAPER 2 (PRACTICALS)	TOTAL MARKS	% WEIGHTING
	A (MC)	B (Structured Quest.)			
Knowledge and Understanding	50	-	-	50	20
Application of Knowledge	-	50	-	50	30
Attitudes and Practical Skills	-	-	100	100	50
Total Marks	50	50	100	200	
% Contribution of Exams Papers	40	60	100	-	100

The structure of the examination in the chart follows the structure in the WAEC examination presented as follows:

PAPER 1 (THEORY): This consists of two (2) Sections A and B.

SECTION A - Consists of fifty (50) multiple choice/objective questions from the syllabus to be answered in one (1) hour for fifty (50) marks.

SECTION B - Consists of ten (10) short answer questions drawn from the syllabus. Candidates will be required to respond to five (5) questions in one (1) hour for a total of fifty (50) marks.

PAPER 2 (PRACTICALS): This consists of two practical experiments to be carried out in three (3) hours for a total of 100 marks.

GUIDELINES FOR SCHOOL-BASED ASSESSMENT (SBA)

A new School Based Assessment system (SBA) will be introduced into the school system in 2011. The new SBA system is designed to provide schools with an internal assessment system that will help schools to achieve the following purposes:

- Standardize the practice of internal school-based assessment in all Senior High Schools in the country
- Provide reduced assessment tasks for subjects studied at SHS
- Provide teachers with guidelines for constructing assessment items/questions and other assessment tasks
- Introduce standards of achievement in each subject and in each SHS class
- Provide guidance in marking and grading of test items/questions and other assessment tasks
- Introduce a system of moderation that will ensure accuracy and reliability of teachers' marks
- Provide teachers with advice on how to conduct remedial instruction on difficult areas of the syllabus to improve class performance.

The arrangement for SBA may be grouped in categories as follows. Folio Preparation, Project designed to include folio preparation, Mid-Term test, Group Exercise and End of Term Examination.

Folio Preparation**:** Folio preparation may include the following:

i. Specific Design
ii. Investigative study and field visit reports.

Project: This will consist of a selected topic to be carried out by groups of students for a year. Segments of the project will be carried out each term toward the final project completion at the end of the year,

The projects may include the following:
i) farm work
ii) experiment
iii) investigative study (including case study)

A report must be written for each project undertaken.

2. Mid-Term Test: The mid-term test following a prescribed format will form part of the SBA

3. Group Exercise: This will consist of written assignments or practical work on a topic(s) considered important or complicated in the term's syllabus

4. End-of-Tem Examination: The end-of-term test is a summative assessment system and should consist of the knowledge and skills students have acquired in the term. The end-of-term test for Term 3 for example, should be composed of items/questions based on the specific objectives studied over the three terms, using a different weighting system such as to reflect the importance of the work done in each term in appropriate proportions. For example, a teacher may build an End-of-Term 3 test in such a way that it would consist of the 20% of the objectives studied in Term 1, 20% of objectives studied in Term 2 and 60% of the objectives studied in Term 3.

GRADING PROCEDURE

To improve assessment and grading and also introduce uniformity in schools, it is recommended that schools adopt the following WASSCE grade structure for assigning grades on students' test results. The WASSCE structure is as follows:

Grade A1:	80 - 100%	-	Excellent
Grade B2:	70 - 79%	-	Very Good
Grade B3:	60 - 69%	-	Good
Grade C4:	55 - 59%	-	Credit
Grade C5:	50 - 54%	-	Credit
Grade C6:	45 - 49%	-	Credit
Grade D7:	40 - 44%	-	Pass
Grade D8:	35 - 39%	-	Pass
Grade F9:	34% and below	-	Fail

In assigning grades to students' test results, you are encouraged to apply the above grade boundaries and the descriptors which indicate the meaning of each grade. The grade boundaries i.e., 60-69%, 50-54% etc., are the grade cut-off scores. For instance, the grade cut-off score for B2 grade is 70-79% in the example. When you adopt a fixed cut-off score grading system as in this example, you are using the criterion-referenced grading system. By this system a student must make a specified score to be awarded the requisite grade. This system of grading challenges students to study harder to earn better grades. It is hence a very useful system for grading achievement tests.

Always remember to develop and use a marking scheme for marking your class examination scripts. A marking scheme consists of the points for the best answer you expect for each question, and the marks allocated for each point raised by the student as well as the total marks for the question. For instance, if a question carries 20 marks and you expect 6 points in the best answer, you could allocate 3 marks or part of it (depending upon the quality of the points raised by the student) to each point , hence totalling 18 marks, and then give the remaining 2 marks or part of it for organisation of answer. For objective test papers you may develop an answer key to speed up the marking.

SENIOR HIGH SCHOOL - YEAR 1

SECTION 1

HEALTH, SAFETY AND PROTECTION

General Objectives: The student will:

1. recognize potential health and safety hazards in handling of materials and equipment in the workshop.
2. apply safety and judicious methods in the use of tools and materials in the workshop.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1	The student will be able to:			Students to:
ELECTRICAL PROTECTIVE DEVICES	1.1.1 identify various types of electrical protective devices.	Electrical Protective devices: Rewirable fuse Cartridge fuse Miniature circuit breaker	Using samples of protective devices, assist students to discuss type of protection offered by each device	identify protective devices and select appropriate device for specific application
	1.1.2 perform earthing installation	Earthing of premises	demonstrate earthing installation demonstrate earthing methods in electrical installation work and how earthing accomplishes effective protection.	complete earthing installations
UNIT 2				
GENERAL SAFETY	1.2.1 outline safe working procedures and safety regulations and apply relevant statutory regulations in a given work situation.	Electrical safety regulations. Application of electrical safety regulations.	Group students to discuss safe working procedures Students to practice compliance to electrical safety regulations in given work situations.	state safety regulations and apply relevant regulations to work situation.
	1.2.2 practice general safety			
UNIT 3				
FIRE SAFETY	1.3.1 explain and match fire extinguishers to their appropriate uses.	Fire extinguishers. - Foam - Dry powder - Sand - Water - Wet blanket	Group students to discuss various fire extinguishers and match them to their appropriate uses.	list the type of extinguishers and match them to their appropriate uses.

SENIOR HIGH SCHOOL - YEAR 1

SECTION 2

INTRODUCTION TO ELECTRICITY

General Objectives: The student will:

1. understand the basic concepts of electricity and electronics .
2. be aware of the key differences between the two sciences.
3. understand the nature of electricity and electronics

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1	The student will be able to:			Class Exercise:
ELECTRONICS AND ELECTRICITY	2.1.1 distinguish between Electricity and Electronics	Electronics and Electricity. Differences and Similarities	Group students to discuss the differences and similarities between electronics and electricity.	students to explain electronics and electricity Assignment:
	2.1.2 outline the key differences and similarities between electronics and electricity	Electronics – is the study of precisely controlling the flow of electrons. Electricity – is the flow of electrons through a pathway that conducts electricity.	Group students to brainstorm to come out with the concepts under the content. Follow this up with a class discussion to clarify the meanings.	students to look out from other sources for more differences and similarities between electronics and electricity.
		Electrical power controls voltage levels and the flow of electrons. Electrical current controls the flow of electrons.	Group students to discuss the differences and similarities between electronics and electricity.	sescribe how static electricity is produced.
UNIT 2				
NATURE OF ELECTRICITY	2.2.1 explain the nature of electricity	Nature of Electricity: - Production of Static Electricity - Production of Current Electricity	Discuss how static current and current are produced with students Illustrate how current electricity is produced	explain how current electricity is produced

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 2 (CONT'D.) **NATURE OF ELECTRICITY**	The student will be able to: 2.2.2 distinguish between conductors, insulators and semi conductors using energy level diagrams	Conductor, Insulator and Semi conductor.	Stress to students that electronics and electricity are not the same.	

