FEDERAL MINISTRY OF EDUCATION

National Technical Certificate (NTC) Curriculum in

ELECTRONIC SYSTEMS MAINTENANCE CRAFT PRACTICE

February, 2025

Innovation Development and Effectiveness in the Acquisition of Skills (IDEAS) Project

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NATIONAL BOARD FOR TECHNICAL EDUCATION
Plot B, Bida Road, PMB 2239, Kaduna - Nigeria

ADVANCED NATIONAL TECHNICAL CERTIFICATE

CURRICULUM AND MODULE SPECIFICATIONS IN

ELECTRONIC SYSTEMS MAINTENANCE CRAFT PRACTICE

FEBRUARY, 2025

General Information

AIM
To give training and impart the necessary skills leading to the production of craftsmen and women and other skilled personnel who will be enterprising and self-reliant.

ENTRY QUALIFICATIONS

CRAFT PROGRAMME
Candidates must not be less than 14 years of age and should have successfully completed nine years of Basic Education or three years of Junior Secondary Education or its equivalent. Special consideration may be given to sponsored candidates with lower academic qualifications who hold trade test certificates and are capable of benefiting from the programmed.
ADVANCED CRAFT PROGRAMME
Candidates should possess the National Technical Certificate or its equivalent and should have had a minimum of two years of post-qualification cognate industrial experience.

I. THE CURRICULUM
The Curriculum of each programmed is broadly divided into three components:
General Education, which accounts for 30% of the total hours required for the programmed.
Trade Theory, Trade Practice and Related Studies which account for 65%.
Supervised Industrial Training/Work Experience, which accounts for 5% of the total hours required for the programmed. This component of the course, which may be taken in industry or in the College Production Unit, is compulsory for the full-time students.
Included in the curriculum is the teacher□s activity and learning resources required for the guidance of the teacher.

UNIT COURSE/MODULE
A Course/Module is defined as a body of knowledge and skills capable of being utilized on its own or as a foundation or pre-requisite knowledge for more advanced work in the same or other fields of study. Each trade when successfully completed can be used for employment purposes.

BEHAVIOURAL OBJECTIVES
These are educational objectives, which identify precisely the type of behavior a student should exhibit at the end of a course/module or programmed. Two types of behavioral objectives have been used in the curriculum. These are:
General Objectives
Specific Learning Outcomes

General objectives are concise but general statements of the behavior of the students on completion of a unit of week such as understanding the principles and application in:
Orthographic projection in Engineering/Technical drawing;
Loci in Mathematics
Basic concepts of politics and government in Political Science
Demand and supply in Economics

Specific learning outcomes are concise statements of the specific behavior expressed in units of discrete practical tasks and related knowledge which the students should demonstrate as a result of the educational process to ascertain that the general objectives of course/program have been achieved. They are more discrete and quantitative expressions of the scope of the tasks contained in a teaching unit.

GENERAL EDUCATION IN TECHNICAL COLLEGES
The General Education component of the curriculum aims at providing the trainee with complete secondary education in critical subjects like English Language, Economics, Physics, Chemistry, Biology, Entrepreneurship and Computer Studies. While the Trade Theory, Trade Practice and Related Studies aim at providing training and their applications, and as a foundation for post-secondary technical education for the above average trainee. Hence, it is hoped that trainees who successfully complete their trade and general education components may be able to compete with their secondary school counterparts for direct entry into the universities or polytechnics or colleges of education (technical) for a Degree, National Diploma (ND) or NCE courses respectively.

NATIONAL CERTIFICATION
The NTC and ANTC programs are run by Technical Colleges accredited by National Board for Technical Education (NBTE), while National Business and Technical Examination Board (NABTEB) conducts the final national examination and awards certificates.

Trainees who successfully complete all the courses/modules specified in the curriculum table and passed the national examinations in the trade will be awarded one of the following certificates:

S/NO	LEVEL	CERTIFICATE
	Technical Program	
1.	Craft Level	National Technical Certificate
2.	Advanced Craft Level	Advanced National Technical Certificate

GUIDANCE NOTES FOR TEACHERS TEACHING THE CURRICULUM

The number of hours stated in the curriculum table may be increased or decreased to suit individual institutions timetable provided the entire course contents are properly covered and the goals and objectives of each module are achieved at the end of the term.

The maximum duration of any module in the new scheme is 300 hours. This means that for a term of 15 weeks, the course should be offered for 20 hours a week. This can be scheduled in sessions of 4 hours in a day leaving the remaining hours for general education. However, (if properly organized and if there are adequate resources), most of these courses can be offered in two sessions a day, one in the morning and the other one in the afternoon. In so doing, some of these programs may be completed in lesser number of years than at present.

The sessions of 4 hours include the trade theory and practice. It is left to the teacher to decide whether the class should be held in the workshop or in a lecture room.

INTEGRATED APPROACH IN THE TEACHING OF TRADE THEORY, TRADE SCIENCE AND TRADE CALCULATION

The traditional approach of teaching Trade Science and Trade Calculation as separate and distinct subjects in technical college programs is not relevant to the new program as it will amount to a duplication of the teaching of mathematics and physical science subjects in the course. The basic concepts and principles in mathematics and physical science are the same as in the Trade Calculation and Trade Science. In the new scheme therefore, qualified persons in these fields will teach mathematics and physical science and the instructors will apply the principles and concepts in solving Trade Science and Trade Calculation problems in the trade theory classes. To this end, efforts have been made to ensure that mathematics and science modules required to be able to solve technical problems were taken as pre-requisite to the trade module.

EVALUATION OF PROGRAMME/MODULE

For the program to achieve its objectives, any course started at the beginning of a term must terminate at the end of the term.

Teachers/Instructors should therefore device methods of accurately assessing the trainees to enable them give the student s final grades at the end of the term. All students who have successfully completed their modules will take a national examination. The final award will be based on the aggregate of the scores attained in the course work and the national examination.

Contents

Table 1: Curriculum Table for National Technical Certificate (NTC) in Electronics Systems Maintenance Craft Practice

S/No	Subject Code	Module	YEAR 1						YEAR 2						YEAR 3						Total Hours for each
			Term 1		Term 2		Term 3		Term 1		Term 2		Term 3		Term 1		Term 2		Term 3		
			T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	
1	CMA 12-15	Mathematics	2	-	2	-	2	-	2	-	2	-	2	-	2	-	2	-	2	-	216
2	CEN 11-17	English	2	-	2	-	2	-	3	-	3	-	3	-	3	-	3	-	3	-	288
3	CPH 10-12	Physics	2	-	2	-	2	-	2	1	2	1	2	1	2	1	2	1	2	1	288
4	CCH 11-12	Chemistry	2	-	2	-	2	-	2	1	2	1	2	1	2	1	2	1	2	1	288
5	CEC 11-13	Economics	2	-	2	-	2	-	2	-	2	-	2	-	2	-	2	-	2	-	216
6	CBM10	Entrepreneurship	-	-	-	-	-	-	-	-	-	-	2	-	2	-	-	-	-	-	48
7	ICT11-15	Computer Studies	-	-	-	-	-	-	1	2	1	2	1	2	1	2	1	2	-	-	180
8	CTD 11-13	Drawings	-	3	-	3	-	3	-	3	-	3	-	3	-	4	-	-	-	-	264
9	CTD 14	Electrical/Electronic Drawing	-	-	-	-	1	2	1	4	-	-	-	-	-	-	-	-	-	-	96
10	CME 11	General Metalwork I	2	5	2	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	168
11	CEI 11	Basic Electricity	2	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	72
12	CRT 12	Electronics Devices & Circuits	-	-	-	-	-	-	3	2	3	2	2	3	-	-	-	-	-	-	180
13	CRT 13	Radio Communication	-	-	-	-	-	-	-	-	-	-	2	2	2	3	1	3	1	3	204
14	CRT 14	Radios & Audio	-	-	-	-	-	-	-	-	3	2	2	3	-	-	-	-	-	-	120
		Freq. Amplifier																			
15	CRT 15	Satellite Transmission, Reception,	-	-	-	-	-	-	-	-	2	3	2	3	2	3		-	-	-	180

		Installation and Maintenance																			
16	CRT 16	Television.	-	-	-	-	-	-	-	-	2	3	-	-	-	-	4	1	-	-	120
16	CRT 17	CCTV Installation and Maintenance 1-IP-BASE CCTV SYSTEM 2-ANALOG CCTV SOLAR STAND-ALONE CCTV Thermal long range	-	-	-	-	-	-	-	-	-	-	-	-	2	3	2	3	2	3	180
		GRAND TOTAL																			**2928 HRS**

Table 2: Curriculum Table for ANTC in Electronics Systems Maintenance Craft Practice

S/No	**Subject Code**	**Module**	**YEAR 1**						**Total Hours for each**
			Term 1	**Term 2**	**Term 3**				
1.	CMA 21-22	Mathematics	3	-	3	-	2	-	96
2	CEN 21-22	English	1	-	1	-	1	-	36
3	CEC 21-23	Economics	2	-	2	-	2	-	72
4	CBM 21	Entrepreneurship	2	-	2	-	2	-	72
5	ICT 21-22	Auto CAD	1	2	1	2	-	-	72
6	CRT 21	Colored Television	3	6	2	6	2	6	300
7	CRT 22	Radio & Electronic Systems.	3	6	3	5	2	5	288
		GRAND TOTAL							**936 HRS**

ELECTRONIC DEVICES AND CIRCUITS

PROGRAMME:	**National Technical Certificate in Electronics Systems Maintenance Craft Practice**
MODULE:	CRT 12 - **Electronic Devices and Circuits**
DURATION:	180 HRS
PRE-REQUISITE:	CEI 11 (Basic Electricity)
GOAL:	The module is intended to provide the trainee with the knowledge, attitude and skills to enable him/her understand the types, functions, characteristics and applications of electronic devices and circuits.

GENERAL OBJECTIVES:
On completion of this module, the trainee should be able to:
1.0 Know the principles of operation, characteristics and applications of electronic devices.
2.0 Know the principles of operation, characteristics and applications of Integrated Circuit (IC) and Oscilloscopes.
3.0 Understand the principles of operation and maintenance of Power Supply.
4.0 Know the principles of operation, construction and testing of Simple Electronic Circuits
5.0 Know the principles of operation, testing and applications of Oscillator Circuits.
6.0 Know the principle of operation and applications of Electronic Logic Gates.
7.0 Understand the principle of operation and application of Modulation and Demodulation Circuits.
8.0 Know the principles of operation and Maintenance of some Electronic Equipment and Devices.
9.0 KNOW and understand electronics testing, fault detection and analyzing devices

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN ELECTRONICS SYSTEMS MAINTENANCE CRAFT PRACTICE						
COURSE: CRT 12 ELECTRONIC DEVICES AND CIRCUITS			**Course Code: CRT □ 12**			**Contact Hours: 3-2**
Course Specifications: General Objective 1.0: Know the principles of operation, characteristics and applications of electronic devices.						
Year 2 Term 1	**Theoretical Content**			**Practical Content**		
Week	**Specific Learning Outcome**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcome**	**Teacher□s Activities**	**Resources**
1-3	Define the term electronic	Discuss the electronic concept	*Computer, Handset, TV	*Show the different types of electronic	Display to the students the different types of	*Computer, Handset, TV

	State the types of electronic. Explain the basic components of electronic Explain the term electrons emission Explain the term semiconductor. Explain the	List the types of electronic Describe the basic components of electronic. Describe the basic concept of electrons emission Discuss the term semiconductor. Describe the	*Resistors *Diodes, *Transistor *capacitors Multimedia. Charts, slides. White board	devices, e.g. handset, computer, etc. *Demonstrate the 4 basic components of electronic: resistors, diodes, transistors and capacitors Demonstrate how current flows in the following types of semiconductor diodes:	electronic devices Guide Students to: Set up a circuit to demonstrate how current flows in the following types of semiconductors	*Resistors *Diodes, *Transistor Multimedia. Charts, slides. White board
	principles of operations, characteristics and applications of semi-conductor diodes. 1.7 Explain the effect of load on the characteristics of semi-conductors. 1.8 Describe types of rectifiers. 1.9 Describe the effect of filter elements on ripples of D.C. output voltage for half wave Rectifiers. 1.10 Describe the effect of filter elements on D.C. output voltage for full wave Rectifiers on Ripples.	principles of operations, characteristics and applications of semiconductor diodes. Describe the effect of load on the characteristics of semi-conductors. Discuss types of rectifiers. Discuss the effect of filter elements on ripples of D.C. output voltage for half wave Rectifiers. Discuss the effect of filter elements on D.C. output voltage for full wave Rectifiers.	Chart Variable dc power supply Semiconductor diodes (silicon and germanium), Connecting Leads. Multimeter Experiment kit Variable power supply PN diodes) silicon and germanium), Connecting Leads Multimeter Variable resistors Capacitors of various range Resistor (variable)	Silicon Germanium Demonstrate the effect of load on the output characteristics of PN diodes, Carry out an experiment to show the following: Reverse characteristics of a semiconductor diode. Rectification in a semiconductor diode. Effect of capacitor on the output of a halfwave rectifier. Effect of capacitor on the output of a	diodes: Silicon Germanium Demonstrate the effect of load on the output characteristics of PN diodes, Carry out an experiment to determine the following: Forward and Reverse characteristics of a semiconductor diode. Rectification in a semiconductor diode. Effect of capacitor on the output of a halfwave rectifier. Effect of capacitor on the output of a bridge	Chart Variable dc power supply Semiconductor diodes (silicon and germanium), Connecting Leads. Multimeter Experiment kit Variable power supply PN diodes) silicon and germanium), Connecting Leads Multimeter Variable resistors Capacitors of various range Resistor (variable)
				bridge rectifier. Demonstrate how to	rectifier. Demonstrate how to	

				use a multimeter to identify the terminals of a semiconductor diode.	use a multimeter to identify the terminals of a semiconductor diode.	
4-7	1.11 Explain the principles of operation, characteristics and applications of the Bipolar Junction Transistor. 1.12 Explain the types of Bipolar Junction Transistor: A) NPN B) PNP 1.13 Explain the effect of load on the gain of a transistor.	Describe the principles of operation, characteristic and applications of the Bipolar Junction Transistor. Describe the types of Bipolar Junction Transistor: A) NPN PNP Describe the effect of load on the	Transistor PNP and NPN Charts Multimedia Chart Multimedia White board marker Bipolar Junction Transistor Analogue	Demonstrate how to use a multimeter to identify the terminals of a bipolar junction transistor; NPN and PNP. Perform an experiment to show how to bias a Bipolar Junction Transistor. Carry out an experiment to	Guide Students to: Demonstrate how to use a multimeter to identify the terminals of a bipolar junction transistor; NPN and PNP. Perform an experiment to show how to bias a Bipolar Junction Transistor. Carry out an experiment to determine the:	Transistor PNP and NPN Charts Multimedia Chart Multimedia White board marker Bipolar Junction Transistor Analogue
	1.14 Describe Bipolar transistor parameters, e.g. gain, input and output impedance, etc. 1.15 Describe the principles of operation and applications of photoelectric devices like solar cell, light dependent resistor and diodes. 1.16 Describe the principles of operation of the following types of display devices, cathode ray tube (CRT), liquid crystal	gain of a transistor. Discuss Bipolar transistor parameters, e.g. gain, input and output impedance, etc. Discuss the principles of operation and applications of photoelectric devices like solar cell, light dependent resistor and diodes. Discuss the principles of operation of the following types of display devices, cathode ray tube (CRT), liquid crystal display (LCD), light emitting diode (LED) and Plasma	multimeter Connecting leads Variable resistor Bipolar Junction Transistor Variable DC power supply Digital Multimeter	determine the: Input characteristics of a Bipolar Junction Transistor connected in CE, CB, and CC. Transfer characteristics of a Bipolar Junction Transistor connected in CE, CB and CC. Output characteristics of Bipolar Junction Transistor connected in CE, CB and CC.	Input characteristics of Bipolar Junction Transistor connected in CE, CB, and CC. Transfer characteristics of Bipolar Junction Transistor connected in CE, CB and CC. Output characteristics of Bipolar unction Transistor connected in CE, CB and CC.	

