

Radio, TV & Electronic Work - National Technical Certificate (NTC) and Advanced National Technical Certificate (ANTC)

NATIONAL TECHNICAL CERTIFICATE AND ADVANCED NATIONAL TECHNICAL CERTIFICATE PROGRAMMES

Curriculum and Course Specifications - August, 2001

NTC AND ANTC Curriculum and Module Specifications in Radio Television & Electronic Work

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General Information

AIM

To give training and impart the necessary skills leading to the production of craftsmen, technicians 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 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 programme.

ADVANCED CRAFT PROGRAMME

Candidates should possess the National Technical Certificate or its equivalent and should have had a minimum of two years post qualification cognate industrial experience.

THE CURRICULUM

The Curriculum of each programme is broadly divided into three components:

- (a) General Education, which accounts for 30% of the total hours required for the programme.
- (b) Trade Theory, Trade Practice and Related Studies which account for 65% and
- (c) Supervised Industrial Training/Work Experience, which accounts for about 5% of the total hours required for the programme. This component of the course, which may be taken in industry or in 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/MODULES

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 behaviour a student should exhibit at the end of a course/module or programme. Two types of behavioural objectives have been used in the curriculum. They are:

- (a) General Objectives
- (b) Specific Learning Outcomes

General objectives are concise but general statements of the behaviour of the students on completion of a unit of work such as understanding the principles and application in:

- (a) Orthographic projection in engineering/technical drawing;
- (b) Loci in Mathematics
- (c) Basic concepts of politics and government in Political Science
- (d) Demand and supply in Economics

Specific learning outcomes are concise statements of the specific behaviour 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/programme 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, Entrepreneurial Studies and Mathematics to enhance the understanding of machines, tools and materials of their trades and their application 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 may be able to compete with their secondary school counterparts for direct entry into the polytechnics or colleges of education (technical) for ND or NCE courses respectively.

For the purpose of certification, only the first three courses in mathematics will be required. The remaining modules are optional and are designed for the above average students.

NATIONAL CERTIFICATION

The NTC and ANTC programmes are run by Technical Colleges accredited by NBTE.

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 Programme	
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 content is 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 programmes 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 programmes is not relevant to the new programme 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 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 programme to achieve its objectives, any course started at the beginning of a term must terminate at the end of the term.

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.

Curriculum Table (NTC)

RADIO, TV AND ELECTRONIC SERVICING FOR NTC

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	CAM 12-15	Mathematics	2	-	2	-	2	-	2	-	2	-	2	-	2	-	2	-	2	-	2	-	216
2	CEN 11-17	English	2	-	2	-	2	-	3	-	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	2	1	288
4	CCH 11-12	Chemistry	2	-	2	-	2	-	2	1	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	-	2	-	216
6	CBM10	Entrepreneurship	-	-	-	-	-	-	-	-	-	-	2	-	2	-	-	-	-	-	-	-	48
7	ICT11-15	Computer Studies	-	-	-	-	-	-	1	2	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/Electronics Drawing	-	-	-	-	-	-	-	-	1	2	1	4	-	-	-	-	-	-	-	-	96
10	CME 11	General Metalwork I	2	5	2	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	168
11	CEI 11	Basic Electricity	2	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	72
12	CRT 12	Electronics Devices & Circuits	-	-	-	-	-	-	3	2	3	2	2	3	-	-	-	-	-	-	-	-	180
13	CRT 13	Radio Communication	-	-	-	-	-	-	-	-	-	-	3	2	2	3	1	4	1	4	-	-	240
14	CRT 14	Radios & Audio Freq. Amplifier	-	-	-	-	-	-	-	-	3	2	-	-	-	-	-	-	-	-	-	-	60
15	CRT 15	Satellite Transmission & Reception	-	-	-	-	-	-	-	-	2	3	2	3	4	1	-	-	-	-	-	-	180
16	CRT 16	Television.	-	-	-	-	-	-	-	-	2	3	-	-	-	-	4	1	-	-	-	-	120
		GRAND TOTAL																					2904 HRS

Curriculum Table (ANTC)

CURRICULUM TABLE

RADIO, TV AND ELECTRONIC SERVICING FOR ANTC

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	Coloured 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