SECTION 3

DIRECT CURRENT CIRCUIT THEORY

General Objectives: The student will:

1. apply ohm's law in solving problems.
2. apply Kirchhoff's laws in solving problems.
3. be aware of types of resistors used in circuits.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1 **RESISTORS**	The student will be able to: 3.1.1 describe types of resistors and their properties	<u>Type of resistors</u> - Carbon - Wire wound - Variable	Using types of resistors, assist student to discuss resistors and their properties;	Students to: connect resistors in series and in parallel and carry out calculations
	3.1..2 select any nominal value of resistor using colour codes.	Resistor colour code.	Group students to discuss how to use colour code chart to determine value of resistor.	
	3.1.3 connect resistors in series and in parallel.	Combining resistors in series and parallel circuit.	Group students to discuss ways for connecting resistors in series and parallel circuits. Show various sizes of resistors and assist students to determine their power rating	differentiate between various sizes of resistor. construct simple circuit and solve simple problems through application of Ohm's law.
	3.1.4 determine power rating of a resistor.	Power rating of resistors.	Group students to discuss Ohm's law and show how to use it to find out current, voltage and resistance through measurements, calculations and drawing of graphs.	
	3.1.5 explain Ohm's law and apply it in a simple circuit to determine current, voltage and resistance.	Ohm's law calculations: V=IR	Assist students to analyze simple circuits using Kirchhoff's laws.	
	3.1.6 explain Kirchhoff's laws and apply them in simple electrical/electronic circuits.	Kirchhoff's laws: - Voltage law - Current law	Students to solve simple problems using Kirchhoff's laws	apply Kirchhoff's laws in analyzing simple electrical circuits and in calculations.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1 (CONT'D) **RESISTORS**	The student will be able to: 3.1.7 apply Kirchhoff's laws in circuits comprising two loops	Application of Kirchhoff's laws	Guide students to perform the following activities: i. Kirchhof's Law experiment in a two loop network. ii. Calculate voltage and current in two loop network.	Students to: calculate voltage, current in a two loop network
UNIT 2 **INSULATORS AND CONDUCTORS**	3.2.1 identify various conductors and insulators, and describe their properties and uses	Properties of conductors and Insulators - copper - aluminium - wool - rubber - pvc - wood - mica - asbestors	show types of conductors and insulators to students and assist them to discuss their properties and uses. Assist students to discuss how particular conductors and insulators may be used for specific jobs, given their properties.	explain the properties of conductors and insulators.
UNIT 3 **RESISTIVITY OF A CONDUCTOR**	3.3.1 describe the nature of resistivity of a conductor.	Resistivity: The formula $R=\frac{Pl}{A}$	Group students to discuss the nature of resistivity of a conductor.	state the formula for resistivity.
	3.3.2 solve problems involving resistivity.	Calculation of resistivity.	Assist students to calculate the resistance and length of conductors; measure resistance; measure diameter of cross-section, calculate cross-sectional area.	calculate the length and resistance of a conductor.
	3.3.3 examine temperature coefficient of resistance and show its applications	Temperature coefficient of resistance and applications	Group students to brainstorm to come out with the meaning of temperature coefficient of resistance and show its significance in electrical appliances	explain the characteristics of temperature coefficient of resistance and solve simple problems.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 4 **POWER AND ENERGY**	The student will be able to: 3.4.1 distinguish between power and energy in d.c. circuits. 3.4.2 solve problems involving power and energy.	 Power and Energy. Calculations of power and energy.	 Group students to discuss the differences between power and energy in d.c. applications. Assist students to solve problems involving power and energy.	Students to: define power and energy. calculate for power and energy.

SECTION 4

MAGNETIC FIELD

General Objectives: The student will:

1. Apply the principles of magnetisation and demagnetisation.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1	The student will be able to:			Students to:
FUNDA-MENTALS OF MAGNETISM	4.1.1 identify types of magnet and describe their applications.	Types of magnet: - permanent magnet - electromagnet	Display types of magnet and help students to discuss their differences and applications.	state four applications each of permanent magnet and electromagnet.
	4.1.2 identify materials that have magnetic properties and explain their usage in applied electricity.	Magnetic Properties of materials: flux, flux density, permeability, magnetomotive force, (mmf), magnetizing force and reluctance.	Group students to discuss the following: - concept of magnetic properties - importance of each property and applications in industrial measurement and instrumentation.	describe magnetic properties of various materials
	4.1.3 solve problems involving simple magnetic circuit.	Calculations involving magnetic circuits. $0 = BA, H = \frac{IN}{L}$	Students to solve problems involving magnetic circuit.	calculate the magnetic properties for flux, mmf, flux density and solve simple problems.
	4.1.4 describe magnetization and demagnetization of a magnetic material	Magnetization and demagnetization of magnetic material.	Demonstrate the processes of magnetizing and demagnetizing magnetic materials Group students to discuss the concept of magnetic domains.	describe the process of magnetising and demagnetising a magnetic material.
UNIT 2				
B/H CURVE AND HYSTERESIS LOOP	4.2.1 draw and explain the B/H curve and the hysterises loop.	B/H curve and hysterises loop	Assist students to draw and discuss the B/H curve and hysterises loop.	draw and use the B/H curve and hysterises loop to select suitable magnetic materials for relevant applications.

SENIOR HIGH SCHOOL - YEAR 1

SECTION 5

ELECTRIC FIELD

General Objectives: The student will:

1. become aware of the concepts of electric field and magnetic field and their relationship
2. develop knowledge on applications and calculations on capacitors

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1	The student will be able to:			Students to:
CONCEPT OF ELECTRIC FIELD	5.1.1 state the importance of electric field	Importance of electric field	Group students to discuss the importance of electric field	
	5.1.2 explain electric field and its properties.	<u>Electric field and properties:</u> Electric flux, electric flux density, electric field strength, permittivity and dielectric constant.	Group students to brainstorm to come out with the meaning of electric field. Group students to discuss the properties of electric field the relationship between the magnetic and electric properties of materials	explain electric field. explain electric field properties correctly.
UNIT 2 **CAPACITORS**	5.2.1 explain types of capacitor.	<u>Types of capacitor</u>: - air - paper - mica - ceramic - polyester - electrolytic	Show types of capacitors to observe	state type of capacitors.
	5.2.2 explain the capacitance of a capacitor .	Capacitance and dielectric	Group students to discuss the capacitance of a capacitor. - Discuss the properties of dielectric - Discuss how the dielectric gives effect to the action of the capacitor	explain the capacitance of a capacitor.

UNIT	*SPECIFIC OBJECTIVES*	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 2 (CONT'D) **CAPACITORS**	The student will be able to: 5.2.3 state the relationship between charge and applied voltage of a capacitor.	Charge on capacitor. Relationship between charge and applied voltage of a capacitor $Q = CV$ (Culomb) $C = \frac{Q}{V}$ (Farad) $V = \frac{Q}{C}$ (Volts)	Group students to discuss the relationship between charge and applied voltage of a capacitor. - discuss the emergence of time when charges accumulate in or discharge from a capacitor - discuss to bring out the notion of time constant	Students to: explain the relationship between charge and applied voltage of a capacitor. state the rating of a capacitor.
	5.2.4 relate the voltage rating of a capacitor to its application	Application and voltage rating of capacitors.	Group students to discuss the importance of voltage rating in all applications of capacitors.	explain the importance of voltage ratings of capacitors in all applications.
	5.2.5 solve problems involving capacitors in series and in parallel.	Series and Parallel Connection. CT = C, + C2 +--- + Cn $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \text{---} + \frac{1}{C_n}$	Assist students to solve problems involving capacitors in series and in parallel.	solve problems involving capacitors in series and in parallel.
	5.2.6 calculate the energy stored in capacitors.	Energy stored in a capacitor $E = \frac{1}{2} cv^2$ Joule.	Guide students to calculate energy stored in a capacitor.	calculate energy stored in a capacitor.