	display (LCD), light emitting diode (LED) and Plasma tube.	tube.				
8-10	1.17 Describe the principles of operation and	Discuss the principles of operation and	□ White Board Marker	□ Carry out an experiment to show the effect of	□ Guide students to carry out an experiment to show	□ White Board Marker
	applications of the following semiconductor devices: 1-Rectifier diode 2-Zener diode 3-Tunnel diode 4-Light Emitting Diode (LED) 5-Field Effect Transistors (FET) 6-Thyristors 7-Diacs 8-Triacs	applications of the following solid-state devices: a. Rectifier diode b. Zener diode c. Tunnel diode d. Light Emitting e. Diode (LED) f. Field Effect g. Transistors (FET) and Various types. f. Thyristors h. Diacsec i. Triacs	Multimedia Chart □Variable dc power supply □Assorted diodes, Zener diode, Tunnel diode, LED, FET. □Connecting leads. □Assorted FET Digital Multimeter	Zener diode on the output voltage o f a power supply. □ Perform an experiment to determine: • The input resistance of FET. • Transfer characteristic ICS of FET. • Output resistance of FET. • Demonstrate how to identify the terminals of the different types of semiconductor diodes	the effect of Zener diode on the output voltage of a power supply. □ Guide students to perform an experiment to determine: a. The input resistance of FET. b. Transfer characteristics of FET. c. Output resistance of FET.	Multimedia Chart □Variable dc power supply □Assorted diodes, Zener diode, Tunnel diode, LED, FET. □Connecting leads. □Assorted FET Digital Multimeter

	General Objective 2.0: Know the principles of operation of Integrated Circuits (ICs) and Oscilloscope. Contact Hour 3-2					
Week	**Specific Learning Outcome**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcome**	**Teacher□s Activities**	**Resources**
11-12	2.1 Define Integrated Circuit (IC) 2.2 Describe the principles of operation of integrated circuit, types and their application. 2.3 Explain the difference between integrated circuit and discrete components. 2.4 Define an Oscilloscope 2.5 Describe the principles of operation of oscilloscope. 2.6 Describe the basic functions of external features of Oscilloscope.	Explain the term integrated circuit Discuss the principles of operation of integrated circuit, types and their application. differentiate between integrated circuit and discrete components Explain the term oscilloscope Discuss the principles of operation of oscilloscope. Discuss the basic functions of external features of Oscilloscope.	*Assorted integrated circuits *Assorted discrete components □White Board Marker/Magnetic board □Multimedia □Chart Oscilloscope Function Generator □Variable AC power supply □Variable DC power supply.	*Describe integrated circuit □Demonstrate how to identify the terminals of an IC □Demonstrate how to carry out resistance test on an IC. *Demonstrate the difference between integrated circuit and discrete components □ Demonstrate how to use oscilloscope to measure voltage and frequency.	Guide Students to: *to identify integrated circuits □Demonstrate how to identify the terminals of an IC *identify the different types of ICs and discrete components. *Describe an oscilloscope □Demonstrate how to carry out resistance test on an IC. □ Demonstrate how to use oscilloscope to measure voltage and frequency.	*Assorted integrated circuits *Assorted discrete components □White Board Marker/Magnetic board □Multimedia □Chart Oscilloscope Function Generator □Variable AC power supply □Variable DC power supply.

Year2 Term 2	**General Objective 3.0: Understand the Principles of Operation and Maintenance of Power Supply. Contact Hour 3-2**					
Week	**Specific Learning Outcome**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcome**	**Teacher□s Activities**	**Resources**
13-15	3.1 Define a power supply 3.2 Explain the principles of operation of linear power supply employing zener diode and transistor regulators.	Explain a power supply Describe the principles of operation of linear power supply employing zener diode and transistor as regulator.	Schematic diagram of a linear power supply □Multimedia □Magnetic Board □Chart □Marker □Variable dc power supply □Voltmeter □Ammeter Variable resistor □Transformer □Diodes Capacitors □Transistors □Zener diodes	□ Describe a power supply *Carry out an experiment to determine the efficiency and percentage regulation of a linear power supply employing: Zener diode Transistor regulators	Guide Students to: *Demonstrate their understanding of a power supply Show a video clip on an experiment on efficiency of regulation of linear power supply employing the following components and guide students to set up and conduct the experiment. Carry out an experiment to determine the percentage voltage regulation of a linear power supply employing: Zener diode. Transistor regulator	Schematic diagram of a linear power supply □Multimedia □Magnetic Board □Chart □Marker □Variable dc power supply □Voltmeter □Ammeter Variable resistor □Transformer □Diodes Capacitors □Transistors □Zener diodes
	3.3 Explain the principle of operation of power supply using IC regulators, namely 78□.,79□... and 317□. series.	Define the principle of power supply using IC regulators, namely: 78□.,79□... and 317□. series. Describe the principles of operation of	□White Board Marker/ Magnetic Board Soldering Iron □Multimedia •Marker □Chart	Carry out an experiment to determine voltage regulation in a switched Mode Power regulator. □ Construct a simple	Guide students to determine voltage regulation in a Switched Mode Power regulator. Guide the students on how to construct a	□White Board Marker/ Magnetic Board Soldering Iron □Multimedia □Marker □Chart Soldering lead

	3.4 Explain the principles of operation of Switched Mode Power Supply (SMPS). Explain the principles of operation and applications of the following circuits: *voltage protection circuits *voltage comparator circuits *current limitation circuits	Switched Mode Power Supply (SMPS). Describe the principles of operation and applications of the following circuits: voltage protection circuits voltage comparator circuits current limitation circuits	Soldering lead •Sucker FET Transistor Transformer Diodes Bread Board Vero Board IC Regulators Connecting leads Resistors	12V regulated power supply employing IC regulator. Construct the following circuits: voltage protection circuits voltage comparator circuits current limitation circuits	simple 12V regulated power supply employing IC regulator. Guide the students on how to construct the following circuits: voltage protection circuits voltage comparator circuits current limitation circuits	Sucker FET Transistor Transformer Diodes Bread Board Vero Board IC Regulators Connecting leads Resistors
			Capacitors SMPS Training kit 78,79 & 317 IC regulator series			Capacitors SMPS Training kit 78,79 & 317 IC regulator series circuits
	General Objective 4.0: Know the principles of operation, Construction and Testing of Simple Electronic Circuits. Contact Hour 3-2					
Week	**Specific Learning Outcome**	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
16-18	4.1 Explain the principles of operation and applications of different types of amplifiers. 4.2 Explain the principle of operation of Astable Multivibrator	Describe the principles of operation and applications of different types of amplifiers. Describe the principle of operation of Astable Multivibrator and its applications	Transformer Rectifier Diodes Capacitors Resistors Transistors Toggle switch Variable DC Power supply	Construct and test the performance of different types of amplifiers (current and voltage amplifiers). Construct astable and monostable multivibrator	Guide Students to: Construct and test the performance of different types of amplifiers.	• Transformer • Rectifier Diodes • Capacitors • Resistors • Transistors • Toggle switch • Variable DC • Power • supply

	and its application. 4.3 Explain the principle of operation of Monostable Multivibr ator and its application. 4.4 Explain the principle of operation of Bistable Multivibrator and its applications.	Describe the principle of operation of Monostable Multivibr ator and its application. Describe the principle of operation of Bistable Multivibrator and its applications.	• White board marker.	and measure their frequencies		
	General Objective: 5.0 Know the principles of Operation, Testing and Applications of Oscillator Circuits. Contact Hour 3-2					
Week	**Specific Learning Outcome**	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
19-22	5.1 Explain Oscillation 5.2 Explain the principles of operation and applications of the following types of oscillators: a. L.C. Oscillator	Describe Oscillation Illustrate with diagrams and describe the principles of operation and applications of the following types of oscillators:	Circuit diagrams of oscillators i.e., LC oscillator, Hartley, Colpitt, Crystal controlled, signal generator. Switches, bulb, connecting leads & oscilloscope. Circuit diagrams of power supply.	Measure the Oscillation frequency of the following circuits using oscillation demonstration kits a. L-C Oscillator b. R-C Oscillator	Guide Students to: Construct the following oscillators and measure their frequency of oscillation using oscillator demonstration kits:	Circuit diagrams of oscillators i.e., LC oscillator, Hartley, Colpitt, Crystal controlled, signal generator. Switches, bulb, connecting leads & oscilloscope. Circuit diagrams of power supply.
	Hartley Oscillator Colpitt Oscillator Crystal controlled Oscillator R.C.	L.C. Oscillator Hartley Oscillator Colpitt Oscillator Crystal controlled Oscillator R.C. Oscillators Crystal oscillators	Power supply, transistors, resistors, capacitors, connecting leads, soldering iron and lead. Oscillator	Construct the following types of oscillator circuits: L.C. Oscillator Hartley Oscillator Colpitt	L-C Oscillator R-C Oscillator c. Astable multivibrator d. Bistable multivibrator e. Monostable multivibrator Construct the	Power supply, transistors, resistors, capacitors, connecting leads, soldering iron and lead. Oscillator demonstration kits Resistor

	Oscillators Crystal oscillators Wien bridge oscillators Phase shift oscillators Auto electronic oscillators Cross couple oscillators Tri-Tet oscillators 5.3 State the frequency of the oscillators used in radio channels or radio station.	Wien bridge oscillators Phase shift oscillators Auto electronic oscillators Cross couple oscillator Tri-Tet oscillators Describe the frequency of the oscillators used in radio channels or radio station.	demonstration kits □Resistor □Capacitor □Audio coil □IC □Vero board □Lead suckers	Oscillator Crystal controlled Oscillator R.C. Oscillators Crystal oscillators Wien bridge oscillators Phase shift oscillators Auto electronic oscillators Cross couple oscillator Tri-Tet oscillators	following types of oscillator circuits: L.C. Oscillator Hartley Oscillator Colpitt Oscillator Crystal controlled Oscillator R.C. Oscillators Crystal oscillators Wien bridge oscillators Phase shift oscillators Auto electronic oscillators	□Capacitor □Audio coil □IC □Vero board □Lead suckers
					Cross couple oscillator Tri-test oscillators	
Year Term3	**General Objective 6.0: Know the principle of operation and applications of Electronic Logic Gates. Contact Hour 2-3**					
Week	**Specific Learning Outcome**	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
23-26	6.1 Explain the use of binary numbers in electronic circuits. 6.2 Describe simple logic circuit of: AND OR NOT NOR NAND	Describe the use of binary number in electronic circuits. Describe simple logic circuit of: AND OR NOT NOR NAND	Diagrams of symbols and logic circuits Diagrams of logic gate symbols, truth table for the following logic gates: □AND gate □OR gate □NOT gate	□Demonstrate the operation of the following electronic gates using logic gate kits: AND OR NOT NOR NAND	□Guide students to implement the following logic gate circuits using logic gate kits: AND OR NOT NOR NAND	• Diagrams of symbols and logic circuits Diagrams of logic gate symbols, truth table for the following logic gates: □AND gate □OR gate □NOT gate

	6.3 Explain areas of application of logic gates	Describe areas of application of logic gate	□NOR gate □NAND gate □Logic gate kits □Connecting wires □Light Emitting Diode Toggle switches □Variable dc power supply.	□Construct and test the operation of the following logic gates: AND OR NOT NOR NAND		□NOR gate □NAND gate □Logic gate kits □Connecting wires □Light Emitting Diode Toggle switches □Variable dc power supply.
Year 2 Term3	**General Objective 7.0: Understand the principle of operation and application of Modulation and Demodulation Circuits. Contact Hour 2-3**					
Week 27-30	**Specific Learning Outcome**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcome**	**Teacher□s Activities**	**Resources**
	7.1 Explain the principles of modulation and	Describe the principles of modulation and demodulation	□ Charts showing modulated and demodulated envelopes	□Demonstrate the following types of modulation using	Guide Students to: □Demonstrate the	□ Charts showing modulated and demodulated envelopes
	demodulation. 7.2 Explain the purposes of modulation and demodulation. 7.3 Describe amplitude, frequency, pulse modulation and pulse duration modulation. 7.4 Explain the principle of demodulation of circuits in AM/FM radio sets. 7.5 Explain how signals are detected.	Describe the purposes of modulation and demodulation. 7.3 Discuss amplitude, frequency, pulse modulation and pulse duration modulation. Describe the principle of demodulation of circuits in AM/FM radio sets. Describe how signals are detected.	□ FM & AM R.F, signal generator, oscilloscope, signal tracer AM Radio receiver FM Radio receiver Schematic diagrams. □ Demodulated envelope. □ Oscilloscope. □Modulator kits □Radio Trainer	modulation kits: Amplitude Frequency Phase	following types of modulation using modulation kits: - Amplitude - Frequency - Phase.	□ FM & AM R.F, signal generator, oscilloscope, signal tracer AM Radio receiver FM Radio receiver Schematic diagrams. Demodulated envelope. Oscilloscope. □Modulator kits □Radio Trainer

Year 2 Term 3	**General Objective 8.0: Know the principles of operation and Maintenance of Electronic Equipment and Devices. Contact Hour 2-3**					
Week	**Specific Learning Outcome**	**Teacher□s Activities**	**Resources**	**Specific Learning Outcome**	**Teacher□s Activities**	**Resources**
31-36	8.1 Explain the term electronic equipment and devices. 8.2 Describe the principles of operation of the following equipment and Devices: Public Address System (PAS) Solar cell Compact Disc (CD) DVD Player mini disc mini dart f Loud speaker g Microphone 8.3 Describe the application of electronic devices.	Discuss Electronic equipment and devices. Discuss the principles of operation of the following equipment: a. Public Address System (PAS) Compact Disc (CD) DVD Player mini disc mini dart 8.3 Discuss the applications of electronic devices.	Microphone PAS Compact Disk (CD) player DVD Player Minidisc Mini dart Multimedia White Board Marker Loud Speaker	Demonstrate the use of: Public Address System (PAS) Compact Disc (CD) DVD Player mini disc mini dart f Microphone g Loud Speaker	Guide Students to demonstrate the use of the following: Public Address System (PAS) Compact Disc (CD) DVD Player mini disc mini dart	Microphone PAS Compact Disk (CD) player DVD Player Minidisc Mini dart Multimedia White Board Marker Loud Speaker

RADIO COMMUNICATION

PROGRAMME:	National Technical Certificate in **Electronics Systems Maintenance Craft Practice**
MODULE:	CRT 13 - Radio Communication
DURATION:	204 HRS
GOAL:	This module is intended to provide the trainee with the knowledge of basic principles of Radio Transmission and Reception.