General Metal Work I

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN RADIO, TV & ELECTRONIC WORK		
Course: General Metal Work I	Course Code: CME 11	Contact Hours: 168 HRS
Module Specification: PRACTICAL/KNOWLEDGE REQUIREMENTS		
<p>General Objective: On completion of this module the student will be able to:</p> <ol style="list-style-type: none">1. Understand workshop safety rules and their application in machine shop.2. Know the physical properties, manufacturing process and application of ferrous and non-ferrous metals in common use.3. Select and use common measuring, marking out, cutting and striking tools.4. Understand the basic working principles of drilling machine and be able to use it for various types of screw threads, rivets, and be able to rivet and cut screws by hand.5. Understand the application of various types of screw threads and rivets, and be able to rivet and cut screws by hand.6. Understand the ISO system of tolerances and fits their application in engineering production.7. Produce simple engineering components on the bench.8. Understand the essential features and working principles of the center, lathe and carry out basic operations such as turning, stepped turning, facing, taper turning, knurling, chamfering and undercutting. <p>Practical Competence: On completion of this module, the student will be able to:</p> <ol style="list-style-type: none">1. Use all tools correctly ensuring the machinery guards and protective eye shields are used at all times.2. Comply with the general rules for safe practice in the work environment at all times.3. Use and select hand tools for carrying out various bench fitting and assembly tasks.4. Tools: hacksaws, taps, reamers, drills, dividers, surface gauge5. Produce threads using taps and dies6. Correctly grind drill point angles: Drills: twist and flat drills7. Select and set drilling machine speeds to carry out a range of operations using the appropriate coolants. Drilling, reaming, counter sinking, counter boring.8. Perform metal joining by a range of processes. Cut through the joints and investigate the depth of penetration of the metals at the interface. Processes: Soldering, brazing, and fusion welding.9. Mark out on metals and other materials, datum lines, angles, radii/circles and hole positions using a range of tools.		

PROGRAMME NATIONAL TECHNICAL CERTIFICATE IN RADIO, TV & ELECTRONIC WORK

Course: General Metal Work I

Course Code: CME 11

Contact Hours: 2-5

Course Specification: Knowledge Requirement YEAR I, TERM I

General Objective 1.0: Understand Workshop Safety Rules and application in Machine Shop

Week	Specific Learning Outcome	Teachers Activities	Resource
1	<p>1.0 Workshop safety rules and practice. One completion of this module, the trainee should be able to:</p> <p>1.1 State sources of hazard in the workshop and how to prevent them. e.g.</p> <p>a. handling and using tools, portable power tools and machines;</p> <p>b. stepping on or striking obstructions left on floors or benches;</p> <p>c. lifting, moving and storing materials or jobs;</p> <p>d. using inflammable or corrosive liquids and gases;</p> <p>e. inhaling vapours of fumes;</p> <p>1.2 Explain the application of factory safety regulations in the machine shop.</p> <p>1.3 Name safety equipment and wears essential in the machine shop, and state their application in working situations</p> <p>Note: Example of safety wears and equipment should include overall, eye goggles, gloves, safety boots, helmet, fire extinguishers, etc.</p>	<ul style="list-style-type: none"> • State sources of hazards in the workshop. • Through questions and answers, determine whether the students grasped the topic • Show a film on industrial safety. • Through question and answers determine comprehension • Demonstrate how to treat emergency case like artificial respiration, cold compress etc • List the safety equipment and wards that are essentially in the workshop. • Give detailed notes and explanation in each topic a-g. • Use questions and answers to determine comprehension. • Assess the students 	<ul style="list-style-type: none"> • Safety posters, common hand tools like files hacksaw • Television, Video machine. • Overall, goggles, gloves, hard shoes, head shield, fire extinguishers.

PROGRAMME NATIONAL TECHNICAL CERTIFICATE IN RADIO, TV & ELECTRONIC WORK			
Course: General Metal Work I		Course Code: CME 11	Contact Hours: 2-5
Course Specification: Knowledge Requirement YEAR I, TERM I			
General Objective 1.0: Understand Workshop Safety Rules and application in Machine Shop			
Week	Specific Learning Outcome	Teachers Activities	Resource
	<p>1.4 Outline safety rules and regulations relating to: -</p> <ul style="list-style-type: none"> a. clothing and health hazards; b. Workshop hygiene c. movement and other behaviour of workers in the workshops; d. materials handling; e. tool handling, storage and usage f. machine operation; g. fire protection <p>1.5 Understand appropriate procedures in the events of a workshop accident</p> <p>1.6 Examples of procedures may include:</p> <ul style="list-style-type: none"> i. application of first aid to the victim; ii. removal and rectification of the accident; iii. reporting the accident to the appropriate authority iv. keeping a record of accidents for management use 	<ul style="list-style-type: none"> • Give detailed notes and explanation of appropriate procedures to be taken in the event of workshop accident 	