SECTION 6

ELECTROMAGNETISM

General Objectives: The student will:

1. acquire knowledge of the concept of electromagnetism.
2. use the principle of electromagnetic induction correctly.
3. solve problems involving electromagnetism

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1	The student will be able to:			Students to:
ELECTRO-MAGNETIC FIELD	6.1.1 draw the magnetic field around a current carrying conductor and a solenoid when the direction of current is known	Magnetic field around current carrying conductor and solenoid: Fleming's Right Hand Rule	Guide students to demonstrate the existence of magnetic field around a current carrying conductor and solve problems. Discuss Fleming's Right Hand Rule	draw the magnetic field around a current carrying conductor.
	6.1.2 determine a force on a current carrying conductor in a magnetic field.	Force on current carrying conductor F = B L I sinØ Newtons	Guide students to calculate the force on a current carrying conductor in a magnetic field. **Note**: Emphasize the effects of combined fields on current carrying conductor	explain the force on a current carrying conductor in a magnetic field and perform simple calculations to solve problems.
UNIT 2				
INDUCED EMF	6.2.1 explain Lenz's law and Flemings Right Hand Rule and their applications in Applied Electricity.	Laws of magnetism. -Lenz' law and Flemings' Right Hand Rule	Through discussions, assist students to examine how the Lenz's law and Flemings right Hand Rule can be used in applications. Students to carry out simple calculations on Lenz's law applications	apply Lenz's law and Flemings Hand Rule correctly. solve simple problems using Lenz's law.
	6.2.2 determine the induced e.m.f. in a conductor cutting a magnetic field.	Calculation of induced e.m.f. e = Blv volts.	Group students to discuss the effects due to the relative movement between conductor and magnetic field. Brainstorm to come out with areas of application of induced e.m.f.	solve problems of induced e.m.f. in a conductor cutting a magnetic field.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 3 **SELF AND MUTUAL INDUCTION**	The student will be able to: 6.3.1 distinguish between self and mutual induction and solve problems involving self and mutual induction.	Differences and calculations on self and mutual induction. Self induction values a single (O_i). Mutual induction involves double coil.	Through discussion, help students to distinguish between self and mutual induction. Assist students to solve problems involving self and mutual induction.	Students to: solve problems involving self and mutual induction.
	6.3.2 describe the applications of electromagnetism.	Application of electromagnetism: - moving coil instrument - electric bell - solenoid - loud speaker - buzzer - transformer	Group students to discuss some of the applications of electromagnetism.	explain the applications of electromagnetism in the devices listed in content
	6.3.3 calculate the energy stored in a coil.	Energy stored in a coil $E = ½ L I^2$ joules.	Group students to discuss how energy is stored in a coil Students to calculate the energy stored in a coil.	calculate the energy stored in a coil.
	6.3.4 design, construct and install a simple bell circuit and security alarm system.	Simple bell circuit and security alarm system.	Guide students to design, construct and install a simple door bell circuit and security alarm system. **Note:** Emphasize the importance of defining operating conditions for each system	<u>Project work</u> Trouble shoot a simple door bell circuit and security system.

SENIOR HIGH SCHOOL - YEAR 2

SECTION 1

ALTERNATING CURRENT CIRCUIT THEORY

Genera0l Objectives: The student will:

1. develop knowledge and skills for solving problems connected with alternating current generation.
2. develop knowledge and skills for solving problems connected with single phase and 3-phase circuits
3. be aware of the effect of frequency on components in a circuit.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1	The student will be able to:			Students to:
GENERATORS	1.1.1 identify parts of a.c. generator.	Parts of an a.c. generator: - stator - rotor	using a real generator, show parts of a generator to students and discuss their functions with them	list parts of a generator and explain their functions
	1.1.2 explain the principles of operation of a generator.	Principle of operation of a generator.	group students to discuss the principles of operations of a generator.	explain the principle of operation of generator.
UNIT 2 **RLC CIRCUIT**	1.2.1 identify and explain the various a.c. quantities.	<u>A.C. Quantities:</u> RMS Value, Peak Value, Average value, Waveform factor, Cycle, Period and Frequency.	group students to discuss the various a.c. quantities	explain a.c. quantities and solve problems involving them
	1.2.2 solve problems involving RL series circuit.	Solution of problems involving RL circuit. Xc = XL	group students to discuss the conditions at which resonance occurs.	identify the conditions at which resonance occurs.
	1.2.3 explain the conditions at which resonance occurs.	Conditions for occurrence of resonance circuit.	solve problems involving RL series circuit.	solve problems involving RL series circuit.
	1.2.4 draw phasor diagram for RL Series circuit. .	Phasor diagram for RL circuit.	illustrate the phasor diagram for RL series circuit.	draw a phasor diagram for RL series circuit.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 2 (CONT'D)	The student will be able to:			Students to:
RLC CIRCUIT	1.2.5 solve problems involving RC series circuit	Solution of problems involving RC circuit.	solve problems involving RC series circuit.	solve problems involving RC series circuit.
	1.2.6 draw phasor diagram for RC series circuit.	Phasor diagram RC circuit.	help students to draw a phasor diagram for RC series circuit.	draw a phasor diagram for RC in series circuit.
	1.2.7 explain the characteristics of RLC circuit and solve problems involving RLC series circuit.	Characteristics and solution problems involving RLC series circuit.	group students to discuss the characteristics of RLC circuit and solve problems involving RLC series circuit.	solve problems involving RLC series circuit.
	1.2.8 draw phasor diagram for RLC series circuit.	Phasor diagram for RLC series circuit.	illustrate the drawings of phasor diagram and draw a phasor diagram for RLC series circuit.	draw a phasor diagram for RLC series circuit.
	1.2.9 draw phasor diagram of a series resonance circuit.	Phasor diagram of a series resonance.	assist students to draw a phasor diagram of a series resonance circuit.	draw phasor diagram of a series resonance.
UNIT 3				
POWER IN A.C. CIRCUIT	1.3.1 explain power factor and state the effect of low power factor.	Definition of power factor and effect of low power factor.	group students to discuss power factor and the effects of low power factor.	describe the effects of low power factor
	1.3.2 determine power in single phase circuit.	Power in single phase circuit.	assist students to determine power in single phase circuit and calculate power in single phase circuit. P = IV Cosø	calculate power in single phase circuit.
	1.3.3 determine power in 3-phase circuit.	Power in 3-phase circuit.	assist students to determine power in 3-phase circuit and calculate power in 3-phase circuit. P = 3 VI Cos ø	calculate the power in 3 phase circuit.
	1.3.4 determine the power factor of a circuit.	Determination of power factor of a circuit.	assist students to perform experiment to determine power factor of a fluorescent lamp circuit.	perform experiment to determine the power factor of a fluorescent lamp circuit.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 3 (CONT'D)	The student will be able to:			Students to:
POWER IN A.C. CIRCUIT	1.3.5 determine power factor in single and 3-phase circuits.	Power factor in single and 3-phase circuits	Assist students to determine the power factor in single-phase and 3-phase circuit.	calculate the power factor of a single phase circuit.
	1.3.6 solve problems involving Active, Apparent and Reactive Power.	Active, Apparent, and Reactive Power.	Assist students to solve problems involving active, apparent and active power.	solve problems involving active, apparent and active power.
UNIT 4				
STAR DELTA CONNECTIONS	1.4.1 analyze the relationship between star delta connections.	Relationship of star delta connections: Line voltage and phase voltage, Line current and Phase current in star-delta connections.	Assist students to analyze the relationship between line voltage and phase voltage, line current and phase current in star delta connections.	analyze the relationship between line voltage and phase voltage.
	1.4.2 connect star and delta system of 3-phase and measure line and phase voltages and line and phase currents.	Measurement of line and phase voltages and line and phase currents.	Demonstrate how to set up a facility to connect star and delta system of 3-phase and measure line and phase voltages and line and phase currents of 3-phase system.	connect star and delta system of 3-phase and measure line and phase voltages and line and phase currents of 3-phase system.
	1.4.3 solve problems involving line voltage and phase voltage, line current and phase current.	- Line voltage - Phase voltage - Line current - Phase current	Assist students to: i. take measurements ii. collect data, analyze and draw conclusions Assist students to solve problems involving line voltage, phase voltage, line current and phase current.	solve problems involving line current and phase current.