GENERAL OBJECTIVES:
On completion of this module, the trainee should be able to: 56
Understand the basic principles of radio transmission and reception (AM/FM).
Know the principles of operation of a digital radio transmitter and receiver.
Understand how to troubleshoot and maintain radio equipment
To know the basic tools and equipment use in testing and detection of all kind of fault

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN ELECTRONIC SYSTEMS MAINTENANCE CRAFT PRACTICE						
COURSE: CRT 13 RADIO COMMUNICATION			**Course Code: CRT 13**		**Contact Hours: 3-2**	
Course Specification: General Objective 1.0: Understand the basic principles of radio transmission and reception (AM & FM). Contact Hour 3-2						
Year: 2 Term: 3	**Theoretical Content**			**Practical Content**		
Week	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
1-12	1.1 Explain the basic principles of radio transmission (AM/FM). 1.2 Explain with the aid of simple block diagram, the operation of radio transmitter. 1.3 Explain with the aid of a simple block diagram the operation of radio receiver (AM/FM). 1.4 Describe the following	Describe the basic principles of radio transmission (AM /FM). Describe with the aid of a simple block diagram, the operation of radio transmitter. Describe with the aid of a simple block diagram the operation of radio receiver. Discuss the selectivity,	White board Marker Pictorial block diagram. Circuit Diagrams of different radio receivers. Signal generator. AM/FM Modules. Radio Sets	Draw a block diagram of AM/FM receivers. Construct a simple AM/FM receiver and test its functionality Show how to adjust the RF and IF sections of an AM/FM	Demonstrate how to draw a block diagram of AM & FM receiver. Demonstrate the difference between AM & FM transmission and reception.	White board Marker Pictorial block diagram. Circuit Diagrams of different radio receivers. Signal generator. AM/FM Modules. Radio Sets

	terms: selectivity, sensitivity and fidelity in a radio set. 1.5 Explain the series/parallel LC	sensitivity and fidelity in a radio set		receiver		
	Circuits and Resonance.	Describe the series/parallel LC Circuits and Resonance.				
Contact Hour 2- 3						
Year 3 Term 1 13-25	1.6 Explain with the aid of diagram the use of series/parallel-tuned circuits in Radio Communication. 1.7 Explain with the aid of diagram the principles of operation of: RF stage (Aerial Input circuits) Mixer (Acceptor and Rejector circuits) Local oscillator IF (IF filter). Detector /A.G.C. (Image suppressor) A.G.C. (Amplifier etc. cross modulation). 1.8 Explain the importance of A.F.C.(Automatic	Describe with the aid of a diagram the concept of tuned circuits and its function in Radio Communication. 1.7 Describe the operation of the following: a. RF stage mixer. c. Local Oscillator d. IF stage. d. detector stage e. A.F.C. and f. A.G.C. and their importance in a radio receiver. Describe the importance of AFC (Automatic	□ Variable capacitors, inductors, signal generator. □ Radio set □ Schematic diagram and pictorial diagram. □Radio kits Signal injector	Construct a single Tuned Amplifier and measure the frequency of operation	Guide students to carryout experiment on series and parallel LC circuits. Demonstrate to the students the stages of radio receivers.	□ Variable capacitors, inductors, signal generator. □ Radio set □ Schematic diagram and pictorial diagram. □Radio kits Signal injector
	Frequency Control) in radio receiver and compare the functions of A.G.C. and A.F.C.	frequency control) in radio receiver.				

Year 3 Term 2	**General Objective 2.0: Know the principles of operation and Maintenance of a digital radio transmitter and receiver. Contact Hour 1-3**					
Week	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
25-35	2.1 Explain the principles of operation of digital radio transmitter using a block diagram. 2.2 Distinguish between digital and analogue radio transmitter. 2.3 Explain the principles of operations of a digital radio receiver using block diagram. 2.4 Distinguish between digital and analogue radio receiver. 2.5 Explain the Principle of Operation of the following stage in AM radio receiver. Tuner IF amplifier Detector AF amplifier 2.6 Explain the principle of operation of the following stages in FM Radio receiver. • Frequency • Discriminator • IF Amplifier • AFC	• Describe the principle of operation of a digital radio transmitter using block diagram. • Describe the differences • between digital and analogue transmitters. • Describe the principle of operation of a digital radio receiver using a block diagram. • Describe the difference between digital analog radio receiver. • Draw the block diagram of AM receiver. • Draw a block diagram of FM receiver. • Discuss the following equipment:	White board marker Pictorial block diagram. Radio Set. Signal generator. Show how to Construct and test the functionality of the following: A Simple Digital Radio Transmitter. A simple Digital Radio Receiver.	Show how to Construct and test the functionality of the following: A Simple Digital Radio Transmitter. A simple Digital Radio Receiver. Demonstrate to the Students how to receive and tune FM/AM Signals Carryout measurement of current, voltage and resistance using multimeter.	Guide Students to construct and test the functionality of the following: Digital Radio Transmitter. Digital Radio Receiver. Guide the students to practice tuning an FM/AM receiver. Demonstrate and Guide the students to practice how to measure current, voltage and resistance using multimeter.	White board marker Pictorial block diagram. Radio Set. Signal generator. Show how to Construct and test the functionality of the following: A Simple Digital Radio Transmitter. A simple Digital Radio Receiver.

		Multimeter Frequency counter				
Year 3 Term 3	**General Objective 3.0: Understand how to troubleshoot and maintain radio equipment. Contact Hour 1-3**					
Week	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
36-48	3.1 Compare and Contrast AM & FM receivers 3.2 Explain the uses of the following equipment in fault finding • Digital/Analog • Multimeter • Frequency Counter. 3.3 Explain workshop safety precaution in electronics workshop 3.4 Explain the types of faults in AM and FM receiver, e.g. open and short circuits. Explain the following methods of fault finding and repairs in AM and FM radio receiver: Physical Observation Signal Tracing DC Voltage Measurement Testing of Components	Describe to students safety and precautions in the workshop. Describe Fault Finding techniques. Describe faults finding equipment. Replacement of components.	Marker Board Multimedia Screw driver Plier Soldering Iron Lead Sucker Hand Glove Multimeter Radio repair kit	Show how to carry out the following methods of fault finding and repairs in AM and FM radio receivers: Physical Observation Signal Tracing DC Voltage Measurement Testing of Components Replacement of components.	Demonstrate and Guide students to practice the following methods of fault finding and repairs in AM and FM radio receivers: Physical Observation Signal Tracing DC Voltage Measurement Isolating Faulty Components. Testing of Components Replacement of components.	Marker Board Multimedia Screw driver Plier Soldering Iron Lead Lead Sucker Hand Glove Multimeter Radio repair

RADIO AND AUDIO FREQUENCY AMPLIFIERS

PROGRAMM E:	National Technical Certificate in **Electronics Systems Maintenance Craft Practice**
MODULE:	CRT 14 - Radio and Audio Frequency Amplifiers
DURATION:	60 HRS
GOAL:	This module is aimed at making the trainee to understand the principles of operation and types of Radio and Audio frequency amplifiers and oscillators.

GENERAL OBJECTIVES:
On completion of this module, the trainee should be able to:
Understand the Principle of operations and applications of Radio and Audio- Frequency Amplifiers.
2.0 Understand the principles of operation and applications of Oscillators.
3.0 Understand diagnosis and troubleshooting in amplifier circuits

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN ELECTRONICS SYSTEMS MAINTENANCE CRAFT PRACTICE						
COURSE: RADIO & AUDIO FREQUENCY AMPLIFIERS			**Course Code: CRT 14**			**Contact Hours: 3-2**
Course Specification	**General Objective 1.0 Understand the Principles of operation and applications of Radio and Audio- frequency Amplifiers.**					
Year 2, Term 2	**Theoretical Content**			**Practical Content**		
Week	**Specific Learning Outcome:**	**Teacher's Activities**	**Learning Resources**	**Specific Learning Outcome:**	**Teacher's Activities**	**Learning Resources**
1-8	1.1 Explain classes of amplifiers. 1.2 Describe the principles of operation of	State classes of amplifiers Discuss the principles of operation of the	□ White board marker/Magnetic	□Carry out an experiment to determine the	Guide Students to Carry out an experiment to	□ White board marker/Magnetic
	the following classes of amplifiers: Class A, Class AB,	following classes of amplifier: Class A, AB, Class B, Class C Describe the meaning of	board Multimedia □Chart Amplifiers Amplifier training	frequency response, efficiency, gain and other performance characteristics of the following	determine the frequency response, efficiency, gain and other	amplifiers. □ Explain the difference between power and voltage amplifiers. Explain the principles of

9-15	Class B Class C Explain the frequency response of an amplifier. Explain the difference between power and voltage amplifiers. Explain the principles of operation of the following amplifiers: Audio frequency (AF) Intermediate	frequency response of an amplifier. Describe the difference between power and voltage amplifiers. Describe the principles of operation of the following amplifiers: Audio frequency (AF) Intermediate frequency (IF) Cascade Cascode	kits Discrete Components/Equipment Such as Transistor Resistor Bread Board Capacitor DC variable power supply Voltmeter Ammeter Radio repair kit	amplifiers: Audio frequency (AF) Intermediate frequency (IF) Single stage Cascade Cascode Push pull Class A Class B Class C Class AB	performance characteristics of the following amplifiers: Audio frequency Intermediate frequency Single stage Cascade Cascode Push pull Class A Class B Class C Class AB	operation of the following classes of amplifiers: Class A Class B Class AB Class C
	frequency (IF) Cascade Cascode push-pull. Explain how to calculate amplifiers gain and bandwidth. Explain safety precautions necessary in	e. push-pull. Describe how to calculate amplifiers gain and bandwidth. Describe safety precautions necessary in electronic workshop. **Mention** safety precautions necessary in electronics workshop. Describe the applications of AF amplifiers, e.g. in public address system,	Connecting wires Multimedia Chart Amplifiers Amplifier training kits Discrete Components/Equipment Such as Transistor Resistor Bread Board Capacitor DC variable power	Calculate amplifiers gain and bandwidth. Observe safety precautions necessary in electronics workshop. Demonstrate the applications of AF amplifiers, e.g. in public address system, audio recording, hearing	Guide students to: observe safety precautions necessary in electronics workshop. state the various applications of AF amplifiers, e.g. in public address system, audio recording, hearing aids, etc.	Connecting wires Multimedia Chart Amplifiers Amplifier training kits Discrete Components/Equipment Such as Transistor Resistor Bread Board Capacitor DC variable power

	electronics workshop. Explain the applications of AF amplifiers, e.g. in public address system, audio recording, hearing aids, etc. Explain the applications of RF amplifiers, e.g. in Radio & TV Broadcast, wireless communication, radar & satellite, etc.	audio recording, hearing aids, etc. Describe the applications of RF amplifiers, e.g. in Radio & TV Broadcast, wireless communication, radar & satellite, etc	supply Voltmeter Ammeter Radio repair kit Connecting wires Multimedia Chart Amplifiers Amplifier training kits Discrete Components/Equipment. Such as Transistor Resistor Bread Board Capacitor DC variable power supply Voltmeter Ammeter Radio repair kit	aids, etc. Demonstrate the applications of RF amplifiers, e.g. in Radio & TV Broadcast, wireless communication, radar & satellite, etc	state the various applications of RF amplifiers, e.g. in Radio & TV Broadcast, wireless communication, radar & satellite, etc	supply Voltmeter Ammeter Radio repair kit