PROGRAMME NATIONAL TECHNICAL CERTIFICATE IN RADIO, TV & ELECTRONIC WORK			
Course: General Metal Work I		Course Code: CME 11	Contact Hours: 2-5
Course Specification: Knowledge Requirement YEAR I, TERM I			
General Objective 2.0: Know the physical properties, manufacturing process and application of ferrous and non-ferrous metals in common use			
Week	Specific Learning Outcome	Teachers Activities	Resource
2	<p>2.1 Explain the meaning of the following general physical properties of metals: ductility, malleability, strength, toughness, brittleness, elasticity, plasticity</p> <p>2.2 Describes the basic composition and properties of plain carbon steels, cast iron and alloy steel and state their application in the engineering industry. Note: Specific examples of tools and equipment made from the various steel and cast iron should be mentioned. Examples of steels and cast irons should include: plain carbon steels, dead mild steels, mild steel, medium, carbon steel, high carbon steel. Cast Iron: gray cast iron malleable cast iron, alloy cast irons (spheroidal and acicular) Alloy Steel - high-speed steels, high tensile steels, tungsten, Iron carbide stainless steels, satellite.</p> <p>2.3 Outline:</p> <ol style="list-style-type: none"> the cupola process of manufacture of cast iron; the blast furnace process of manufacture of cast iron the direct reduction process of manufacture of steel. 	<ul style="list-style-type: none"> Give detailed notes and explanations to explain the meaning of the following general physical properties of metals; ductility, malleability, strength, toughness, brittleness, elasticity, plasticity, Assess the students Give detailed notes and explanations of the topics in 2.1 Give notes and specific examples of tools and equipment made from the various steels and cast iron. Examples of steels and cast irons should include plain carbon steels, dead mild steels, mild steel, medium carbon steel, high carbon steel, gray cast iron, malleable cast iron alloy cast iron high speed steels, high tensile steels, tungsten, iron-carbide, stainless steels. Give notes and explanation on the cupola process, the blast furnace and the direct reduction process of manufacture of steel. 	<ul style="list-style-type: none"> Video and television including cassettes on production processes.

PROGRAMME NATIONAL TECHNICAL CERTIFICATE IN RADIO, TV & ELECTRONIC WORK			
Course: General Metal Work I		Course Code: CME 11	Contact Hours: 2-5
Course Specification: Knowledge Requirement YEAR I, TERM I			
General Objective 2.0: Know the physical properties, manufacturing process and application of ferrous and non-ferrous metals in common use			
Week	Specific Learning Outcome	Teachers Activities	Resource
	2.4 Describe the physical properties and applications of non-ferrous metals below: copper, tin, zinc, aluminum and aluminum alloys brass (muntz metal, cartridge brass gilding etc) metal, bronze (manganese bronze tunmetal, bell metal, aluminum bronze, phosphor bronze and lead.	<ul style="list-style-type: none"> This can be preceded by film show and a visit to the manufacturing plant. Give detailed notes and explanations describing the physical properties and applications of the following non-ferrous metals: copper, tin, zinc, aluminum, aluminum alloys, brass, (muntzmetal, cartridges brass, gilding metal) etc. bronze, manganese bronze bell metal, aluminum bronze phosphor bronze and lead. Assess the students 	
General Objective 3.0: Select and use common measuring, making out, cutting and striking tools			
Week	Specific Learning Outcome	Teachers Activities	Resource
3	3.1 Explain with examples the difference between: "line" and "end" measurement 3.2 Explain the use of datum points, datum lines and datum faces in marking out. 3.3 Describe, the functions and application of the following instruments used in metal-work steel rule, dividers, caliper, (inside, outside and odd-legs), trammel, scribe angle plate, vee-block, centre square. 3.4 Describe, the various types of files, stating their grades and applications. Note. Types of files should include: flat, square, round, half round, three square, warding pillar, mill and rasp	<ul style="list-style-type: none"> Prepare notes that will clearly differentiate between "line" and "end" measurement Prepare notes and examples that will explain the use of datum points, datum lines and datum faces in marking out. Give detailed notes and explanations regarding the functions and application of: steel rule, dividers, calipers (inside, outside and oddleg) trammel, scribe angle plate, vee block, centre square Prepare note that will describe the various types of files stating their grades and applications, By type it means: flat square round, half round, three square warding, pillar mill and rasp. 	<ul style="list-style-type: none"> Steel rules dividers calipers trammel, scribe range plate, vee block, centre square. Micrometer vernier calipers vernier height gauge combination set Flat file, hard file, round file square, half round, triangular warding, mill file, rasp file. Flat file, hand file engineers square Surface plate try square (engineers square)