SENIOR HIGH SCHOOL - YEAR 2

SECTION 2

TRANSFORMERS

General Objectives: The student will:

1. be aware of the principles of operation of a transformer.
2. be aware of the effects of losses in a transformer.
3. recognize the importance of cooling a transformer.
4. solve problems connected with voltage regulation

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1	The student will be able to:			Students to:
CONSTRUCTION OF TRANSFORMERS	2.1.1 identify types of transformers and describe their construction	Types of Transformer Construction: - Shell type - Core type	Using charts, show types of transformer to students and discuss various transformer constructions with them.	State types of a transformer construction.
	2.1.2 construct simple transformers	Construction of simple transformers	Help students to construct simple transformers	Project: Design and construct simple transformers
UNIT 2				
PRINCIPLES OF OPERATION OF A TRANSFORMER	2.2.1 explain the principles of operation of a transformer.	Operation of a transformer.	Group students to discuss the principles of operation of a transformer.	explain the principle of operation of a transformer.
	2.2.2 solve problems involving transformation ratio.	Transformation ratio. $\frac{Vp}{Vs} = \frac{Np}{NS} = \frac{Is}{Ip}$	Assist students to solve problems involving transformation ratio.	Solve problems involving transformation ratio.
UNIT 3				
LOSSES AND TEMPERATURE RISE IN TRANSFORMERS	2.3.1 identity the losses in a transformer.	Transformer losses - Copper - iron	Group students to discuss the losses in a transformer.	explain the losses in a transformer.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 3 (CONT'D.)	The student will be able to:			Students to
LOSSES AND TEMPERATURE RISE IN TRANSFORMERS	2.3.2 describe the effects of losses in a transformer.	Effect of losses in a transformer. Out put of transformer is affected by the losses.	Group students to discuss the effects of losses in a transformer.	describe the effect of losses in a transformer.
	2.3.3 determine losses in a transformer.	Determination of losses in a transformer.	Group students to perform an experiment to determine losses in a transformer.	determine the losses in a transformer.
	2.3.4 demonstrate the methods of minimising losses in a transformer.	Methods of minimising losses in a transformer e.g. limitation of the core.	Demonstrate the methods of minimising losses in a transformer.	explain the method of minimising losses in a transformer.
UNIT 4				
EFFICIENCY OF TRANSFORMER	2.4.1 determine losses in a transformer and explain its effect on efficiency.	Losses and efficiency of transformer.	Guide students to perform experiment to determine losses of transformer: - Open circuit test - Short circuit test	perform open and short circuit test on a transformer. calculate efficiency of the transformer. Students to:
UNIT 5				
COOLING OF TRANSFORMERS	2.5.1 identify and demonstrate various methods of cooling power transformer.	Methods of cooling power transformer: - air cooling - oil cooling - air and oil circulation method of cooling	Group students to discuss methods of cooling a power transformer and demonstrate each method.	list methods of cooling power transformer and explain the most economical method of cooling a power transformer.
	2.5.2 explain the importance of cooling a transformer.	Need for cooling.	Group students to discuss the importance of for cooling a power transformer.	State the need for cooling a power transformer.
UNIT 6				
VOLTAGE REGULATION	2.6.1 explain voltage regulation.	Voltage regulation.	Group students to discuss voltage regulation.	explain voltage regulation.
	2.6.2 explain the effects of load on voltage regulation of a transformer	Effects of load on voltage regulation	Discuss the effects of load on voltage regulation of a transformer with students	explain the effect of load on voltage regulation

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
	The student will be able to: 2.6.3 determine voltage regulation. 2.6.4 calculate voltage regulation of a transformer.	Determination of voltage regulation. Calculation of transformer regulation. $VR = \frac{V_{no\ load} - V_{full\ load}}{V_{no\ load}}$	Group students to perform experiment to determine voltage regulation of a transformer. Assist students to calculate transformer regulation.	Solve problems on voltage regulation of a transformer. Solve problems on voltage regulation

SECTION 3

SEMICONDUCTOR DIODES

General Objectives: The student will:

1. acquire knowledge of the principles of semiconductor devices.
2. recognize the difference between n-type and p-type materials.
3. develop knowledge and skills in using the diode

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1	The student will be able to:			Students to:
SEMI CONDUCTOR THEORY	3.1.1 describe the electrical properties of semiconductor materials in terms of the Periodic Table	Properties of semiconductor materials; energy levels and conductivity; Periodic Table	Display semi-conductors and assist students to: - discuss types of semiconductor materials - discuss the electrical properties of semi -conductor materials. - discuss electron bands and number of electrons in outermost shells; the significance of the Periodic Table	describe the properties of semi conductor materials.
	3.1.2 differentiate between n-type and p-type semi conductor materials and their formation	Differences between n-type and p-type semi conductor materials	Discuss the difference between n-type and p-type materials with students.	explain the difference between n-type and p-type materials.
UNIT 2				
DIODE	3.2.1 explain the difference between forward and reverse biasing with reference to P.N. diode.	Difference between Forward and Reverse Biasing.	Group students to discuss the difference and forward reverse biases.	explain the difference between forward and reverse biasing of P.N. junction diode.
	3.2.2 draw a symbol of a P.N Junction diode and explain formation of p-n junction diode	- Circuit symbol - P.N. junction diode - Barrier potential - Forward and reverse bias of - p-n junction;	Discuss doping; formation of N-type and P-type materials; donor and acceptor atoms Guide students to draw a P.N junction diode and interpret the drawing.	draw symbol for P.N. junction diode and interpret.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 2 (CONT'D.) **DIODE**	The student will be able to: 3.2.3 draw the v/I characteristics of a P.N. Diode	Characteristics of P.N diode.	Assist students to draw the V/I characteristics of a P.N Diode	Students to: connect P.N diode in a circuit and determine the V/I characteristics of the diode.
	3.2.4 apply applications of P.N. diode	Application of P.N junction diode e.g. Power Supply.	Assist students to perform experiment to determine the V/I characteristics of a diode; set up suitable circuit, take measurements, analyse and draw conclusions. Assist students to apply the diodes.	state the applications of a diode.