Year 2, Term 2	**General Objective 2.0: Understand the principles of operation and applications of Oscillators. Contact Hour 2-3**					
Week	**Specific Learning Outcome**	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers' Activities**	**Resources**
15 -18	2.1 Define Oscillators 2.2 Explain the difference between amplifiers and	Explain oscillators State the difference between amplifiers and oscillators Describe the principles of operation of the following	White board marker/Magnetic board Multimedia Chart White Board Marker Colpitt oscillator	Discuss the meaning of oscillators Demonstrate the difference between amplifiers and oscillators Carry out an experiment to	Guide Students to: Carry out an experiment to measure the frequency of oscillation of the following oscillators: Colpitt	White board marker/Magnetic board Multimedia Chart White Board

	oscillators 2.3 Explain the principles of operation of the following types of oscillators: a. Colpitt oscillator b. Hartley oscillator Phase shift oscillator Wien-Bridge oscillator RC oscillator 2.4 Explain the applications of: Colpitt Oscillator Hartley Oscillator	types of oscillators: a. Colpitt oscillator Hartley oscillator c. Phase shift oscillator Wien-Bridge oscillator RC oscillator 2.2 Describe the application of: Colpitt Oscillatorr Hartley Oscillator Wein-Bridge Oscillator	□Wien-Bridge oscillator □Hartley Oscillator □ Oscillator training kits	measure the frequency of oscillation of the following oscillators: Colpitt Hartley Oscillator Wien-bridge Carryout an experiment to determine the output frequency of: Colpitt Oscillator Hartley Oscillator Wein- Bridge Oscillator	•Wien-bridge 2.2 Guide Students to carry out an experiment to determine the output frequency of: Colpitt Oscillator Hartley Oscillator Wein-Bridge oscillators	Marker □Colpitt oscillator □Wien-Bridge oscillator □Hartley Oscillator □ Oscillator training kits
Course Specification: General Objective 3.0: Understand diagnosis and troubleshooting in amplifier circuits**. Contact Hour 2-3**						
Year 2 Term 3	Specific Learning Outcome	Teachers; Activities	Resources	Specific Leaning Objective	Teachers□ Activities	Resources
Week: 18-24	3.1 Explain common faults in RF and AF amplifier circuits, such as signal distortion, oscillation, and component failure. 3.2 Explain systematic troubleshooting	Identify common faults in RF and AF amplifier circuits, such as signal distortion, oscillation, and component failure Perform systematic troubleshooting techniques to locate and fix faults in amplifiers Discuss solutions to	Oscilloscope Multimeter (Digital/Analog) Signal Generator Spectrum Analyzer	Carry out procedures to identify common faults in RF and AF amplifier circuits, such as signal distortion, oscillation, and component failure Use systematic troubleshooting techniques to locate and fix faults in amplifiers	Guide students to: Identify common faults in RF and AF amplifier circuits, such as signal distortion, oscillation, and component failure Carry systematic troubleshooting techniques to locate and fix faults in amplifiers	Screwdrivers Pliers Soldering Iron Soldering Station DE soldering Pump/Wick Tweezers Magnifying Glass

	techniques to locate and fix faults in amplifiers. 3.3 Describe solutions to improve amplifier performance, such as heat dissipation techniques and noise reduction methods.	improve amplifier performance, such as heat dissipation techniques and noise reduction methods		Find solutions to improve amplifier performance, such as heat dissipation techniques and noise reduction methods	Observe solutions to improve amplifier performance, such as heat dissipation techniques and noise reduction methods	

SATELLITE TRANSMISSION, RECEPTION, INSTALLATION AND MAINTENANCE

PROGRAMME:	National Technical Certificate in **Electronics Systems maintenance Craft Practice**
MODULE:	**CRT - 15 Satellite Transmissions, Reception. Installation and Maintenance**
DURATION:	180 Hours
PREREQUISITE:	**CRT 13**
GOAL:	This module is aimed at making the trainee to understand the Basic Concept of Satellite Transmission and Reception

GENERAL OBJECTIVES:
On completion of this module the trainee should be able to:
1.0: Understand the principle of operations and maintenance of Satellite Transmission system.
2.0: Understand the principle of operation and maintenance of Satellite Receiver
3.0 Know the basic principle of Installation and Maintenance of a Satellite System.
4.0 know the basic tools and equipment use in satellite installation and Repairs

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN ELECTRONICS SYSTEMS MAINTENANCE CRAFT PRACTICE						
COURSE: Satellite Transmission, Reception, Installation and Maintenance			**Course Code: CRT 15**		**Contact Hour: 2**	**-3**
Course Specification: General Objective 1.0: Understand the Principle of operation and maintenance of Satellite Transmissionsystem.					**Contact Hour 2-3**	
Year 2 Term 2	**Theoretical Content**				**Practical Content**	
Week	**Specific Learning Outcome:**	**Teacher□s Activities**	**Learning Resources**	**Specific Learning Outcome:**	**Teacher□s Activities**	Resources
1-10	1.1 Explain the basic principle of Radio and Television transmission using repeater stations for a wider area coverage (terrestrial transmission). 1.2 Explain how the	Describe the basic principle of Radio and Television transmission using repeater stations for a wider area coverage (terrestrial transmission). Describe how the concave mirror relates to a parabolic receiving antenna. Describe Multicast transmission	White Board Marker Satellite Receiver (World Receiver set). TV Broadcast Stations □Dish antenna □Pipe	□Construct a dish antenna using locally available materials. □Carry out an installation of satellite dish.	Guide Students to: □Construct a dish antenna using locally available materials. □ Install satellite dish.	• White Board Marker Satellite Receiver (World Receiver set). TV Broadcast stations □Dish antenna □Pipe □Complete satellite system □Coaxial cable

	concave mirror relates to a parabolic receiving antenna. 1.3 Explain Multicast transmission over microwave frequencies e.g. a. Voice (Telephones) b. Video (Television) c. Data (Facsimile). 1.4 Explain Geostationary orbit. 1.5 Explain Transponder. 1.6 Explain Uplink and Downlink	over microwave frequencies e.g. a. Voice (Telephones) b. Video (Television) c. Data (Facsimile). Describe Geostationary Orbit Describe Transponders. Describe uplink and downlink frequencies.	□Complete satellite system □Coaxial cable □Satellite signal meter □Wrench □Black tape Brackets Mounting bolts Smart LNB			□Satellite signal meter □Wrench □Black tape Brackets Mounting bolts
	frequencies 1.7 Discuss common faults in satellite transmitters and basic troubleshooting methods. 1.8 discuss common tools use in fault finding and how to detect faults.	Explain the common faults in satellite transmitters and basic troubleshooting methods 1.11 list the common testing tools use in satellite transmission system,	Compass Signal finder etc	Highlights the common faults in satellite transmitter and basic troubleshooting methods	Identify common faults in satellite transmitters and suggest basic troubleshooting methods.	Write some common faults in satellite transmitters. Suggest some basics troubleshooting methods in satellite transmitters
Year 2, Term 3	**General Objective 0: Understand the Principles of operation and maintenance of Satellite Receiver. Contact Hour 2-3**					
Week	**Specific Learning Outcome:**	**Teacher□s Activities**	**Learning Resources**	**Specific Learning Outcome:**	**Teacher□s Activities**	**Evaluation**
11-20	2.1 Explain a focal point of a parabolic dish antenna	Describe a focal point of a parabolic dish antenna. Illustrate the focal point (F) of any	Satellite location and footprint manual	• Identify and explain the different types	Guide students to identify and explain the different types of satellite location	Satellite location and footprint manual Plan (magnetic)

	2.2 Calculate the focal point (F) of any parabolic dish antenna using $F = 2\pi d/D^2$ (formula to be verified	parabolic dish antenna using $F = 2\pi d/D^2$ (formula to be verified	Plan (magnetic) Measuring tape (steel) Complete set of	of satellite location such on equator.	such on equator. Guide the students to identify dish	Measuring tape (steel) Complete set of
	please) Where d = Diameter of dish D = depth of dish. 2.3. Explain the following components of satellite reception: Low Noise Down Converter - Amplifier (LND, LNC, LNA, LNB/ Feed horn), Coaxial Cable, Satellite Receivers/Decoders. 2.4 Explain the reception of satellite signals. 2.5 Installation of satellite receiving dish. 2.6 Describe the principles and practice of satellite dish alignment. 2.7 Explain how to diagnose and rectify basic faults in satellite reception systems.	please) Where d = Diameter of dish D = depth of dish. Describe the following components of satellite reception: Low Noise Down Converter- Amplifier (LND, LNC, LNA, LNB/Feed horn), Coaxial Cable, Satellite Receivers/Decoders. Describe the transmission and reception of satellite signals. Describe the installation of satellite receiving dish. Describe the principles and practice of satellite dish alignment. Explain how basic faults in satellite reception systems are being diagnosed and rectified	spanners 2.0 meter Knocked down parabolic dish antenna. C - Band Low Noise Down converter (LND) Coaxial Cable Satellite Receiver Color Television. Multimedia Chart White board marker/Magnetic board F-connector	identify dish sizes, dish location; BSKYB, free, etc. Know how to install a satellite dish. Describe how basic faults in satellite reception systems are being diagnosed and rectified	• sizes, dish location; • BSKYB, free, etc. Demonstrate and guide the student to practice the installation of a satellite dish. Demonstrate and guide the students to practice alignment of satellite dish. Diagnose and rectify basic faults in satellite reception systems	spanners 2.0 meter Knocked down parabolic dish antenna. C - Band Low Noise Down converter (LND) Coaxial Cable Satellite Receiver Colour Television. Multimedia Chart White board marker/Magnetic board F-connector

Year 3, Term 1	**Course Specification: General Objective 3.0: Know the basic principle of Installation and Maintenance of a Satellite System.** Co**ntact: Hour 2-3**					
Week	**Specific Learning Outcome:**	**Teacher□s Activities**	**Learning Resources**	**Specific Learning Outcome:**	**Teacher□s Activities**	**Evaluation**
21-36	Explain the tools and equipment required for satellite installation. Explain the procedures for mounting and aligning a satellite dish. Explain how to connect a satellite receiver to a TV system. Explain all the safety precautions during satellite installation and maintenance.	• Identify the tools and equipment required for satellite installation. • Describe the procedures for mounting and aligning a satellite dish. • Describe how to connect satellite receiver to a TV system. • Explain all the safety precautions during satellite installation and maintenance.	White board Satellite dish Low Noise Blocker Feed (LNBF) Receiver Cables Connectors Signal meter Alignment tool, etc. Multimedia White board Satellite dish Low Noise Blocker Feed (LNBF) Receiver Cables Connectors Signal meter Alignment tool, etc. Multimedia	Describe the tools and equipment needed for satellite installation. Describe the procedures for mounting and aligning a satellite dish Demonstrate how to connect satellite receiver to a TV system. Describe safety precautions during satellite installation and maintenance.	Identify and list the tools and equipment required for satellite installation. Demonstrates the procedures for mounting and aligning a satellite dish. Show how to connect a satellite receiver to a TV system. Demonstrates all safety precautions during satellite installation and maintenance.	White board Satellite dish Low Noise Blocker Feed (LNBF) Receiver Cables Connectors Signal meter Alignment tool, etc. Multimedia .
	Explain basic troubleshooting and maintenance on a satellite system. Explain how to	Describe basic troubleshooting and maintenance on a satellite system. Explain how to Interpret signal strength and quality using a	White board Satellite dish Low Noise Blocker Feed (LNBF)	Highlight basic troubleshooting and maintenance on a satellite system.	Perform basic troubleshooting and maintenance on a satellite system. Interpret signal strength	

	Interpret signal strength and quality using a satellite signal meter. Discuss proper grounding and protection measures for satellite systems	satellite signal meter. Explain the proper grounding and protection measures for satellite systems	Receiver Cables Connectors Signal meter Alignment tool, etc. Multimedia	Describe how to interpret signal strength and quality using a satellite signal meter. Describe the proper grounding and protection measures for satellite system	and quality using a satellite signal meter. Demonstrate proper grounding and protection measures for satellite systems	

CCTV INSTALLATION AND MAINTENANCE

PROGRAMME:	**National Technical Certificate in Electronics Systems Maintenance Craft Practice**
MODULE:	CRT 17 **CCTV Installation and Maintenance**
DURATION:	180 HRS
PRE-REQUISITE:	CRT 16: Television
GOAL:	To provide students with fundamental understanding of CCTV Systems, types of CCTV their applications, the functions of various components, installation, maintenance and troubleshooting.

GENERAL OBJECTIVES:
On completion of this module, the trainee should be able to:
Understand the principles of operation of a Closed-Circuit Television (CCTV)
Understanding the various types (IP-Base and Analog) and components of a CCTV systems and their application.
Understand the principle of CCTV system design and Installation techniques.
Know the skills in troubleshooting and repairing faulty CCTV systems.
Understand how CCTV systems-work with other security systems

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN ELECTRONIC SYSTEMS MAINTENANCE CRAFT PRACTICE						
COURSE: CRT 17 CCTV INSTALLATION AND MAINTENANCE			**Course Code: CRT 17**		**Contact Hours: 3-2**	
Course Specification: General Objective 1.0: Understand the principles of operation of a Closed-Circuit Television (CCTV) Co**ntact Hour 2-3**						
Year:3 Term: 1	**Theoretical Content**			**Practical Content**		
Week	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
1 - 6	Define CCTV systems and explain their purpose in surveillance and security. Explain the basic principle of operation of	Explain the concept of CCTV and the purpose in surveillance and security Describe the basic principle of operation of closed-circuit television	White marker Board Multimedia Television Receivers Mini CCD	Describe the concept of CCTV system and the purpose in surveillance and security. Demonstrate how to	Guide the students to explain the principles of operation of CCTV systems and its purpose in surveillance and security. Demonstrate and guide	Voltage tester Multimeter Coaxial cable Tester Screw driver Wire striper

	closed-circuit television transmission and reception. Explain the history and evolution of CCTV system Explain the Explain the different types and advantages of CCTV camera IP-Base and Analog. Explain remote connection and its impotence	transmission and reception Explain the history and evolution of CCTV system.	Monitor Camera CCTV camera (IP-Base and Analog) Coaxial cable CAT5e/6e cables Video Balloon CCTV monitor RJ45 Plugs Clipping Tools Network routers	install closed circuit television employing one monitor. Describe the history and evolution of CCTV system	students to practice the following methods of fault finding and repairs in a closed-circuit Television: Physical Observation Signal Tracing Voltage Testing Component Testing Replacement Highlights the history and evolution of CCTV system	LAN Tester Coaxial cable Crimping Tool Ladder CCTV Tester Monitor Cable ties and clips etc
Course Specification: General Objective 2.0: Understanding the various types and components of a CCTV systems and their application Co**ntact Hour 2-3**						
	Theoretical Content			**Practical Content**		
Week	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
7-12	2.1 Describe the different types of CCTV systems, including: Analog CCTV systems Digital/IP-based CCTV systems Wireless CCTV systems PTZ (Pan-Tilt-Zoom) camera systems Thermal and infrared CCTV systems AI-powered smart surveillance systems. Solar powered CCTV 2.2 Explain the functions	Discuss how different types of CCTV systems can be identified using examples as listed in 2.1 Describe the functions of key CCTV components as listed in 2.2. Describe the working principles of analog and IP- based CCTV system. Discuss the difference between wired and wireless CCTV systems. Discuss the	Multimedia Video Pictorial of block diagram White board White board Multimedia White board White board	Demonstrates the different types of CCTV systems using some the examples as listed in 2.1 Describe the functions of key CCTV components as captured in 2.2. Discuss the working principles of analog and IP-based CCTV systems. Highlights the difference between wired and wireless	Guide the students to: describe different types of CCTV system as highlighted in 2.1. highlights the functions and features of key CCTV components as captured in 2.2 demonstrate the working principles of analog and IP-based CCTV systems. differentiate between wired and wireless CCTV systems, including their advantages and limitations.	Analog CCTV systems Digital/IP-based CCTV systems Wireless CCTV systems PTZ (Pan-Tilt-Zoom) camera systems Thermal and infrared CCTV systems AI-powered smart surveillance systems.