PROGRAMME NATIONAL TECHNICAL CERTIFICATE IN RADIO, TV & ELECTRONIC WORK			
Course: General Metal Work I		Course Code: CME 11	Contact Hours: 2-5
Course Specification: Knowledge Requirement YEAR I, TERM I			
3	<p>3.5 Classify the common files use in metal work and state their composition of material used for their manufacture.</p> <p>3.6 Sketch the bench vice explain its clamping power and demonstrate the technique of holding work in the vice for filing tapping and designing operation.</p> <p>3.7 Describe the functions of the various parts of a bench vice, its holding power while performing various operations on its, such as filing, etc.</p>	<ul style="list-style-type: none"> • Prepare detailed notes that will classify the common files used in the metal work as well as stating the composition of materials used for their manufacture. • Show a bench vice and demonstrate the work in the vice for filing, tapping and designing operations • Prepare detailed notes that will describe the functions of the various parts of a bench vice, its holding power while performing various operation 	<ul style="list-style-type: none"> • File card • Flat file • Bench vice • Bench vice • Ball pein hammers mallets
4	<p>3.8 Show a bench vice and demonstrate the technique of holding work in the vice for filing, tapping and designing operations.</p> <p>3.9 Prepare detailed notes that will describe the functions of the various parts of a bench vice, its holding power while performing various operation</p> <p>3.10 Describe and use the following tools:</p> <ol style="list-style-type: none"> a. cold chisel (flat cross, cut half round, diamond-points) b. centre punch and dot punch c. scraper (flat, triangular, half round) d. power hack saw <p>3.11 Describe the various parts of a hacksaw and their function.</p> <p>3.12 Describe the common types of hacksaw blades, their range of pitches and their application</p>	<ul style="list-style-type: none"> • Assess the students • Prepare detailed notes and demonstration that will describe the uses of: cold chisel, centre punch, dot punch, scrapers and power hacksaw. • Prepare notes that will describe the various parts of a hacksaw and their functions. • Show samples of hacksaw blades as well as prepare notes that will describe the common types of hacksaw blades their range of pitches and their applications. • Prepare notes that will show correct way of inserting blades. • Prepare detailed notes and explanation, stating the safety precautions to be observed when using a hand hacksaw. • Prepare detailed notes and explanation, stating the safety precautions to be observed when using a power hacksaw. 	<ul style="list-style-type: none"> • Cold chisel, centre punches, dot punch scrapers power hacksaw blades • Hacksaw blade • Hacksaw frame • Adjustable hacksaw junior hacksaw piercing saw. • Bench drill • Pillar drill • List drills, flat drill counter sink drill, counter bore drill combination centre drill

PROGRAMME NATIONAL TECHNICAL CERTIFICATE IN RADIO, TV & ELECTRONIC WORK			
Course: General Metal Work I		Course Code: CME 11	Contact Hours: 2-5
Course Specification: Knowledge Requirement YEAR I, TERM I			
4		<ul style="list-style-type: none"> • Prepare notes that will describe the uses of various hacksaws. Assess the students 	
General Objective 4.0: Understand the working principles of a drilling machine, use it to drill and ream holes on metals and other engineering materials.			
Week	Specific Learning Outcome	Teachers Activities	Resource
5.6	<p>4.1 Identify the various types of drilling machines</p> <p>4.2 Describe with sketches and state where each of the following types of drills are best suited e.g. twist drill (taper shank., parallel shank and jobbers drill, and their relative merits), flat drill, countersink drill, counter bore drill, combination centre drill.</p> <p>4.3 Explain the effects of the following faults in a ground twist drill bit:</p> <ol style="list-style-type: none"> a. point angle too acute. b. point angle too obtuse: c. cutting edges at unequal angles d. insufficient lip clearance; e. excessive lip clearance <p>4.4 Calculate spindle revolution or cutting speed for specified size of drill using the formulae:-</p> $N = 1000S/\pi d$ $S = \pi dN/1000$ <p>Where S = cutting speed (m/min)</p> <p>N - revolution/minute</p> <p>D = diameter of drill (mm)</p> $\pi = 3.142$	<ul style="list-style-type: none"> • Show different types of drilling machines • Make notes and drawings that will identify the various types of drilling machines. • Prepare detailed notes and drawings that will describe the main features of a bench or pillar-drilling machine. • Solve many problems for students to practice. • Prepare notes and drawings that will describe where each of the following drills are best suited • Twist drill (taper shank, parallel shank, jobber drill and their relative merits), flat drill, counter bore drill and combination center drill • Assess the students 	<ul style="list-style-type: none"> • Ball pein hammers, mallet, cold chisels, dot/center punches, hacksaw and hacksaw blades • Drilling machines and its accessories.