SECTION 4

POWER SUPPLY

General Objectives: The student will:

1. develop knowledge and skill in using the principle of power supply unit.
2. draw and interpret block, circuit and layout diagrams.
3. develop knowledge and skills in the operation of rectification and regulation.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1	The student will be able to:			Students to:
POWER SUPPLY UNIT	4.1.1 identify voltage sources available for use as d.c. power source	Power supply units: - Dry cell - Solar cell - Cadium cell - Accumulator	Using illustrations guide students to discuss various power supply sources, their voltage levels and suitability as d.c. power supply sources.	identify various voltage levels of d.c sources.
	4.1.2 identify and describe the function of each block in a power supply unit.	Function of blocks of power supply unit.	Discuss the functions of each block in the power supply unit with students.	describe the function of each block in the power supply unit
	4.1.3 draw a block diagram of a.c to d.c power supply converter	Block diagram of d.c. power supply.	Assist students to draw a block diagram of a d.c power supply.	draw block diagram of d.c. power supply and interpret the drawing.
UNIT 2				
RECTIFICATION	4.2.1 connect half and full wave rectifier circuits.	Types of rectification - full wave bridge - full wave centre tapped - half wave	Assist students to discuss and connect half and full wave rectifier circuit.	connect various types of rectifier circuit and measure the output voltage.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 3 **VOLTAGE REGULATION AND STABILIZATION**	The student will be able to: 4.3.1 draw, label and construct a simple regulator circuit.	Voltage regulator	Guide students to draw and lable a simple voltage regulator circuit. Assist students to connect the circuit.	Students to: connect a simple regulator circuit. measure the voltage at various points.

SECTION 5

BIPOLAR, UNIPOLAR TRANSISTOR AND OTHER SEMICONDUCTORS DEVICES

General Objectives: The student will:

1. develop knowledge in the general concept of transistors.
2. recognise the difference between Bipolar and Unipolar transistors.
3. develop knowledge and skills in the modes of connection of transistor and other semiconductor devices.
4. develop knowledge in simple integrated circuits.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1	The student will be able to:			Students to:
TRANSISTOR (BIPOLAR)	5.1.1 explain the principles of operation of the three configuration of bipolar transistor.	Principle of operation of the three configuration of bipolar transistor	Discuss the principles of operation of each of the three configurations of bipolar transistor.	explain the operation of all three configurations the transistor.
	5.1.2 explain the biasing of NPN and PNP transistors.	Two P.N junction devices (NPN and PNP).	Group students to discuss the biasing of NPN and PNP transistor; -the formation of the bi-polar transistor; and explain quiescent point.	explain biasing of NPN and PNP transistors and select suitable quiescent point.
	5.1.3 draw the configurations of a bipolar transistor.	Configuration of a bipolar transistor; CC, CB, CE	Assist students to draw the three configurations of a bipolar transistor CC, CB and CE	draw the three configuration of a bipolar transistor and conduct analysis
	5.1.4 connect the configurations of a transistor.	Mode of connection of the three configurations of a transistor.	Demonstrate methods of connecting configurations of a transistor circuit.	
	5.1.5 sketch the characteristic curves of bipolar transistor.	Characteristics of NPN transistor.	Using illustrations assist students to sketch the characteristic curves of bipolar transistor.	sketch the characteristic curves of bipolar transistor and analyze them.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 2 **UNIPOLAR TRANSISTOR**	The student will be able to: 5.2.1 identify the symbol of JFET	P channel and N channel of Field Effect transistor (JFET).	Assist students to draw circuit symbols of JFET, P channel and N channel devices;	Students to: draw circuit symbol of JFET and explain the operation of JFET; provide correct explanations about the JFET and Bi-polar characteristics;
	5.2.2 explain the principles of its operation	Principles of operation of N channel JFET	Discuss the difference between the JFET and Bi-polar Junction Transistor. Discuss the principles of operation of JFET.	
	5.2.3 draw the symbol for JFET	Drawing of JFET	Help students to draw the symbol for JFET.	draw the symbols of semi-conductor devices
UNIT 3 **OTHER SEMI CONDUCTOR DEVICES**	5.3.1 identify symbols for semiconductor devices and the various devices on an electronic circuit.	Semi conductor devices - diac - triac - silicon controlled Rectifier(SCR) - LED - Zener diode	Using illustrations, show symbols of semiconductor devices listed in content.	draw the symbols for semiconductor devices
	5.3.2 explain principles of operation of photo transistor	Principle of operation of photo transistor	Group students to discuss the principles of operations of photo transistor.	explain the principle of operation of photo transistor.
	5.3.3 outline the applications and principles of semiconductor devices.	Application of listed semi conductor devices. - diac - triac - silicon controlled Rectifier - (SCR) - LED - Zener diode .	Assist students to discuss the properties and applications of the semiconductor devices listed in content.	state applications of semiconductor devices listed

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 3	The student will be able to:			Students to:
(CONT'D.) OTHER SEMI CONDUCTOR DEVICES	5.3.4 state the application of photo transistor and 5.3.5 design and construct a burglar alarm using photo transistor.	Application of photo transistors e.g. Burglar alam circuit. Designing and construction of a burglar alarm	Group students to discuss applications of photo transistor; design and construct a burglar alarm circuit using photo transistors.	students in groups to select a different circuit from the classroom, state the application of photo transistor, design and construct the circuit using photo transistors.
UNIT 4				
INTERGRATED CIRCUITS	5.4.1 identify simple integrated circuits. 5.4.2 describe the fabrication of a simple integrated circuit.	Identification of integrated circuits. Formation of Simple Integrated circuit.	Using charts assist students to identify simple integrated circuit; Discuss the dual-in-line logic gates Discuss the fabrication of a simple integrated circuit with students.	identify simple integrated circuit.

SENIOR HIGH SCHOOL - YEAR 2

SECTION 6

AMPLIFIERS

General Objectives: The student will:

1. develop knowledge in the general concept of Amplifiers.
2. apply the skills of using electrical and electronics active component as amplifiers.
3. develop knowledge in the methods of biasing amplifiers.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1	The student will be able to:			Students to:
VOLTAGE AMPLIFIERS	6.1.1 state advantages of negative feedback.	Negative feedback.	Group students to discuss the advantages of negative feedback.	calculate the gain of an amplifier and solve related problems.
	6.1.2 demonstrate methods of biasing.	Biasing of amplifiers.	Demonstrate methods of biasing.	
	6.1.3 draw the output characteristics of common emitter transistor.	Output characteristics of common emitter transistor	Assist students to draw the output characteristics together with the D.C. load line, take measurements, collect data, tabulate data, draw d.c. load line on the output characteristics, draw graph and interpret graphs.	draw the output characteristics of a common emitter transistor with a D.C. load line and solve simple problems on biasing and d.c. load line.
	6.1.4 draw a single stage common emitter amplifier.	Single stage common emitter amplifier.	Assist students to draw a single stage common emitter amplifier and interpret the drawing.	draw single stage common emitter amplifier, label the components and perform simple calculations on the C.E. amplifier
	6.1.5 calculate the gain of an amplifier.	Gain of an amplifier.	Discuss the effects of negative feedback on the gain of an amplifier Students to calculate the gain of an amplifier	state advantages and disadvantages of negative feedback.
	6.1.6 sketch the gain frequency response.	Gain frequency response of common emitter amplifier	Assist students to sketch the gain frequency response of common emitter amplifier and interpret. Students to collect data for drawing the frequency response curve.	collect data for building frequency response curve sketch the gain frequency response.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 2	The student will be able to:			Students to:
POWER AMPLIFIERS	6.2.1 examine the applications of an amplifier.	Applications of amplifier	Show an amplifier to students to examine the applications	apply an amplifier correctly and solve problems through calculations.
	6.2.2 describe how temperature stability of the quiescent point is established	Temperature stability of quiescent point.	Assist students to: i. discuss temperature stability of transistor quiescent point; ii. examine why an emitter resistor provides temperature stability	explain why and how biasing and temperature stability may be achieved.
	6.2.3 calculate power gain and solve related problems.	Calculation of power gain.	Assist students to calculate power gain.	calculate power gain.
	6.2.4 calculate the efficiency of the amplifier.	Calculation of efficiency of an amplifier.	Assist students to calculate the efficiency of an amplifier.	calculate efficiency of an amplifier.
UNIT 3		.		
OPERA-TIONAL AMPLIFIERS	6.3.1 describe the main properties of operational amplifier and construct an amplifier	Properties and construction of an ideal operational amplifier.	Discuss the main properties of operational amplifier.	identify the main properties of operational amplifier.
	6.3.2 draw inverting and non inverting operational amplifier and establish voltage gain for each configuration.	Inverting and non inverting operational amplifier.	Assist students to draw inverting and non-inverting operational amplifier. Discuss the concept of “virtual ground”.	draw inverting and non-inverting operational amplifiers and perform simple calculations on both inverting and non-inverting op-amps.