	of key CCTV components, including: Cameras (Dome, Bullet, PTZ, Infrared, etc.) Digital Video Recorders (DVR) and Network Video Recorders (NVR) Monitors and display units Cables and connectors (Coaxial, Ethernet, Fiber-optic) Power supply units and Power over Ethernet (PoE) technology Storage devices (HDD, SSD, Cloud storage). Explain the working principles of analog and IP-based CCTV systems. Explain the difference between wired and wireless CCTV systems, including their advantages and limitations. 2.5 Explain the application of various CCTV systems in different sectors, such as: Residential security Commercial and	application of various CCTV systems in different sectors, such as captured in 2.5		CCTV systems, including their advantages and limitations Describe the application of different CCTV systems in various sectors as listed in 2.5	highlights the application of various CCTV systems in different sectors as listed in 2.5	Multimedia Video Cameras (Dome, Bullet, PTZ, Infrared, etc.) Digital Video Recorders (DVR) and Network Video Recorders (NVR) Monitors and display units Cables and connectors (Coaxial, Ethernet, Fiber-optic) Power supply units and Power over Ethernet (PoE) technology Storage devices (HDD, SSD, Cloud storage).

	industrial surveillance Traffic and transportation monitoring Public safety and law enforcement Smart city applications. Spy CCTV camera					

Course Specification: General Objective 3.0: Understand the principle of CCTV system design and Installation techniques Co**ntact Hour 2-3**						
	Theoretical Content			**Practical Content**		
Week	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
13-20	3.1 Explain the fundamental principles of CCTV system design. 3.2 Explain the factors to consider when designing a CCTV system, including: Coverage area and field of view. Lighting conditions Camera placement and angles Resolution and image quality requirements Explain the difference between centralized and decentralized CCTV system architectures.	Discuss the fundamental principles of CCTV system design. Determine the factors to consider when designing a CCTV system, including: Coverage area and field of view Lighting conditions Camera placement and angles Resolution and image quality requirements Discuss the difference between centralized and decentralized CCTV system architectures.	Multimedia White board Multimedia White Board Multimedia White Board Multimedia White Board Hardware component cable and connectors mounting tools testing instruments CCTV Cables	Discuss the fundamental principles of CCTV system design. Mention the factors to consider when designing a CCTV system, including: Coverage area and field of view Lighting conditions Camera placement and angles Resolution and image quality requirements State the Difference between centralized	Guide students to: Identify the factors to consider when designing a CCTV system, including: Coverage area and field of view Lighting conditions Camera placement and angles Resolution and image quality requirements Differentiate between centralized and decentralized CCTV system architectures. select appropriate cameras, recorders, and other	Multimedia Voltage tester Multimeter Coaxial cable Tester Screw driver Wire striper LAN Tester Coaxial cable Crimping Tool Ladder CCTV Tester Monitor Cable ties and clips etc White board Dome camera

	Explain bandwidth and storage requirements for different CCTV setups. Demonstrate how to select appropriate cameras, recorders, and other components based on project requirements. Explain site plans and security risk assessments to develop an effective CCTV system layout. Explain the role of cybersecurity in CCTV system design, particularly in networked/IP-based systems. Identify the tools and equipment required for CCTV installation. Describe the step-by-step process of installing an analog and IP-based CCTV system. Describe proper cabling techniques, including: Coaxial cable installation for analog systems Ethernet cable crimping for IP cameras. Fiber optic cable usage for long-distance applications Explain how to configure and set up Digital Video	Describe bandwidth and storage requirements for different CCTV setups. Demonstrate how to select appropriate cameras, recorders, and other components based on project requirements. Describe site plans and security risk assessments to develop an effective CCTV system layout. Identify role of cybersecurity in CCTV system design, particularly in networked/IP-based systems. State the tools and equipment required for CCTV installation Discuss the step-by-step process of installing an analog and IP-based CCTV system. Demonstrate proper cabling techniques, including: Coaxial cable installation for analog systems Ethernet cable crimping for IP cameras. Fiber optic cable usage for long-distance applications Describe how to configure	White Board	and decentralized CCTV system architectures. Identify bandwidth and storage requirements for different CCTV setups. Describe how to select appropriate cameras, recorders, and other components based on project requirements. Demonstrate how to interpret site plans and security risk assessments to develop an effective CCTV system layout. Describe the role of cybersecurity in CCTV system design, particularly in networked/IP-based systems. Describe the tools and equipment required for CCTV installation Demonstrate the step-by-step process of installing an analog and IP-based CCTV system. Perform proper cabling techniques, including: Coaxial cable	components based on project requirements. Interpret site plans and security risk assessments to develop an effective CCTV system layout. State the role of cybersecurity in CCTV system design, particularly in networked/IP-based. systems Apply appropriate tools and equipment required for CCTV installation Carry out step-by-step the installation of analog and IP-based CCTV system. Carry out proper cabling techniques, including: Coaxial cable installation for analog systems Ethernet cable crimping for IP cameras. Fiber optic cable usage for long-distance applications configure and set up of Digital Video Recorders (DVR) and Network Video Recorders (NVR) Carry out proper mounting and positioning of CCTV cameras for optimal coverage how to configure network settings for remote access	Bullet Camera PTZ Camera Infrared (IR) Camera Wide-Angle or 4K Camera IP Camera Wireless Camera DVR NVR XVR + NVR Combo POE Switch PSU Cable Connector Monitor/Display UPS Multimeter Coaxial cable Tester Screw driver Wire striper LAN Tester Coaxial cable Crimping Tool Ladder CCTV Tester Monitor Cable ties and clips etc Training manual DVR NVR HDD (Hard Disk

	Recorders (DVR) and Network Video Recorders (NVR). Describe proper mounting and positioning of CCTV cameras for optimal coverage. Explain how to configure network settings for remote access and mobile monitoring of CCTV systems. 3.14 Explain the importance of grounding, surge protection, and weatherproofing in CCTV installations. 3.15 Explain how to conduct testing of installed CCTV systems to ensure proper functionality. 3.16 Explain safety guidelines and industry standards for CCTV system installation.	and set up Digital Video Recorders (DVR) and Network Video Recorders (NVR). Discuss proper mounting and positioning of CCTV cameras for optimal coverage Describe how to configure network settings for remote access and mobile monitoring of CCTV systems. Describe the importance of grounding, surge protection, and weatherproofing in CCTV installations. Discuss testing of installed CCTV systems to ensure proper functionality. Discuss safety guidelines and industry standards for CCTV system installation.		installation for analog systems Ethernet cable crimping for IP cameras. Fiber optic cable usage for long-distance applications Demonstrate configuration and setting up of Digital Video Recorders (DVR) and Network Video Recorders (NVR) Demonstrate proper mounting and positioning of CCTV cameras for optimal coverage Demonstrate how to configure network settings for remote access and mobile monitoring of CCTV systems. Discuss the importance of grounding, surge protection, and weatherproofing in CCTV installations. Demonstrate how to conduct testing of installed CCTV systems to ensure	and mobile monitoring of CCTV systems. State the importance of grounding, surge protection, and weatherproofing in CCTV installations. Carry out testing of installed CCTV systems to ensure proper functionality Observe safety guidelines and industry standards for CCTV system installation.	Drive) Camera PSU Cable Connector Monitor/Display Mouse/Keyboard UPS Router and Internet Connection Spirit Level Conduit bender(metallic) Wall Plugs Mounting Brackets Weatherproof Junction boxes Conduit and Cable Trays Waterproof Tape Surge Protectors Installation Manual DVR NVR HDD (Hard Disk Drive) Camera PSU Cable Connector Monitor/Display Mouse/Keyboard UPS Router and Internet

				proper functionality. Discuss safety guidelines and industry standards for CCTV system installation.		Connection Multimedia Chart Monitor Digital Video Recorder (DVR) CCTV Cameras Camera mounts and brackets Ethernet Cables Router and Modem Power Supply UPS
Course Specification: General Objective 4.0: Know the skills in troubleshooting and repairing faulty CCTV systems Co**ntact Hour 2-3**						
	Theoretical Content			**Practical Content**		
Week	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
21-30	4.1 Identify common faults in CCTV systems, including video loss, poor image quality, and connectivity issues. 4.2 Explain the step-by-step troubleshooting process for diagnosing CCTV system failures. 4.3 Explain how to use diagnostic tools such as multimeters, network testers, and signal analyzers in troubleshooting. 4.4 Explain how to replace	Explain common CCTV faults and there causes Describe the step-by-step troubleshooting process for diagnosing CCTV system failures Discuss the use of diagnostic tools such as multimeters, network testers, and signal analyzers in troubleshooting. Identify how to replace faulty CCTV components, including cameras, cables, power supplies, and	White board White board	Highlights the common CCTV faults and their causes. Describe the step-by-step troubleshooting process for diagnosing CCTV system failures Demonstrate the use of diagnostic tools such as multimeters, network testers, and signal analyzers in troubleshooting Demonstrate how to replace faulty CCTV components, including	Guide the students to: identify common CCTV faults and their causes. Apply diagnostic tools such as multimeters, network testers, and signal analyzers in troubleshooting. use diagnostic tools such as multimeters, network testers, and signal analyzers in troubleshooting how to replace faulty CCTV components, including cameras, cables,	

	faulty CCTV components, including cameras, cables, power supplies, and DVR/NVR units. 4.5 Explain the importance of firmware updates and software troubleshooting for digital CCTV systems. 4.6 Explain proper soldering and cable termination techniques for repairing damaged connections. 4.7 Describe preventive maintenance techniques to enhance the longevity of CCTV systems. 4.8 Implement cybersecurity measures to troubleshoot and prevent hacking or unauthorized access to networked CCTV systems.	DVR/NVR units. Discuss the importance of firmware updates and software troubleshooting for digital CCTV systems. Discuss proper soldering and cable termination techniques for repairing damaged connections. Describe preventive maintenance techniques to enhance the longevity of CCTV systems.		cameras, cables, power supplies, and DVR/NVR units. Demonstrate the importance of firmware updates and software troubleshooting for digital CCTV systems. Demonstrate proper soldering and cable termination techniques for repairing damaged connections in CCTV systems. Apply preventive maintenance techniques to enhance the longevity of CCTV systems. Demonstrate cybersecurity measures to troubleshoot and prevent hacking or unauthorized access to networked CCTV systems.	power supplies, and DVR/NVR units. How to carry out firmware updates and software troubleshooting for digital CCTV systems. Carry out proper soldering and cable termination techniques for repairing damaged connections in CCTV systems. Carry out preventive maintenance techniques to enhance the longevity of CCTV systems Apply cybersecurity measures to troubleshoot and prevent hacking or unauthorized access to networked CCTV systems	

Course Specification: General Objective 5.0: Understand how CCTV systems-work with other security systems Co**ntact Hour 2-3**						
	Theoretical Content			**Practical Content**		
Week	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
31-36	5.1 Explain the role of CCTV in an integrated security system. 5.2 Explain the different security systems that can be integrated with CCTV (e.g., alarm systems, access control, motion detectors, fire detection systems). 5.3 Explain how CCTV systems interact with intrusion detection systems to enhance security. 5.6 Explain how CCTV footage is used for real-time monitoring and forensic investigations. 5.8 Identify common challenges and solutions in integrating CCTV with other security systems.	Discuss the roles of CCTV in an integrated security system. Identify the different security systems that can be integrated with CCTV (e.g., alarm systems, access control, motion detectors, fire detection systems). Discuss how CCTV systems interact with intrusion detection systems to enhance security. Describe how CCTV footage is used for real-time monitoring and forensic investigations State common challenges and solutions in integrating CCTV with other security systems.	White board Multimedia Multimedia White board	Describe the roles of CCTV in an integrated security system. Discuss the different security systems that can be integrated with CCTV (e.g., alarm systems, access control, motion detectors, fire detection systems) Describe how CCTV systems interact with intrusion detection systems to enhance security. Demonstrate how CCTV footage is used for real-time monitoring and forensic investigations Outline common challenges and solutions in integrating CCTV with other security systems.	Guide the students to: Outline the roles of CCTV in an integrated security system. Outline the different security systems that can be integrated with CCTV (e.g., alarm systems, access control, motion detectors, fire detection systems). Perform some activities to show how CCTV systems interact with intrusion detection systems to enhance security. Perform some activities to show how CCTV footage is used for real-time monitoring and forensic investigations List common challenges and solutions in integrating CCTV with other security systems.	Alarms Systems Access Control Motion detectors Fire Detections System

TELEVISION

PROGRAMME:	**NATIONAL TECHNICAL CERTIFICATE IN ELECTRONICS SYSTEMS MAINTENANCE CRAFT PRACTICE**
MODULE:	CRT 16 □ Television
DURATION:	120 Hours
PRE-REQUISITE	
GOAL:	This module is designed to enable the trainee diagnose and clear faults of common types found in every section or stage in a Television set.