PROGRAMME NATIONAL TECHNICAL CERTIFICATE IN RADIO, TV & ELECTRONIC WORK			
Course: General Metal Work I		Course Code: CME 11	Contact Hours: 2-5
Course Specification: Knowledge Requirement YEAR I, TERM I			
	<p>4.5 State the cause and remedy of drilling faults such as: -</p> <ol style="list-style-type: none"> drill breaking; drill coloured blue walls of drilled hole left rough chipped cutting lips <p>4.6 State the safety precautions to be observed when using drilling machine reamers.</p> <p>4.7 Ream to given specification by hand and machine method.</p>		
General Objective 5.0: Understand The Applications Of Various Types Of Screw Threads, Rivet And Cut Screws By Hand.			
Week	Specific Learning Outcome	Teachers Activities	Resource
7	<p>5.1 Sketch the thread forms below and state their applications:-</p> <ol style="list-style-type: none"> the ISO metric thread the unified thread Whitworth and British fine threads British Association (BA) thread British Standard pipe Square thread Acme thread <p>5.2 Buttrass thread.</p> <p>5.3 Sketch and state the functions of:-</p> <ol style="list-style-type: none"> taps (taper tap, second tap, plug) tap wrench die and die stock 	<ul style="list-style-type: none"> Give detailed notes with diagrams that will show the various forms of thread and their uses. State the functions of taps, tap wrench, die and die stock. Demonstrate how to produce internal and external threads. Give detailed notes that will explain the meaning of tapping size or tapping drill and estimate its values using the formula: $T = D - P$ Where T = tapping diameter D = thread top diameter and P = Pitch 	<ul style="list-style-type: none"> Diagrams/charts of thread forms Parallel reamers taper reamers twist drills.

PROGRAMME NATIONAL TECHNICAL CERTIFICATE IN RADIO, TV & ELECTRONIC WORK			
Course: General Metal Work I		Course Code: CME 11	Contact Hours: 2-5
Course Specification: Knowledge Requirement YEAR I, TERM I			
	<p>5.3 Explain the meaning of tapping size or tapping drill and estimate its value in given situations using formulae such as:-</p> $T = D - P$ <p>Where</p> <p>T = tapping diameter D = thread top diameter P = pitch</p> <p>5.4 State precautions to be taken when tapping on the bench.</p>		
	<p>5.5 Describe and differentiate types of rivets e.g. snap and pan head, mushroom and counter-sunk head, flat head, dod rivet, etc.</p> <p>5.6 Sketch the rivet set and state its uses.</p> <p>5.7 Calculate the diameter of rivet and riveting allowance in given situations.</p>	<ul style="list-style-type: none"> • Give notes and diagrams that will describe and differentiate types of rivets, rivet sets, and its uses and guide to calculate the diameter of rivet and riveting allowance. • Assess the students. 	<ul style="list-style-type: none"> • Rivet sets
General Objective 6.0: Understand The ISO Tolerances And Fits And Its Application In Engineering Production.			
Week	Specific Learning Outcome	Teachers Activities	Resource
	<p>6.1 Differentiate between the following:-</p> <ol style="list-style-type: none"> nominal size limits (upper and lower) tolerance (unilateral and bilateral) fit (clearance, transition and interference). <p>6.2 Explain the importance of tolerance and fit in engineering production and describe briefly the ISO system of limits and fits.</p> <p>6.3 Determine by calculation the amount of tolerance and types of fit in given situations.</p>	<ul style="list-style-type: none"> • Give detailed notes that will differentiate between nominal size, limits, tolerance and fits. • Prepare detailed note and diagrams that will explain the importance of tolerance and fits in engineering production as well as describing the ISO systems of limits and fits. • Give notes and explanations that will guide in calculating the amount of tolerance and types of fits in given situations. • Assess the students. 	<ul style="list-style-type: none"> • Charts on tolerances, limits and fits.

PROGRAMME NATIONAL TECHNICAL CERTIFICATE IN RADIO, TV & ELECTRONIC WORK			
Course: General Metal Work I		Course Code: CME 11	Contact Hours: 2-5
Course Specification: Knowledge Requirement YEAR I, TERM I			
General Objective 7.0: Produce Simple Engineering Components On The Bench.			
Week	Specific Learning Outcome	Teachers Activities	Resource
	<p>7.1 Explain layout procedures from working drawing of simple engineering components or tools such as:</p> <ol style="list-style-type: none"> a. open ended spanner b. engineer's try square c. tool maker's clamp d. plate bracket or gusset (involving rounds, angles, holes) e. centre square. <p>7.2 Explain how to produce any simple engineering component to given specifications including dimensions, tolerance and finish.</p> <p>7.3 Explain how to carry out simple precision fitting project, e.g. hexagonal mild steel bar making push fit through a mild steel plate.</p>	<ul style="list-style-type: none"> • Teachers to prepare notes and explanations to guide the students in producing simple engineering components as in 7.1 • Assess the students. 	<ul style="list-style-type: none"> • Lesson notes. • Diagrams and charts.
General Objective 8.0: Understand The Essential Features And Working Principles Of The Centre Lathe And Use It To Carry Out Basic Operations Such As Plain Turning, Stepped Turning, Facing Taper Turning, Chamfering, And Under-Cutting.			
Week	Specific Learning Outcome	Teachers Activities	Resource
	<p>8.1 Describe the essential features of a centre lathe and state their functions e.g lathe bed, headstock, tailstock, saddle or carriage, etc.</p> <p>8.2 Explain the working principles of the centre lathe.</p> <p>8.2 Identify and state the functions of centre lathe accessories such as: catch or driving plate, face plate, lathe dog or carrier, lathe centres, fixed and travelling steadies.</p>	<ul style="list-style-type: none"> • Prepare detailed notes that will describe the essential features of center lathe and their functions. • Give notes and diagrams that will explain the working principles of center lathe and functions of its accessories. • Give explanations that will show the difference between center lathe and capstan lathe in terms of their main features and functions. 	<ul style="list-style-type: none"> • Centre lathe and accessories like catch plates, face plates, center,s fixed and travelling steadies. • Charts of center lathe and capstan lathe.