SECTION 7

MEASUREMENTS AND INSTRUMENTS

General Objectives: The student will:

1. understand and apply the principle of operation of measuring instruments.
2. appreciate the conversion of galvanometer to Ammeter and Voltmeter.
3. acquire skills in the use of measuring instruments.
4. develop skills in the use and care for the digital multimeter for measurement of quantities.
5. develop knowledge and skills in using the CRO for measuring waveform and voltage.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1	The student will be able to:			Students to:
MOVING COIL INSTRUMENT	7.1.1 explain the operation of moving coil instrument.	Operation of Moving Coil Instrument.	Group students to discuss the principles of the operation of moving coil instrument.	explain the operation of moving coil instrument.
	7.1.2 describe the construction of a moving coil instrument.	Construction of a Moving Coil Instrument.	Group students to discuss the construction of moving coil instrument.	describe the construction of moving coil instrument correctly.
	7.1.3 describe the use of galvanometer to measure resistance.	Measurement of Resistance: Construction of a Moving Iron Instrument.	Discuss how to use the galvanometer in a Wheatstone Bridge network to measure resistance, and show how to determine balance condition.	set up and describe the four armed bridge to measure resistance, and perform simple calculations involving balance conditions.
	7.1.4 outline the advantages and disadvantages of moving coil instrument .	Advantages and Disadvantages of Moving Coil Instrument.	Discuss advantages and disadvantages of a moving coil instrument with students.	state advantages and disadvantages of moving coil instrument.
	7.1.5 convert a moving coil galvanometer to an ammeter, or voltmeter.	Conversion of Moving Coil Galvanometer Shunts and Multipliers.	Demonstrate how to convert a moving coil galvanometer into an ammeter or a voltmeter using shunts and multipliers.	convert a moving coil galvanometer to an ammeter and voltmeter using multipliers and shunts.
	7.1.6 solve problems involving shunts and multipliers.	Determine Value of Shunts and Multipliers.	Illustrate how to solve problems involving shunts and multipliers	solve problems involving shunts and multipliers correctly.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 2	The student will be able to:			Students to:
MOVING IRON INSTRUMENTS	7.2.1 explain the operations of moving iron instrument.	Advantages and Disadvantages of Moving Iron Instrument.	Discuss the operation of moving iron instrument with the students..	describe the construction and operation of moving iron instrument.
	7.2.2 state the advantages and disadvantages of moving iron instrument.	Measurement of Quantities: - Voltage - Current - Resistance - Components	Discuss the advantages and disadvantages of moving iron instrument with the students.	list advantages and disadvantages of moving iron instrument.
	7.2.3 describe the construction of a moving iron instrument.	Operation of Moving Iron Instrument.	Discuss how to construct the moving coil instrument with the students.	describe a moving iron instrument.
UNIT 3				
DIGITAL MULTI-METER	7.3.1 use multimeter to measure electrical quantities.	Cathode Ray Oscilloscope.	Demonstrate the use and care of digital multimeter and help students to practice	use digital multimeter to measure electrical quantities.
UNIT 4				
CATHODE RAY OSCILLO-SCOPE (CRO)	7.4.1 explain the function of the controls on CRO.	Measurement of Voltage Quantities using CRO.	Discuss the functions of the controls on CRO.	
	7.4.2 describe the application of cathode ray oscilloscope.	Functions of Controls of CRO	Group students to brainstorm to bring out the various applications of cathode ray oscilloscope in measurement.	describe application of cathode ray oscilloscope correctly.
	7.4.3 draw a block diagram of cathode ray oscilloscope (CRO) and explain the function of the blocks.	Application of CRO.	Assist students to draw block diagram of cathode ray oscilloscope and explain the function of the blocks.	draw the block diagram of cathode ray oscilloscope and explain the function of the blocks.
	7.4.4 use CRO to observe wave- form and measure voltage	Observing electrical quantity on the scope.	Demonstrate how to calibrate and use CRO to measure voltage and observe wave forms.	

SENIOR HIGH SCHOOL - YEAR 2

SECTION 8

EMISSION OF ELECTRONS AND THERMIONIC DEVICES

General Objectives: The student will:

1. develop knowledge on the general concept of emitting electrons
2. recognise the importance of emission of electrons.
3. be aware of the principles underlying the operation of thermionic devices.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1	The student will be able to:			Students to:
ELECTRON EMISSION	8.1.1 demonstrate methods of emitting electrons and state their applications .	Methods of emitting electrons: - Thermionic emission - Secondary emission - Field emission - Photo emission	demonstrate methods of emitting electrons as listed in content. **Note:** The discussion should bring out applications of each method	students to explain methods of emitting electrons listed in content and their applications.
UNIT 2				
THERMIONIC DEVICES	8.2.1 state the function of electrodes in thermionic devices.	Function of electrodes in thermionic devices: - diode - triode - tetrode - pentode	group students to discuss and state the function and properties of the electrodes assist students to draw the circuit symbols of the thermionic devices.	state the function of the electrodes in thermionic devices and describe their properties. draw the thermionic symbols devices
	8.2.2 draw circuit symbols of a thermoionic devices	Drawing circuit symbols of thermoionic devices	assist students to derive the triode parameters.	derive triode parameters. Identify the electrodes in the cathode ray tube and explain the function of each one.
	8.2.3 derive the triode parameters.	Triode parameters: - transconductors - amplification factor - anode slope resistance.	group students to discuss applications of thermionic devices listed in content of 8.2.1	

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 3 **CATHODE RAY TUBE**	The student will be able to: 8.3.1 explain the function of the electrodes in CRT 8.3.2 apply the CRT .	Function of electrodes in CRT. Application of thermionic devices.	Group students to discuss the functions of each of the electrodes in Cathode Ray Tube. demonstrate the application of thermionic devices	

SENIOR HIGH SCHOOL - YEAR 3

SECTION 1

DIGITAL ELECTRONICS

General Objectives: The student will:

1. understand and apply binary numbers and their various conversions with other number systems.
2. develop knowledge and apply the functions of the logic
3 acquire knowledge in the principles and operations of combinational logic gates.
4. understand the function of logic gates and relationship with Boolean expressions.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1	The students will be able to:			Students to:
BINARY NUMBERS	1.1.1 convert decimal number to binary number and vice versa.	Conversion of Decimal Numbers to Binary Numbers using Basic Calculations.	Assist students to perform basic calculations on base 2 and 10.	convert correctly, decimal to binary and vice versa.
UNIT 2			Illustrate and discuss the Truth Table	write Boolean expression from a truth table.
LOGIC GATES	1.2.1 explain each function and draw the Truth table for each Boolean expression from a truth table and implement.	Truth Table. Boolean Expression	Illustrate to show how to write a Boolean expression from a truth table. combination of gates can be arranged to implement the function.	
	1.2.2 draw general symbol for AND, OR, NOT, NAND, NOR Gates	General Symbols AND, OR, NOT, NAND, NOR Gates.	Illustrate how to convert decimal numbers to binary numbers and vice versa, and perform basic calculations including Addition, Subtraction, and Fractions	explain correctly the conversions into BCD, Hex, and vice versa in applications.
			Using illustrations, assist students to discuss how to draw logic symbols for AND, OR, NOT, NAND, NOR Gates	draw general symbols for AND, OR, NOT Gates and explain the function of each gate correctly.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 2 (CONT'D.) **LOGIC GATES**	The students will be able to: 1.2. 3 draw the timing diagram for the AND, OR, and NOT gates 1.2. 4 implement logic gate function use.	Timing Diagram. Series Connection (AND) Gate Parallel Connection (OR) Gate. Inverter (NOT) Gate.	Demonstrate to show how to implement exclusive OR gate and draw the truth table. Demonstrate how to connect switches to simulate logic gates: AND, OR, NOT functions Demonstrate how to produce a timing diagram from the truth tables, using dynamic input waveforms.	Students to: produce timing diagrams correctly, derive from the truth table for AND, OR and NOT gates. correctly implement exclusive OR gate. connect switches to simulate AND, OR, NOT logic gate functions.