GENERAL OBJECTIVES:
On completion of this module the student should be able to:
1.0 Understand the principle of operation and maintenance of television transmitter
2.0 Understand the principles of operation and maintenance of color television receiver.
3.0 Know the basic principles of operation maintenance of LCD, LED, OLED and Plasma Television Receivers.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN ELECTRONICS SYSTEMS MAINTENANCE CRAFT PRACTICE						
COURSE: TELEVISION			**COURSE CODE: CRT 16**			**Year 2, Term 2 & Year 3, Term 2**
Course Specification: General Objective 1.0: Understand the principles of operation and maintenance of television transmitter. Contact Hour 2-3						
Year 2 Term 2	**Theoretical Content**			**Practical Content**		
Week	**Specific Learning Outcome**	**Teacher□s Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teacher□s Activities**	**Evaluation**
1-4	1.1 Explain the basic principles of operation of television transmitter. 1.2 Explain the function of each of	1.1 Describe the basic principles of operation of television transmitter. 1.2 Describe the function of each of the stages of the simplified block diagrams of the	□Video camera □Microphone □Simplified block diagram of television transmitter. □Multimedia □Marker	• Carry out a field • visit to • Television station. Identify the various sections of a Television	□Guide students to draw the simplified block diagram of television transmitter and use that to identify the stages and explain their functions for the	Explain simple basic principle of a television transmitter TV signals Mention 3 devices that can be used for transmitting

	the stages of the simplified block diagrams of the television transmitter, such as video, camera, microphone, video amplifier, AM modulator, Duplexer/combiner units	television transmitter, such as video, camera, microphone, video amplifier, AM modulator, Duplexer/combiner units etc. 1.3 Describe the importance of the following processes in generating, television signals: a. scanning	board/Magnetic board Textbook Charts Notes from excursion trip, Video clips	transmitter on a schematic Diagram Identify the various sections of a digital transmitter on a schematic diagram	basic operation of television transmitter. Guide students to identify the various sections of a transmitter	TV signals Identify the following sections of a transmitter: Video camera Microphone Video amplifier Describe with the aid of block diagram the functions of the following stages: Video camera Microphone
	etc. 1.3 Explain the working principles of Digital Television Transmitter	modulation amplification 1.4 Guide students to draw the block diagram of a digital TV Transmitter and describe the function of each section				iii. Video amplifier
Year 3 Term 2	**General Objective 3.0: Understand the principles of operation and maintenance of Cathode Ray Tube (CRT)color television receiver. Contact Hour 1-4**					
Week	**Specific Learning Outcome**	**Teacher□s Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teacher□s Activities**	**Evaluation**
11-15	3.1 Explain the principle of operation of color television receiver in relation with the color systems. 3.2 Explain the	3.1 Describe the principle of operation of color television receiver in relation with the color systems. 3.2 Discuss the principle of calorimetry as follows:	Multimedia Color television receiver set Chalkboard/Magnetic board Marker Lesson note	Demonstrate with color chart how the primary colors can be added to obtain any other color. • Identify the External Features of	Guide students to draw the color chart and use it to explain colour mixing.	Mention the primary colors Explain the section that is responsible for color operation in a CRT color television. Identify a colour

	principle			CRT Color Television receiver		decoder circuit in a colour
	of calorimetry as follows: a. primary colours: red, green and blue complimentary colours: magenta, cyan, yellow, white. 3.3 Describe the principle of operation of the following section in a colour television receiver: power supply tuner	primary colours: red, green and blue complimentary colours: magenta, cyan, yellow, white. 3.3 Discuss the principle of operation of the following section in a colour television receiver: power supply tuner circuit IF sound section video section horizontal and vertical circuits f. chrome band pass etc	□Chart □Block diagram of colour television receiver.	Dismantle a color CRT Television Receiver Assemble a Color CRT Receiver Identify the following sections of CRT Color Television Receiver: Power Supply RF Mixer IF Video Audio section Horizontal and Vertical Sections Control Circuit • Demonstrate the following fault finding and repairs		television. • Identify the following sections in a colour a TV set: power supply tuner circuit IF sound section video section horizontal and vertical circuits f. chrome band pass amplifier etc, • Demonstrate the following methods of fault finding and repairs **in a** closed-
	circuit IF sound section video section horizontal and vertical circuits f. chrome band pass amplifier etc,			methods in various sections of a Television receiver: Physical observation Signal Tracing Voltage Testing Components Testing		circuit Television: Physical Observation Signal Tracing Voltage Testing Component Testing Replacement

Year 3 Term 2	**General Objective 4.0: Know the principles of operation and maintenance of Liquid Crystal Display (LCD), Light Emitting Diode (LED), Organic Light Emitting Diode (OLED) and Plasma Television Receivers. Contact Hour 1-4**					
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Evaluation**
16-24	4.1 Explain the Working principles of the following Television receivers: LCD LED OLED Plasma Smart 4.2 Explain the principles of operation of the following sections of LCD/	Describe using video clips/ charts the Component parts and functions of the following television sets: LCD LED OLED Plasma Smart	Analogue Multimeter LCD, LED/ OLED and Plasma Sets LED Back Light Tester Digital Microscope Bonding Machine White board/Magnetic board Marker Multimedia Charts	Identify front and Back Panel controls of LCD/ LED/OLED and Plasma Television sets Dismantle LCD/LED/OLE and Plasma Television Identify the Various Boards of LCD/LED/OLE and Plasma Televisions Identify the following ICs in LCD/LED/OLE D and Plasma Televisions:	Guide Students to demonstrate simple troubleshooting techniques. Demonstrate how to troubleshoot and repair switched mode power supply. Demonstrate how to carry out voltage testing in television receiver Demonstrate how to carry out signal tracing in television receiver Demonstrate how to carry out component	Explain the Principle of Operation of the following Television sets: LCD LED OLED Plasma Smart • Describe the functions of the following Boards in LCD / LED/ OLED and Plasma Television sets: -Power supply Processor Board T Con Board
	LED/OLED TV: - Power supply - Processor Board T Con Board -Remote Receiver Inverter Board -Video/ Control		Multimeter Oscilloscope LCD/ LED/ OLED and Plasma television sets schematic diagrams Soldering iron Desoldering pump	Micro processor RAM iii. ROM iv. Audio 8pin MOSFET Voltage Regulator Identify Faulty	testing in television receiver. Guide students to diagnose and rectify faults in LCD, LED. OLED and Plasma TV based on the following	-Remote Receiver Inverter Board -Video/ Control Board Main/ Mother Board Identify the following ICs in LCD/

	Board Main/ Mother Board 4.3 Explain the symptoms and Problems associated with the following Boards of LCD/ LED/		□Air blowing machine □Assorted components such as: Resistor, Capacitor, Transistors, Diac, Triac etc. □Soldering lead Pattern generator □colour bar generator signal tracer TV analyzer	Components by Observation in LCD/ LED/OLED and Plasma Television sets Assemble the various parts of LCD/ LED/ OLED and Plasma Television sets	methods: Visual inspection Signal tracing - D.C voltage measurement - Component testing - replacement.	LED/OLED and Plasma Television sets: Microproc essor RAM ROM Audio 8□pin MOSFET Voltage Regulator Identify the differences between LCD/LED/OL ED and Plasma TV sets. Identify the following boards in the LCD/LED/OL ED and Plasma TV sets: Power supply
	OLED and Plasma Television sets: Power supply - Processor Board T Con Board -Remote Receiver Inverter Board -Video/ Control					Processor Board iii. T Con Board iv.-Remote Receiver v. Inverter Board vi. Video/ Control Board vii. Main/Mother Board Replace an LED on the backlight strips.

	Board Main/ Mother Board					Show how to Troubleshoot problems and fix them in the following Boards of LCD/ LED/ OLED Television sets: i. Power supply
						ii. Processor Board iii. T Con Board iv. -Remote Receiver v. Inverter Board vi. -Video/ Control Board v Main/ Mother Board

ELECTRICAL/ELECTRONIC DRAWING

PROGRAMME:	National Technical Certificate in **Electronics Systems Maintenance Craft Practice**
MODULE:	CTD 14 - Electrical/Electronic Drawing
DURATION:	96 Hours
PRE-REQUISITE	CTD 11-13
GOAL:	This model is designed to enable the trainee understand the basic electrical/electronic symbols and diagrams
GENERAL OBJECTIVES: On completion of this model the students should be able to: Understand the principles and applications of block and flow diagrams in circuit development Understand the meaning and applications of Electronics component symbols. Understand the meaning and applications of Electrical component symbols.	

PROGRAMME: NTC IN ELECTRONICS SYSTEMS MAINTENANCE CRAFT PRACTICE						
COURSE: ELECTRICAL/ELECTRONICS DRAWING			Course Code: CTD 14			Year 1, Term 2 & 3
Course Specification: General Objective 1.0: Understand the principles and applications of Block and Basic Diagrams in Circuit Development. Contact Hour 1-2						
Year 1 Term 2	**Theoretical Content**			**Practical Content**		
Week	**Specific Learning Outcome**	**Teacher□s Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teacher□s Activities**	**Evaluation**
1-6	1.1 Explain the purposes of block and flow diagrams and logic diagrams. 1.2 List symbols used in the preparation of block and logic diagrams e.g. block, circle, summing points and take-off points 1.3 Explain the	1.1 Describe the purposes of block and flow and logic diagrams. 1.2 Illustrate symbols used in the preparation of block and flow diagram. 1.3 Describe how to plan an	□White Marker Board/Magnetic board □ Drawing Instruments Schematic diagrams □Models Electronic Workbench Multimedia □Scientech innovative	Demonstrate how blocks flow and basic diagrams can be used to describe flow of information. Draw different types of symbols used and sequence of arrangements when drawing	Guide students by explaining how blocks flow and basic diagrams can be used to describe flow of information. Guide students to draw different types of symbols used and sequence	Classify block symbols in terms of input, process and output. Draw the block diagram of radio receiver (AM/FM). □Draw block and flow diagrams for the fault finding in television receiver

	processes in producing block and flow diagrams. 1.4 Describe drafting procedures for preparation of	arrangement of block symbols to produce intelligible block and flow diagrams. 1.4 Discuss drafting	workbench ESD antistatic	block, flow and logic diagrams • Draw block diagrams for the following electronic	of arrangements when drawing block, flow and logic diagrams	
	easily understood block diagrams. 1.5 Explain the elements of logic symbols diagrams	procedure for preparation of easily understood block diagrams. 1.5 Describe the elements of logic symbols diagrams 1.6 Illustrate block diagrams for the following electronic systems: Radio, Colour Television, etc. 1.7 Illustrate flow diagrams for typical industrial production.	workbench E.E. training workbench	systems: Radio, Colour Television, etc. • Draw flow diagrams for typical fault finding in radio receiver, television receiver and Closed Circuit Television		
Year 1 Term 2	**General Objective 2.0: Understand the meaning and applications of Electronic Components Symbols. Contact Hour 1-2**					
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Evaluation**
7-12	2.1 Explain the need for electronic symbols and schematic diagrams.	2.1 Describe the need for electronic symbols and schematic	White Marker board/Magnetic board Drawing	Draw the electronic symbols of some electronic components	Guide Students to: Draw the electronic symbols of some electronic	• Draw symbols of commonly used electronic components. Draw a simple circuit

		2.2 Explain the basic functions of commonly used electronic components e.g. diodes, transistors, capacitors, ICs etc. 2.3 Relate component symbols shape of components and their functions. 2.4 Explain the use of electronic workbench. 2.5 Explain how to convert a breadboard circuit into a proper schematic diagram.	diagrams. 2.2 Describe the basic functions of commonly used electronic component. 2.3 Describe component symbol, shape of components and their functions. 2.4 Describe the use of electronic workbench. 2.5 Describe how to convert a bread-board circuit into a proper schematic diagram.	Instruments Electronics components □Models □Drawing Sheets □Pencil □Eraser Dedicated Internet Service Prepared drawings. □Laptop/Desktop Schematic diagram Electronic workbench	Produce sketches of physical structures of common components e.g. Resistors, Capacitors, Transformers, Diodes, Transistors variable resistors, potentiometer, switches, batteries, microphone. □Draw objects using electronic workbench. □Draw the following electronic circuits using standard symbols: single	components □Learn to produce sketches of physical structures of common components e.g. Resistors, Capacitors, Transformers, Diodes, Transistors variable resistors, potentiometer, switches, batteries, microphone. □Draw objects using electronic workbench software. □Draw the	of transistor amplifier using electronic workbench. □Convert a single stage amplifier breadboard circuit into a proper schematic diagram.
				software □Pencil and eraser □Breadboard	stage, common emitter amplifier, 2-stage common emitter amplifier, power supply unit receiver circuit, etc. □Identify the basic circuits, which make up a complete electronic device.	following electronic circuits using standard symbols: single stage, common emitter amplifier, 2-stage common emitter amplifier, power supply unit, circuit receiver circuit, etc. □ Draw a simple amplifier circuit.	

Year 1, Term 3	**General Objective 3.0: Understand the meaning and applications of Electrical components symbols. Contact Hour 1-4**					
Week	**Specific Learning Outcome**	**Teacher□s Activities**	**Learning Resources**	**Specific Learning**	**Teacher□s Activities**	**Evaluation**
				Outcome		
13-24	3.1 Develop consistency in components cache or reference location on the schematic diagram. 3.2 Explain the differences between industrial wiring and residential wiring diagrams compared to electronic wiring diagrams. 3.3 Explain how to read industrial control wiring diagrams 3.4 Identify electrical symbols used in power distribution diagrams. 3.5 Explain the basic principles of operations of electrical protective devices using their circuits. 3.6 Explain the	3.1 Describe consistency in components cache or reference location on the schematic diagram. 3.2 Describe the differences between industrial wiring and residential wiring diagrams compared to electronic wiring diagrams. 3.3 Describe how to read industrial control wiring diagrams 3.4 Illustrate electrical symbols used in power distribution diagrams. 3.5 Describe the basic principles of operations of electrical	White board marker/Magnetic board □ Schematic diagram. □ Drawings Single line diagram List of electrical symbols drawing. Plan of a house. □Switches □Consumer unit □Wiring diagram, □13A socket outlets □30A fuse and Link □2.5mm^2 cable. □Drawing instruments □Laptop/ Desktop □Wiring Diagram of	Demonstrate to students how to draw a schematic diagram. Draw a schematic diagram and single line diagram. □ Draw a simple plan of a room with its electrical fittings.	Guide the Students to draw a schematic diagram. Guide the students to differentiate between schematic and line diagram. □ Guide the students to draw a simple plan of a room with the electrical fittings using AutoCAD.	• Draw a plan of a • two-bedroom flat • and fix all necessary • electrical fittings. Draw the symbols of the following electrical components: Switches consumer units, 13A sockets, fan regulators, switches, consumer units, change over, cooker control units. Identify some protective devices e.g. fuse, isolators, circuit breakers, change overs etc. Draw the wiring diagram of one point of light.
	difference between schematic and single line diagrams 3.7 Identify electrical symbols used in architectural plans 3.8 Explain how basic	protective devices using their circuits. 3.6 Describe the difference between schematic and single line diagrams	a house. AutoCAD software 1.5mm^2 PVC cables □4mm^2 multi/single core cable			

	lighting circuits are wired. 3.9 Explain how to determine the wire size needed under different load conditions.	3.7 Illustrate electrical symbols used in architectural plans 3.8 Describe how basic lighting circuits are wired. 3.9 Describe how to determine the wire size needed under different load conditions.	earth electrodes			

EVALUATION GUIDE

Students Assessment should be based on assignments, test, his ability to carry out projects on electrical design on building plans, reading of schematic diagrams and recognition of electronic and electrical component symbols.