PROGRAMME NATIONAL TECHNICAL CERTIFICATE IN RADIO, TV & ELECTRONIC WORK

Course: General Metal Work I

Course Code: CME 11

Contact Hours: 2-5

Course Specification: Knowledge Requirement YEAR I, TERM I

<p>8.3 Explain the difference between the centre lathe, capstan lathe, in terms, of their main features and functions.</p> <p>8.4 Name types of cutting fluids used for lathe turning operations and state their composition and purposes.</p> <p>8.5 Outline safety precautions to be observed when working on the lathe.</p> <p>8.6 Sketch and describe common tools:e.g butt-brazed tool, tipped tool, bit and holder.</p> <p>Note: Tool description should include tool materials.e.g plain carbon steel, high speed steel, satellite, cemented carbide, diamond.</p> <p>8.7 Explain with sketches the functions of tool angles (rake clearance), and state their values for different metals to be machined.</p>	<ul style="list-style-type: none"> • Prepare notes that will list types of cutting fluid use for lathe turning operations and their composition and purposes. • Prepare detailed notes and explanation that will outlines safety precautions, common tools and materials used in marking them. • Give detailed notes and diagrams that will explain the functions of tool angles (rake, clearance) stating their values for different metals to be machined. • Assess the students. 	<ul style="list-style-type: none"> • Round nose turning tool, finishing tool, site finishing, knife tool, form tool, parting off tool, and boring tool.
<p>8.0 Differentiate between various tool shapes and state their uses e.g.</p> <p>Round nose rougher, fine finishing, side finishing, knife tool, form tool, parting off tool, boring tool, etc.</p> <p>8.10 Explain with sketches the effects of wrong setting of cutting tool: e.g vibration and chatter, tool rubbing against or digging into the job.</p> <p>8.11 Define cutting speed and feed with respect to lathe operation.</p>	<ul style="list-style-type: none"> • Give notes and diagrams of various tool shapes and their uses. • Prepare detailed notes and explanations to cover 8.10 to 8.15 • Solve many problems for the students practise. • Assess the students. 	<ul style="list-style-type: none"> • Charts on tool height. • Charts and diagrams of different machining operations.

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8.12 Calculate the cutting speed and feed for given turning operation.

8.13 Estimate the rate of metal removal and time required for carrying out specified turning operations.

8.14 Estimate the rate of metal removal and time required for carrying out specified turning operations.

8.15 State precautions to be observed when turning between centres. Set up the lathe for and carry out basic turning operations between centres.