SECTION 2

COMMUNICATION

General Objectives: The student will:

1. develop knowledge in the concept of communication.
2. acquire knowledge in the principle of modulation and waveforms.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1	The student will be able to:			Students to:
ELECTRO-MAGNETIC WAVES	2.1.1 state the relationship between velocity, frequency and wave length.	Characteristics of radio wave.	Group students to discuss the idea of radio as electromagnetic waves. Discuss to bring out the relationship between velocity, frequency and wavelength with students.	state the relationship between velocity, frequency and wavelength.
UNIT 2				
MODULATION	2.2.1 identify the advantages of FM over AM.	Advantages of FM and AM.	Group students to discuss the advantages of FM over AM.	explain the advantages of FM over AM.
	2.2.2 sketch the waveforms and explain amplitude modulation.	Amplitude Modulation.	Illustrate with sketches the main effects of amplitude modulation	sketch and explain amplitude modulation.
	2.2.3 sketch waveforms and explain frequency modulation.	Frequency modulation	Illustrate the characteristic wave form of an amplitude modulation Discuss the frequency modulation with students	sketch waveforms and explain frequency modulation.

SENIOR HIGH SCHOOL - YEAR 3

SECTION 3

ELECTRICAL ENERGY SUPPLY

General Objectives: The student will:

1. acquire knowledge on the concept of power generation.
2. develop awareness of layout of substations and items installed in substations.
3. develop awareness of the difference between transmitting and distributing at High Voltage and Low Voltage of Electrical Power.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1 **GENERATING STATION**	The student will be able to: 3.1.1 identify the parts of a generator.	Parts of a generator: - Poles - Armature	Through discussion, explain the principles of operation of a generator. Students to visit industries to acquaint themselves with generation transmission distribution and utilization of electrical energy e.g. E.C.G. (Local)	Students to: <u>Class Quiz:</u> list parts of a generator. write group report and discuss in class after visit
	3.1.2 explain the various methods of generating electrical power.	Methods of generating electrical power: - Diesel engine - Steam engine - Hydro electric - Nuclear - Gas Turbine - Solar - Wind turbine	Discuss the various method of generating electrical Power.	<u>Class exercise:</u> explain methods of generating Power.
	3.1.3 explain the principle of operation of a generator.	Principle of operation of a generator.	Through discussions list the parts of a generator.	explain the principles of a generator.

SECTION 4

ALTERNATING CURRENT MACHINES

General Objectives: The student will:

1. acquire knowledge on A.C. machines.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1	The student will be able to:			Students to:
ALTERNATORS	4.1.1 identify the parts of an alternator.	Parts of Alternator: - rotor/armature - slip rings - brushgear - exciter - stator	Demonstrate how to dismantle an alternator and show parts to students.	identify parts of an alternator.
	4.1.2 identify types of Alternator.	Types of Alternator: - stationary field revolving armature - revolving armature stationary field.	Show parts of alternators to students	identify types of alternator.
	4.1.3 explain the principles of operation of an Alternator.	Principles of operations of an Alternator.	Discuss the principles of operation of an alternator	state factors which affect the output voltage of an alternator.
	4.1.4 explain the relationship between speed, number of poles and frequency.	Relationship of speed, number of poles and frequency.	Guide students to establish the relationship between speed, number of poles and frequency. $f = \frac{Np}{60}$	calculate frequency of the alternator from $f = \frac{NP}{60}$

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 2	The student will be able to:			Students to:
AC MOTORS	4.2.1. identify types of three-phase and single phase motors.	Types of 3-phase and single phase motors - squirrel cage induction motor - slip ring induction motor - capacitor start induction motor - series motor	Show parts of a.c. motors to students	identify various types of a.c. motor.
	4.2.2 identify the parts of a.c. motor.	a.c motor: - stator - rotor	Show parts of a.c. motors to students	identify the parts of a.c. motor.
	4.2.3 explain the principles of Operation of an a.c. motor.	Operation of a.c. motors - 3-phase induction motor - single phase induction motor	Discuss the principles of operations of a 3-phase and single-phase induction motors.	explain the principle of operation of a 3-phase induction motor.
	4.2.4 describe application of AC. motors.	Application of a.c. motors.	Guide students to discuss the applications of the various types of a.c. motor.	describe application of various type of a.c. motors.
	4.2.5 describe and explain methods of starting 3-phase motors.	Motor starters: - direct-on-line starter - star delta starter - auto transformer starter	Group students to discuss methods of starting 3-phase motors. Organize Industrial visits	explain the method of starting squirrel cage induction motor using star delta starter. write group report and discuss in class after visit

SENIOR HIGH SCHOOL - YEAR 3

SECTION 5

DIRECT CURRENT MACHINES

General Objectives: The student will:

1. acquire knowledge on d.c. generators and motors.
2. be aware of the relationship between d.c. generators and motors.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1	The student will be able to:			Students to:
D.C. GENERATORS	5.1.1 identify and list the parts of d.c. generators.	Parts of d.c. generators. Operation of d.c. generators.	Show parts of d.c. generators to students	examine parts of a d.c. generator.
	5.1.2 explain the principle of operation of d.c. generators and methods of connecting field windings.	Methods of connecting field windings.	Group students to discuss the principles of operation of d.c. generators and method of connecting field winding.	draw and explain the principle of operation of a shunt generator.
UNIT 2				
D.C. MOTORS	5.2.1 identify type of d.c. motors.	Type of d.c. motors - shunt - compound - series	Show types of d.c. motors to students to	identify types of a d.c. motor.
	5.2.2 explain the principles of operation of d.c. motor and state methods of starting.	Operation of d.c. motors.	Group students to discuss the principles of operation of d.c. motors and state methods of starting.	explain the effect of BACK EMF in a d.c. motor (Eb = V – IaRa).
	5.2.3 explain the applications for d.c. motors.	Application of d.c. motors.	Group students to discuss the application of d.c. motors.	explain application of d.c. motors.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 2 (CONT'D.) **D.C. MOTORS**	The student will be able to: 5.2.4 dismantle and describe the construction of motors	Construction of d.c. motors	Assist students to dismantle d.c. motor and discuss its construction and re-assemble it.	Students to: identify and list parts of a d.c. motor.
	5.2.5 demonstrate how the speed of d.c motors is varied.	Variation of speed of d.c. motor.	Demonstrate how the speed of d.c. motor is varied (Field controlled and armature controlled).	explain the speed control of d.c. motors.

SECTION 6

ELECTRICAL WIRING

General Objectives: The student will:

1. acquire skills in electrical wiring.
2. appreciate the importance of IEE/Ghana Code wiring regulations.