ADVANCED COURSES
DIGITAL TELEVISION SYSTEM

PROGRAMME:	Advanced National Technical Certificate in **Electronic Systems Maintenance Craft Practice**
MODULE:	CRT 21 - Color Television
DURATION:	300 Hours
PRE-REQUISITE	CRT 16
GOAL:	This course is intended to provide the trainee with knowledge and skills to enable him install, and maintain Color television set.

GENERAL OBJECTIVES:
On completion of this module, the trainee should be able to:
1.0 Understand the principle of operation and maintenance of Digital Television transmission
2.0 Understand the principle of operation and maintenance of Digital Television reception
3.0 Understand the principle of operation and maintenance of Smart Television

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE INELECTRONICS SYSTEMS MAINTENANCE CRAFT PRACTICE						
COURSE: CRT 21: DIGITAL TELEVISION SYSTEM			**Course Code: CRT 21**			**Year 1, Term 1,2 & 3**
Course Specification: General Objective: 1.0 Understand the principle of operation and Maintenance of Digital Television transmission**. Contact Hours 3-6**						
Year 1 Term 1	**Theoretical Content**			**Practical Content**		
Week	**Specific Learning Outcome:**	**Teacher□s Activities**	**Learning Resources**	**Specific Learning Outcome:**	**Teacher□s Activities**	**Evaluation**
1-8	1.1Define Digital Television Transmission 1.2 List the standards for Digital Television	1.1 Discuss the principle of operation of digital television transmission. 1.2 Discuss the principle of operation of digital	□Multimedia □Chart □Magnetic board/White board	Carry out a field trip to a television station employing Digital transmitter Dismantle Digital transmitter training Kit Assemble Digital	Organize Field trip and Guide Students to dismantle and assemble a digital transmitter	Explain Digital Television transmission? List the Standards for Digital television transmission Carry out Field Trip to a television station employing digital transmission

	transmission 1.3 Explain Digital Modulation Techniques (ASK, FSK, PSK etc.) 1.4 Describe the principle of operation of digital television transmission 1.4 Explain the principles of operation of the following circuits in digital television transmission: Micro controller and Decoder DRAM Audio Decoder CA module MPEG Audio Decoder Transport &PAL Encoder 1.5 Describe the various types of Antennas for digital television transmission.	television transmission 1.3 Describe the principles of operation of the following circuits in digital television transmission: Micro controller and Decoder DRAM Audio Decoder CA module MPEG Audio Decoder Transport &PDAL Encoder Describe the difference in digital and analogue antenna in terms of frequency and the following types: Log period antenna Multi yagi Antenna. Disc	Marker Digital Transmitter training kit Digital Tv receiver kit Schematic diagrams Logic probe Logic pulser Multimeter	transmitter training kit Identify the various sections of a digital transmitter training kit carry out fault finding and repairs in the following sections of digital television transmission Training kit: Microcontroller and decoder circuits C.A. module DRAM Audio Decoder MPEG Audio Decoder Transport PAL Encoder Microprocessor	Kit Guide students to identify parts of a digital transmitter kit and troubleshoot and fix different types of faults in a transmitter Demonstrate and Guide students to practice fault finding and repairs in the following sections of digital transmitter: Microcontroller and decoder circuits C.A. module DRAM Audio Decoder MPEG Audio Decoder Transport PAL Encoder Microprocessor	Describe digital modulation technique Explain the principle of operation of digital television system Describe the functions of the following circuits in digital television transmitter: Micro controller DRAM Audio Decoder CA module Transport and PAL encoder

Term 2	**General Objective: 2.0** Understand the principle of operation and maintenance of Digital Television receiver**. Contact Hours 2-6**					
Week	**Specific Learning Outcome:**	**Teacher□s Activities**	**Learning Resources**	**Specific Learning Outcome:**	**Teacher□s Activities**	**Evaluation**
9-22	2.1 Define Digital Television reception 2.2 Explain the functions of the following units of Digital Television receiver: Turner Demodulation LNB 2.2 Explain the principle of operation of digital television receiver 2.3 Explain the principles of operation of the following circuits in digital television receiver: Micro controller and Decoder DRAM Audio Decoder CA module MPEG Audio Decoder Transport	2.1 Discuss the principle of operation of digital television receiver. 2.2 Discuss the functions of the following units in digital television receiver: Turner Demodulator LNB 2.3 Describe the principles of operation of the following circuits in digital television receiver: (a) Micro controller and Decoder DRAM Audio Decoder CA module MPEG Audio Decoder Transport &PAL Encoder 2.4 Describe the features of the common types	□Multimedia □Chart □Magnetic board/Marker board □Digital Tv receiver kit □Schematic diagrams □Logic probe □Logic pulser □Multimeter	Demonstrate how to Dismantle a digital television receiver Demonstrate how to assemble a dismantled digital television receiver identify the various sections of a digital television receiver on the PCB/ SMB Carry out fault finding and Repairs through visual inspections in a digital television receiver Identify the various types of IC chipsets on the PCB of digital television receiver Show how to find faults and repair in the following units of the digital television receiver: Turner Demodulator LNB	Demonstrate and Guide Students to practice: Dismantling digital television receiver Assembling digital television receiver Identifying the various units of digital television receiver Carry out fault finding and repairs of different problems	What is digital television reception? State the functions of the following units of digital television receiver: Turner Demodulator or LNB Describe the common types of chipsets of digital television receivers Demonstrate the following fault finding and repairs in digital television receiver Turner Demodulator LNB

	&PAL Encoder 2.4 List the common types of chipsets and their features for digital television reception (ST STB6100, ST STB0899, Conexant CX24118A etc.) 2.5 Explain the various types of faults and symptoms associated with digital television receiver 2.6 Explain safety rules in handling digital television receivers	chipsets in digital television receivers 2.5described the various types of faults and symptoms associated with digital television receiver 2.6 describe safety rules in handling digital television receivers				
Term 3	**General Objective: 3.0** Understand the principle of operation and maintenance of Digital Smart Television Receiver**. Contact Hours 2-6**					
Week	**Specific Learning Outcome:**	**Teacher□s Activities**	**Learning Resource**	**Specific Learning Outcome:**	**Teacher□s Activities**	**Evaluation**
23-36	3.1 Define Smart Tv 3.2 State the following classifications of Smart	3.1 Discuss the process of fault finding and	□Multimedia □Chart □Screwdrivers □Digital Tv	Set up smart television for operation Carry out the dismantling and assembling of back	Guide students to practice setting up smart television Guide students to practice dismantling and assembling	i. What is a smart i. television? i. State the types of v. smart television

	Tv Resolution; 4K Ultra HD, Full HD and HD. Display Technology; LCD, LED and OLED Smart TVs. Software Platform; LG **Web OS** Turner Demodulator • LNB: **Samsung Tizen**: **Firefox OS** 3.3 State the advantages and disadvantages of Smart Tv 3.4 Describe following types of Smart TV, iTV of Apple, Android TV 2.0 of Google, and Smart HUB of Samsung. 3.5 Describe the failure associated with the following boards: Backlight Inverter board Timing Control Unit (T-Con) Board Main board Power supply board IR sensor Keypad controller Remote receiver	transmitting in Digital television transmitter 3.1 Discuss the process of fault finding and reception in Digital television receiver	receiver kit Schematic diagrams Logic probe Logic pulsar Multimeter Pliers Soldering iron Lead Lead sucker Air blower Magnify lens Rework Station Allen key Station Allen key	panel of smart television receiver Identify the Boards in a smart television receiver Testing of component such as: PC Isolator LEDs Cold Cathode fluorescent lamp Dry joint check Use SMD Rework station Troubleshooting internet connectivity problems in smart TV Troubleshoot the various Boards in smart Television Troubleshoot the various Boards in smart Television	of the back panel of smart television Guide students to practice identification of various boards inside smart television receiver Demonstrate how to carry out fault finding and repairs in the following sections of digital television transmission: Microcontroller and decoder circuits C.A. module DRAM Audio Decoder MPEG Audio Decoder Transport PAL Encoder Microprocessor • Demonstrate how to test components such as: PC Isolator LEDs Cold Cathode fluorescent lamp Dry joint check Decoder MPEG Audio	v. Carry out fault finding i. and repairs methods in i. the following boards i. in a digital color television: Backlight Inverter board Timing Control Unit (T-Con) Board Main board Power supply board IR sensor Keypad controller Remote receiver Rating scale

RADIO AND ELECTRONIC SYSTEMS

PROGRAMME:	Advanced National Technical Certificate in **Electronics Systems Maintenance**
MODULE:	CRT 22 - Radio and Electronic Systems
DURATION:	240 HRS
PRE-REQUISITE	CRT 14
GOAL:	The course is intended to provide the trainee with the knowledge and skill to enable him install, assemble and repair FM receivers, and double super-heterodyne receivers set.

GENERAL OBJECTIVES:
On completion of this module, the trainee should be able to:
Understand the working principles and maintenance of FM radio receiver.
Understand the working principles and maintenance of a double super-heterodyne receiver
Know the principles of operation and maintenance of audio and video equipment.

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE IN ELECTRONICS SYSTEMS MAINTENANCE						
COURSE: RADIO AND ELECTRONIC SYSTEMS			**Course Code: CRT 22**			**Year 1, Term 1. 2 & 3**
Course Specification General Objective: 1.0 Understand the working principles and maintenance of FM radio receiver. **Contact Hour 3-6**						
Year 1 Term 1	**Theoretical Content**			**Practical Content**		
Week	**Specific Learning Outcome:**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome:**	**Teachers Activities**	**Evaluation**
1-10	1.1 Explain the working principles of an FM radio receiver. 1.2 Explain alignment in AM & FM receivers. 1.3 Explain alignment in RF and	1.1 Discuss the working principles of an FM radio receiver. 1.2 Discuss alignment in AM and FM receivers. 1.3 Discuss alignment in RF & IF sections of radio receiver.	Chart Multimedia Magnetic board White Board/ Marker Alignment kit Signal Generator Recording headset Pictorial chart	Demonstrate how to measure the sensitivity and selectivity of a radio receiver.	Guide Students to: Demonstrate how to measure the sensitivity and selectivity of a radio receiver.	Explain the working principle of an FM radio receiver. Explain the term Stereophonic. Explain alignment in AM and FM radio receivers.

	IF sections of radio receiver					measure the sensitivity of an AM radio receiver.

Term 2	**General Objective 2.0: Understand the working principle and maintenance of double super heterodyne radio receiver. Contact Hour: 3-5**					
Week	**Specific Learning Outcome:**	**Teachers Activities**	**Learning Resources**	**Specific Learning Outcome:**	**Teachers Activities**	**Evaluation**
11-20	2.1 Explain the working principles of a double super heterodyne radio receiver 2.2 Draw and interpret the block diagram of a double super heterodyne radio receiver. 2.3 Clear faults due to adjacent channel interference.	2.1 Discuss the working principles of a double super heterodyne radio receiver 2.2 Illustrate and interpret the block diagram of a double super heterodyne radio receiver. 2.3 Illustrate how to Clear faults due to adjacent channel interference.	Double super heterodyne radio receiver set. Block diagram of double super heterodyne radio receiver. Alignment kit, Non-magnetic screw driver etc. White Board Marker	Demonstrate the working principles of a double super heterodyne radio receiver.	Guide Students to: Demonstrate the working principles of a double super heterodyne radio receiver.	Explain with the aid of a block diagram a double super heterodyne receiver.
Term 2 21-28	2.4 Operate different types of FM radio receiver, amplifiers and	2.4 Illustrate how to operate different types of FM radio receiver, amplifiers and equalizers	Tools Amplifiers set Radio set Video Measuring	Carryout a repair on FM radio receivers, amplifiers and	Guide students to demonstrate repairs on FM radio receiver, amplifiers and	Explain how to diagnose FM radio receivers, amplifiers and
	equalizers 2.5 explain how to repair and service radio receiver, amplifier and	2.5 Describe how to Repair and service stereo receiver, amplifier and equalizers	instrument: oscilloscope, multimeter, function generators, signal tracer	equalizers. Demonstrate to students how to repair and service radio receivers,	equalizers. Guide the students on how to repair and service radio receivers, amplifiers and	equalizers. Demonstrate how to clear faults due to adjacent channel

	equalizers 2.6 explain how Operate different instruments needed for servicing and maintenance of stereo sets.	2.6 Describe how to operate different instrument needed for servicing and maintenance of radio sets.	Air blower Work Station	amplifiers and equalizers.	equalizers	interference. Explain how to repair and service FM radio receivers, amplifiers and equalizers.
Term 3	**General Objective 3.0: Understand the principle of operation and maintenance of audio and video equipment.** **Contact Hours: 2-5**					
Week	**Specific Learning Outcome:**	**Teacher□s Activities**	**Learning Resources**	**Specific Learning Outcome:**	**Teacher□s Activities**	**Evaluation**
29-36	3.1 explain the features of CD/DVD. 3.2 Explain the types of	3.1 Discuss the features of audio CD 3.2 Describe the types of CD	Chart Multimedia □White board/Magnetic	□Demonstrate how to carry out the following preventive maintenance in CD and DVD:	Guide Students to: □Demonstrate how to carry out the following preventive maintenance in CD	Explain the difference between CD and DVD Plates. Explain how
	CD/DVD 3.3 Explain the types of optical pickup devices 3.4 Explain preventive maintenance to be carried out on CD/DVD players. 3.5 Explain some common problems and possible causes of malfunctions in CD/DVD systems.	3.3 Discuss the types of optical pickup devices 3.4 Discuss some preventive maintenance to be carried out on CD/DVD players. 3.5 Describe some common problems and possible causes of malfunctions in CD/DVD systems.	board □Precision screw driver □Some alcohol □Degreaser □Contact cleaner □High oil and greaser □Multimeter □Oscilloscope □Laser power meter □Loud speaker □Frequency counter □VOM or multimeter service	CD lens cleaning How to repair scratched CD Proper handling of CD and DVD. □Demonstrate how to troubleshoot CD and DVD. □Demonstrate how to carry out servo system adjustment □List the motors in CD and DVD players	and DVD: CD lens cleaning How to repair scratched CD Proper handling of CD and DVD. □Demonstrate how to troubleshoot CD and DVD. □Demonstrate how to carry out servo system adjustment □List motors in CD and DVD players	to replace the lens of a CD/DVD player. □ Conduct the cleaning of CD/DVD lenses. □ Carry out servo system adjustment of a DVD player. □ Carry out alignment of the optical pick up assemblies.

			manual Schematic diagram or servicing manual Allen key Variable DC power supply Assorted test leads Air blower Work Station.	Demonstrate how to carry out alignment of optical pick ups Demonstrate how to test optical pickup assemblies.	Demonstrate how to carry out alignment of optical pick ups Demonstrate how to test optical pickup assemblies.	