8.16 Compute required taper dimensions from given data using taper ratio angle formulae i.e.

$$\text{Taper Ratio} = \frac{d_2 - d_1}{L}$$

OR

$$\frac{\tan \frac{\alpha}{2}}{2} = \frac{d_2 - d_1}{L}$$

where

Tan = taper angle

d₁ = small end diameter

d₂ = large end diameter

L = length of taper

PRACTICAL TASKS

PROGRAMME NATIONAL TECHNICAL CERTIFICATE IN RADIO, TV & ELECTRONIC WORK			
General Objective 1.0: Safety and Practice			
Week	Specific Learning Outcome	Teachers Activities	Resource
1 - 3	1.1 Using and handling hand tools, portable power tools and machine 1.2 Lifting, moving and storing materials or job 1.3 Demonstrate first aid application in cases of minor cuts, electric shock, burns	<ul style="list-style-type: none"> • Demonstrate safe ways of handling basic hand tools • Show a film in industrial safety • Demonstrate how to treat energy cases like artificial respiration cold compress, etc • Assess the student 	<ul style="list-style-type: none"> • Hand tools files hacksaw • Television, Video machines • Posters on artificial respiration
General Objective 2.0: Measuring, Marking, Cutting and striking			
Week	Specific Learning Outcome	Teachers Activities	Resource
	2.1 Describe the essential features and use of the following <ul style="list-style-type: none"> a. micrometer b. Vernier caliper c. Vernier height gauge d. Combination set 2.2 Maintain and care for the instruments listed above 2.3 Perform making out exercise on plane surface including profiles 2.4 File a piece of metal to given specifications using any of the following: Cross filing, draw filing, filing square and flat surfaces 2.5 Test surface for flattens using surface plate and try square and state precautions to be taken to avoid pinning 2.6 Maintain files in good working conditions 2.7 Apply various hammers and mallets e.g. ball pein, rubber mallets, etc for engineering purposes	<ul style="list-style-type: none"> • Demonstrate how to use micrometer, vernier caliper vernier height gauge, combination set • Demonstrate the maintenance and care of the instruments listed above • Perform marking out for the students to learn and practice till they become competent • Demonstrate how flat surface can be tested using surface plate and try square • Demonstrate how files are cleaned and state the precautions to be taken against pinning. Students to practice till they become competent • Demonstrate the application of hammers and mallets for engineering purposes • Demonstrate how a hacksaw blade can be inserted correctly 	<ul style="list-style-type: none"> • Micrometer, vernier caliper vernier height gauge, combinations sets • Steel rules, dividers, punches, trammel, scribe angle plate, vee block center square • Flat file hand file, square • file card, flat file • Ball pein hammers, mallet • Hacksaw bald, Hacksaw frame

PROGRAMME NATIONAL TECHNICAL CERTIFICATE IN RADIO, TV & ELECTRONIC WORK

General Objective 2.0: Measuring, Marking, Cutting and striking

Week	Specific Learning Outcome	Teachers Activities	Resource
	2.8 Select and insert hacksaw blade correctly 2.9 Cut metal and other engineering materials to a given specification using the adjustable hacksaws, junior hacksaws, piercing saw, etc	<ul style="list-style-type: none"> • Demonstrate how to use adjustable hacksaw, junior hacksaw piercing • Students should be allowed to practice till they become competent • Guide student to produce simple • engineering component like opened ended spanner, engineers square tool makers clamp, centre square, etc • Assess the student 	

General Objective 3.0: Machine Tools

Week	Specific Learning Outcome	Teachers Activities	Resource
7-9	3.1 Set up and operate a drilling machine in given situations Note Setting up drilling machine should include <ul style="list-style-type: none"> a. change of spindle speed b. adjustment of drilling table to require height and angle, holding of work on drilling bale to required height and angle using appropriate clamping device. c. Install up the drill bit in chuck 3.2 Sharpen a twist drill correctly to manufacturers specification	<ul style="list-style-type: none"> • Demonstrate how to set up and operate a drilling machine in given situation • Students to practice till they become competent • Demonstrate how a twist drill can be sharpened correctly • Demonstrate with the appropriate facility how to perform all the drilling operations • Students to practice till they become competent • Give notes as well as demonstrate the operation sequence in cutting internal (through and blind) and external threads by hand method 	<ul style="list-style-type: none"> • Bench drill, pillar drill, twist drill, flat drill, counter sink drill, counter bore drill, center drill, drill bits. • Drills taps, tap wrench die and die stock • Rivets and sets of drill bits • Surface table, surface plate marking solution, center/dot punches, scribing block

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General Objective 3.0: Machine Tools

Week	Specific Learning Outcome	Teachers Activities	Resource
	<p>3.3 Perform with facility the following operations:</p> <ul style="list-style-type: none"> - drilling blind - drilling round stock - counter boring and counter-sinking - drilling large diameter holes <p>3.4 List the operation sequence and cut internal (through and blind) and external thread by hand method and state precautions to be taken when tapping on the bench.</p> <p>3.5 Rivet metals together in any given situations</p> <p>3.6 Mark out only given bench work using datum points, datum lines, datum faces, chalk or marking solution center or dot, punch, blocks or measurement transfer.</p>	<ul style="list-style-type: none"> • Demonstrate how riveting can be done and let the students practice same till they become competent • Demonstrate the marking out procedures on bench working using datum lines datum faces, etc • Students to practice till they become competent • Assess the Student 	