<table>
<tr><th>UNIT</th><th>SPECIFIC OBJECTIVES</th><th>CONTENT</th><th>TEACHING AND LEARNING ACTIVITIES</th><th>EVALUATION</th></tr>
<tr><td>UNIT 1

WIRING</td><td>The student will be able to:

6.1.1 identify types of cables and accessories.</td><td>Cables and Accessories:

- p.v.c. insulated
- p.v.c insulated and sheathed
- amoured cable
- paper insulated cable
- socket outlet
- one way switch
- two way switch
- intermediate switch
- plugs
- consumer control unit
- cooker control unit
- water heater switch
- flexible cord</td><td>Show various cables and accessories to students and assist them to identify.

Discuss the applications of cables and accessories</td><td>Students to:

list cables and accessories used for wiring.</td></tr>
<tr><td></td><td>6.1.2 identify size of cables and their current ratings.</td><td>Current carrying capacity of cables.

<table><tr><th>Size of cable</th><th>Surface</th><th>Conduit</th></tr><tr><td>Mm^2</td><td>Amps</td><td>Amps</td></tr><tr><td>1.5</td><td>16</td><td>13</td></tr><tr><td>2.5</td><td>23</td><td>18</td></tr><tr><td>4</td><td>30</td><td>24</td></tr><tr><td>6</td><td>38</td><td>31</td></tr><tr><td>10</td><td>51</td><td>42</td></tr><tr><td>16</td><td>68</td><td>56</td></tr></table></td><td>Show cables to students and assist them to discuss current rating of various size of cables (1.5mm^2 – 16mm^2) and how to use data tables and sheets</td><td>select current rating of cables (1.5mm^2 – 16mm^2) and correct cable sizes from data sheets and tables.</td></tr>
</table>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1 (CONT'D.)	The student will be able to:			Students to:
WIRING	6.1.3 wire lighting circuit and socket outlets (ring and radial circuits) and connect plugs.	Wiring of lighting and socket outlets and connection of plugs.	Show how to wire lighting and socket outlets and connect plugs for students to practice: - wire one way, two way and intermediate switches controlling lamps. - wire socket outlets in ring and radial. - connect 3-pin plug to 3-core flexible cable.	wire two lamps controlled by two-way and intermediate switches. wire socket outlets in ring and radial.
	6.1.4 carry out the conduit, surface and trunking nstallation.	Conduit, surface and trunking installation.	Demonstrate ways of carrying out conduit, surface and trunking installation for students to practise.	connect 3-pin plugs using correct colour code.
UNIT 2				
PRO-TECTION	6.2.1 explain the function of protective devices	Protective devices: - fuses - circuit breakers	Discuss the need and function of fuses and circuit breakers in an installation with students.	select suitable protective device for an installation.
	6.2.2 select suitable size of protective device for an installation.	Protective devices.	Assist students to select suitable protective devices for a particular installation.	carry out conduit installation.
	6.2.3 arrange protective devices in an installation to provide discrimination.	Discrimination of protective devices.	Group students to discuss how to arrange protective devices in an installation to provide discrimination.	explain the need for fuses and circuit breakers in a circuit. arrange protective devices to provide discrimination.
UNIT 3				
EARTHING	6.3.1 explain earth loop Impedance of an installation.	Earth loop impedance.	Group students to discuss the effects of high and low earth loop impedance of an installation on the electrical protection	explain the effect of earth loop impedance.
	6.3.2 explain the reason for earthing.	Reasons of earthing.	Group students to discuss reasons for earthing	state the reason for earthing.
	6.3.3 demonstrate method of earthing.	Earthing.	Demonstrate methods of ear thing for students to practise	describe a method of earthing.

EQUIPMENT AND TOOLS LIST FOR APPLIED ELECTRICITY

A.

NO.	MEASURING INSTRUMENTS
1	Digital Multimeter
2	Analogue Multimeter
3	Digital Insulation Resistance Tester (Megger)
4	Digital Clamp-on-meter
5	Capacitance meter (tester)
6	Inductance meter (tester)
7	Dual trace oscilloscope
8	Catholde Ray Tube Restorer
9	Transistor tester or semiconductor tester
10	IC test clip
11	Ammeter
12	Voltmeter
13	Analogue Insulation Resistance Tester (Megger)
14	Wattmeter

NO.	EQUIPMENT/COMPONENTS
1	Audio signal Generators or Functional Generators
2	RF Modulated Signal Generator
3	Audio Signal Tracer
4	Patten Generator (Colour)
5	Voltage Stabilizers (UPS)
6	Universal PLC interface
7	Microprocessor training kit
8	Degausing coil
9	Power Supply Unit (Variac Variable DC Power Supply Unit (0-50V)
10	Signal Injector Probe
11	Logic probes
12	Digital electronics Training Kit or System
13	VDD Player
14	VCD Player
15	PA System Set
16	Satellite Dish and Decoder Unit
17	Radio Receiver (AM/FM)
18	TV Receiver Black and White/Colour
19	Rheostat
20	Circuit breaker

NO.	EQUIPMENT/COMPONENTS
21	Rewireable fuses
22	Cartridge fuse
23	One-way switch
24	Two-way switches
25	Intermediate switch
26	4-Way splitter Unit
27	Double Wound Transformer
28	Auto transformer
29	Wire wound resistor (Assorted Values)
30	Resistor (Assorted Values)
31	Capacitors (Assorted Values)
32	Inductors (Assorted Values)
33	Earth leakage circuit breaker
34	Single Phase Transformer
35	Three Phase Transformer (core and shell types)
36	Fluorescent fitting (complete)
37	Electric iron
38	Electric fan
39	Single phase motors (various types)
40	Three phase induction motor
41	Energy Saving Bulb

C

NO.	CONSUMABLES
1	Electronic components (Active)
2	PVC insulated cables 1.5mm^2 – 16mm^2
3	Flexible cable
4	15A socket outlet
5	13A socket outlet
6	Ceiling Rose
7	Battern Fitting Lamp Holder
8	Ceiling Lamp Holder
9	Filament lamp
10	P.V.C conduit
11	Plastic Trunking

D

NO.	TOOLS
1	Set of screw drivers (star)
2	Set of screw drivers (flat)
3	Pair of pliers
4	Pair of side cutters
5	Set of spanners
6	P.C board (Vero Board)
7	Knife
8	Long Nose Pliers
9	Quick Test Board

REFERENCE BOOKS FOR APPLIED ELECTRICITY

1. Experiments in Amplifiers, filters, oscillators and generators by MORRIS TISCHLER
   Publisher M.C. Graw-Hill Book Company
2. Experiments in Telecommunications by MORRIS TISCHLER
   Publisher M.C. Graw-Hill Book Company
3. Feedback and control systems, Latest Edition by J.J. Williams
   Publisher M.C. Graw-Hill Inc.
4. Electricity and Electronics Fundamentals by Paul B. Zbar
   Publisher M.C. Graw-Hill Book Company
5. Colour and mom TV course volumes I, II and III by Borhlham
   Publishers Dickson Publishers
6. Electronics Servicing Volumes I, II and III by Bohlham
7. Radio Servicing Volumes I, II and III by Bohlham
8. Practical Digital Electronics by Hewlett Pachard
9. Basic Television Theory and Servicing by Paul B. Zbar and Peter W. Orne
10. Digital Electronics by Taknein
11. Success in Electronics by Tom Duncan
12. Advance Electrical Installation by C. Shelton
13. Modern Electrical Installation by Brian Scadan
14. Electrical Technology by Edward Huges
15. Electrical Installation Work Vol. 1, 2 and 3 by Michael Niedle
16. Electrical Installation Principles and Practice (MOTIVATE)
17. IEE Wiring Regulation latest edition
18. Electrical Installation Technology Theory and Regulations by Mauris Lewis
19. Modern Wiring Practice by W.E. Stewards
20. Electrical Installation Workshop Technology by F.G Thompson
21. Electrical Installation Practice Vol. 1, 2 and 3 by H.A. Miller