GUIDELINES FOR TEXTBOOK WRITERS

The following guidelines are suggestions from the Engineering Committees to the writers of the textbooks for the new curricula. They are intended to supplement the detailed syllabuses which have been produced, and which define the content and level of the courses.

Authors should bear in mind that the curriculum has been designed to give the students a broad understanding of applications in industry and commerce, and this is reflected in the curriculum objectives.

One book should be produced for each syllabus
Page size should be A4
The front size should be 12 points for normal text and 14 point where emphasis is needed.
The front size should be 12 points for normal text and 14 point where emphasis is needed.
Line spacing should be set to 1.5 lines
Headings and subheadings should be emboldened
Photographs, diagrams and charts should use extensively throughout the book, and these items must be up-to-date

In all cases the material must be related to industry and commerce, using real life examples wherever possible so that the book is not just a theory book. It must help the students to see the subject in the context of the ´real word

The philosophy of the courses is one of an integrated approach to theory and practice, and as such the books should reflect this by not making an artificial divide between theory and practice.

Examples should draw from Nigeria wherever possible, so that the information is set in a country text.
Each chapter should end with student self-assessment questions (SAG) so that students can check their own master of the subject.
Accurate instructions should be given for any practical work having first conducted the practical to check that the instructions do indeed work.
The books must have a proper index or table of contents; a list of references and an introduction based on the overall course philosophy and aims of the syllabus.

Symbols and units must be listed and a unified approach used throughout the book.
In case of queries regarding the contents of the books and the depth of information, the author must contact the relevant curriculum committee via the National Board for Technical Education.
The final draft version of the books should be submitted to Nigerian members of the curriculum working groups for their comments regarding the content in relation to the desired syllabus.

List of Books and References

Electronics Engineering Fundamentals Vols. 1 and 2 - Engr. Mrs. T.O. AdeifeOsemeikhian (1998) Oshogbo, Nigeria.
The Art of Electronics - Paul Horowitz (1996) Cambridge, London.
Introductory Electricity and electronics - John Watson (1989) Macmillan, London.
Semiconductor Essentials-Stephen Kamichael
Power Supplies Project for the Hobbyist and Technician-David Eines
Simplifying Power Supply Technology-Rayesh Shah
Basic Electricity Revised Edition Complete Course-Van Valkenburgh, Neville, Inc.
Basic Solid-state Electronics Revised Edition- Van Valkenburgh, Neville, Inc.
Introduction to Micro processor theory & operation-J.A. Sam Wilson and Joseph Risser
Test procedures for Basic Electronics-Irving M. Gottlieb
Basic Principles of Semiconductors- Irving M. Gottlieb
Basic Radio Television and Electronic Work Service-K.F. Ibrahim
Davidson, H.L., (1987) Troubleshooting and Repairing Compact Disc U.S.A: TAB Books.
Basic Electronics Troubleshooting and Repair.
Electronics Repair by Jestine Yong
Testing Electronics Components by Jestine Yong
LED Television Repair by HumpreyKimathi
Smart OLED/LED/LCD/Plasma TV Repair Tips by Kent Liew.
Signal and Image Processing Source-book. Springer Science and Business Media. By Libbey, Robert.
Principle of Electronic by Ganguly, Partha Kumar
Radio Receiver Technology by Rudersdorfer, Ralf
The Design of CMOS radio frequency Integrated Circuits 2nd edition by Lee, Thomas H 23. Radio Receiver Design by Dixon, Robert.
Electronic Systems Maintenance Handbook 2nd Edition- Routledge.
Troubleshooting Electronic Equipment 2nd Edition repair and Maintenance. Dr R.S. Khandpour
Troubleshooting consumer electronics by Homer L Davidson. New York: McGraw hill
Consumer Electronics Components, Homer L Davidson, New York, McGraw Hill
Troubleshooting and Repairing consumer electronics, 2004, New York: McGrawHill

List of Laboratories/workshops

1. Physics Laboratory
2. Radio, TV,
3. Satellite and Electronics Lab.
4. Chemistry
5. Metal Work.

6 Technical Drawing Lab

List of Equipment

S/N	DESCRIPTION OF ITEMS	QUANTITY REQUIRED
	TOOLS	
1.	Sets of Screw Drivers: Flat, Large, Medium and Small Philips	10 sets of each
2.	Sets of Spanners- Box: Flat and Ring	10 sets of each
3.	Side Cutters	20
4.	Wire Strippers	20
5.	Long Nose Pliers	20
6.	Combination Pliers	20
7.	Tweezers	20
8.	Files: Smooth, Medium and Coarse	20 each
9.	Electric Drill with Set of Bits	2
10.	Hand Drills with Bits	5
11.	Soldering Irons (Electric) with Stands	20
12.	Wireless Soldering Iron	20
13	Trimming Tools (Alignment)	6
14.	Electrician Knife	20
15.	Hammer	20
16	Wrench	20

	INSTRUMENTS, EQUIPMENT AND MACHINES:	
17.	Meters: Multimeter Analogue Digital Wattmeter Digital RLC meter Galvanometer	 20 20 6 6 6
18.	Signal Generators: AF Generator RF Generators IF Generator(sweep), 455KHz, 10.7MHz, 36.5MHz Pattern Generator TV Analyzer Signal Tracer	 6 6 6 6 6 6
19.	Oscilloscope: with 100MHz BW & facilities for extension triggers (Dual Trace).	10
20.	Frequency counter up to 300MHz capacity	6
21.	Variable DC Power Supply Unit (short- Circuit Protected)	10
22.	Variable Output Auto-Transformer	10
23.	Isolation Transformers	10
24.	Loop Antenna	10
25.	Multi-Element TV Antenna	10
26.	Computer projector	3
27.	Laptop computer	6
28.	Illustration Colour Chart (Several Colour	Several
	Chart)	
29.	Analogue/Digital Radio Set (AM/FM)	3 each
30.	Electronic sets: LED LCD Plasma Smart T V	 10 10 10 10

	CRT Color TV CD Player DVD Player Closed Circuit Television Trainer	10 10 10 10
31.	Microphones	10
32.	Amplifiers Mono	10
33.	Amplifiers Stereo	10
34.	Earphones and Headphones [Wireless]	20
35.	Loud speakers: Large, Medium and Low Power	3 each
36	Transmitter Training Kit (Digital)	20
37	Modulator Training kit	20
38	AM/ FM Radio training kit	10
39	CRT Television training kit	10
40	LED Training kit	10
41	Plasma Television Training kit	10
42	Smart Television Training kit	
43	Magnifying Lens	20
44	Allen Key	20 Sets
45	Lead Sucker	20
46	Optical Visor with Light	20
47	Variable Temperature Soldering iron	20
48	Smart Tweezers	20
49	Insulator Tester	20
50	Soldering Tip Cleaner	20
51	Chip Quick SMD Removal Kit	20
52	Digital Capacitance Tester	10
53	Leak Sucker Tester	10
54	Nut Screw Driver	10
55	Bonding Machine	6
56	Air Blower	3
57	Wrenches	3
58	PA System	3

59.	Soldering station	20
60.	Desoldering station	20
61.	Hot glue gum	20
62.	Heat shrink tubing	20
63.	Colour bar generator	20
64.	Satellite finder	20
65.	Computer sets	5

66.	Innovative work bench software□s: Sinetech innovative workbench ESD antistatic workbench E.E. training workbench	5 5 5 5
67	Digital hand drill/bits	20
68.	Helping hand tool	20
69.	Function generator	20
70.	Testing board (project board)	20
	COMPONENTS AND MATERIALS:	
71.	Screws □ Assorted	2 pkts
72.	Resistors □ Assorted (Fixed and Variable)	Several
73.	Capacitors □ Assorted (Fixed and Variable)	Several
74.	Inductors □ Air Core and Iron core	6 each
75.	Transformers: Power Supply High Frequency, Audio Frequency IF	6 each
76.	Switches □ Assorted	Several
77.	Plugs □ Main Phono Coax DIN	6 6 6 6
78.	Terminal Tags	Several
79.	Vero Boards	Several

80.	IC Sockets (Assorted)	Several
81.	Diodes: Solid State	Several
82.	Transistors Assorted	Several
83.	Cables / Wires (Assorted)	1 coil each
84.	Linear ICs	Several
85.	Digital ICs	Several
86.	IC Programmer	2
87.	Radio Repair Kit	2
88.	Electronic Workbench	3
89.	Flip flops ICs	20
90.	IC voltage Regulator; 3V, 6V, 9V, 12V, 24V	20 EACH
91.	Jumper wires	20
92.	Paste sucker	20
93.	Heat sink	20
94.	Soldering lead	20
95.	F- connectors	20
96.	C-band LNB	20
97.	Ku Band LNB	20
98.	Coaxial cable	5 rolls
99.	Bread board	20
100.	DC battery	20
101.	Insulation tape	20
102.	Printed circuit board (PCB)	20
103.	Sets of permanent magnets	20
104.	Rechargeable cells or battery	20
105.	Battery connecting leads (terminals)	20
106.	$1.5mm^2$ cable	10 rolls
107.	$4mm^2$ multi-core cable	10 rolls
108.	Earthing rods	10
109.	Earth Leakage Circuit Breaker (ELCB)	5
110.	13A socket outlets and plugs	20
111.	15A socket outlets and plugs	20

112.	2.5mm^2 cable	20
113	Electrical wiring charts (assorted)	Several
114	Electronic symbol charts	Several
115	Circuit charts	Several
116	Coaxial cable tester	20
117	LAN tester	20
118	Coaxial cable	20
119	CCTV tester monitor	20
120	CCTV assorted	20
121	CCTV cameras	10
122	Digital video recorder (DVR)	5
123	Network video recorder (NVR)	5
124	Monitor and display units	5
125	Storage device (HDD,SDD) Cloud storage	20
126	Mouse/ keyboard	20
127	Router and internet connectors	several
128	Spirit level	10
129	Conduit bender (metallic)	10
130	Wall plugs	30
131	Mounting brackets	30
132	Weather proof junction boxes (assorted)	50
133	Conduit and cable trays	several
134	Waterproof tape	several
135	Surge protector	30
136	WI-FI analyzer	10

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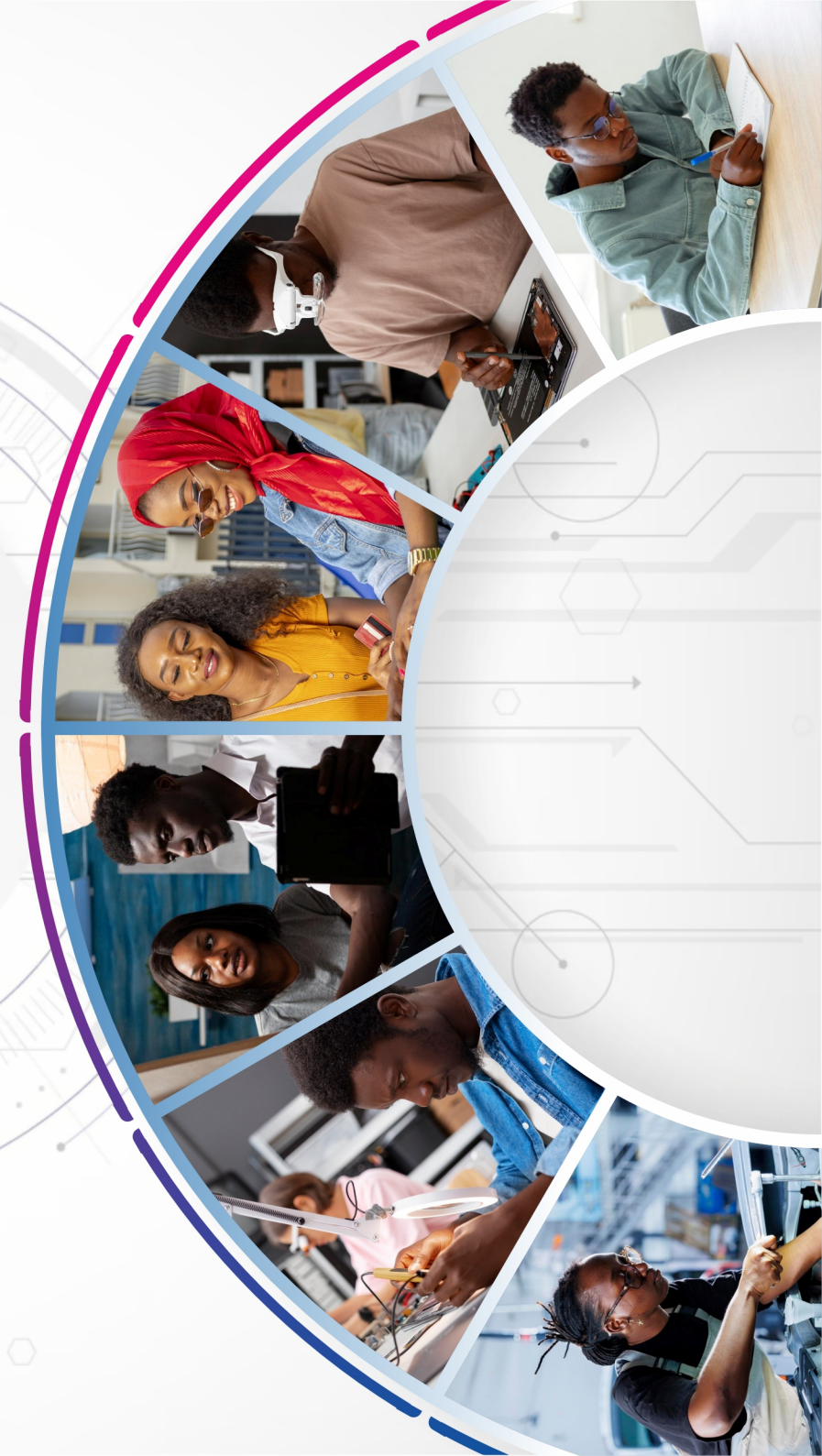

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