General Objective 4.0: Lathe and Lathe work

Week	Specific Learning Outcome	Teachers Activities	Resource
10-12	<p>4.1 Sharpen cutting tool for plain turning shouldering, parting off and facing operations.</p> <p>4.2 Set up rough and turned stock N 3-jaw-chuck</p> <p>4.3 Select appropriate cutting tool and set them up to centre height for turning or facing operations</p> <p>4.4 Carry out chuck work involving facing, step turning, undercutting reducing, chamfering, parting off and knurling</p> <p>Note: Component should be produced to specified tolerance and finish</p>	<ul style="list-style-type: none"> • Guide the students to sharpen cutting tools for plain turning, shouldering, parting off and facing operations and allow students to practice till they become competent • Demonstrate how to set-up rough and turned stock practice till competent • Guide the students to select appropriate cutting tools and set them up to center height for lathe work 	<ul style="list-style-type: none"> • Point tools, grinding machine, lathe machine • 3-jaw chuck and lathe machine • Point tools lathe machine • Lathe machine and accessories • Centre lathe and accessories like catch plate, face plate, dog, lathe, lathe centers fixed steady and travelling steadying

PROGRAMME NATIONAL TECHNICAL CERTIFICATE IN RADIO, TV & ELECTRONIC WORK

General Objective 4.0: Lathe and Lathe work

Week	Specific Learning Outcome	Teachers Activities	Resource
	4.5 Produce simple components involving taper turning using the compound slid	<ul style="list-style-type: none"> • Make a simple recession fitting project like hexagonal mild steel bar making push fit through a mild steel plate • Students should be allowed to practice till they become competent • Prepare simple exercise that will guide students to produce components involving taper turning using the compound slide, Asses the students 	<ul style="list-style-type: none"> • Round nose turning tool, fine finishing tool, form tool, parting off tool, boring tool, bar of goods length and 4mm diameter, Live/deed centres catch plates • Standard exercise prepared
Assessment profile: Practical to take 60% of the overall assessment			

Basic Electricity

PROGRAMME:	NATIONAL TECHNICAL CERTIFICATE IN RADIO, TV & ELECTRONIC WORK
MODULE:	CEI II - Basic Electricity
DURATION:	72 Hours
GOAL:	This module is designed to provide the trainee with basic knowledge of electricity and the competency to wire simple circuits and use common electrical measuring instruments.
GENERAL OBJECTIVES:	
<p>On completion of this module, the trainee should be able to:</p> <ol style="list-style-type: none">1.0 Understand the structure of matter and its relevance to electricity/electronics.2.0 Understand the chemical sources of electromotive force.3.0 Understand the construction of resistors, inductors and capacitors and explain their functions in a simple circuit4.0 Know the values of resistor(s).5.0 State Ohm's Law and apply it to calculate resistance, voltage and current.6.0 Distinguish between AC and DC current and voltage.7.0 Understand the principles of transformer, its construction and operation.8.0 Analyse, connect and carry out simple calculation on simple electrical circuit.9.0 Interpret basic electronic signs and symbols.10.0 Understand the operation, uses and limitations of indicating instruments and operate them.	

PROGRAMME: NTC IN RADIO, TV & ELECTRONIC WORK			
Course: CEI II - BASIC ELECTRICITY		Course Code: CEI II	Contact Hours: 2-1 HRS
Course specification: Theoretical Content Year I, Term I			
General Objective 1.0: Understand the Structure of matter and its relevance to electricity/electronics.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
1-3	1.1 Define: <ul style="list-style-type: none"> a. Molecule b. Electron c. Atom d. Electric charge e. Electric Current f. Coulomb 1.2 Explain the difference between positive and negative charges. 1.3 Explain the flow of electricity 1.4 Distinguish between insulators and conductors	<ul style="list-style-type: none"> • With diagram define atom, electron, proton, molecule, electric charge, electric current, Coulomb. • Give full explanation of the difference between +ve and -ve charge. • Describe how electricity flows. • Explain insulator and conductors with sample 	<ul style="list-style-type: none"> • Chalkboard • Textbooks • Chalk Board • Charts
General Objective 2.0: Understand the chemical source of electromotive force.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
	2.1 Define: <ul style="list-style-type: none"> a. Electric power b. Energy 2.2 Distinguish between emf and potential difference (p.d) 2.3 Identify the following: <ul style="list-style-type: none"> a. Primary Cells b. Secondary cells 2.4 Test for the condition of a cell or battery 2.5 Connect cells in: <ul style="list-style-type: none"> a. Series b. Parallel c. Series - Parallel 2.6 Explain the effects of internal resistance on battery voltage output.	<ul style="list-style-type: none"> • Explain electric power and energy stating their unit, symbol and formula. Work problems based on Power and Energy • Distinguish the differences between emf and p.d. • Show primary and secondary cells and describe their construction. • Use instruments and visual observation to show how to test cell condition. • Show how cells can be connected in series, and series-parallel. Advantages of cells in series or parallel connections. e.g. voltage in series and in parallel • Explain with calculations how resistance affects battery voltage. 	<ul style="list-style-type: none"> • Chalkboard • Textbook • Calculator • Primary cell • Battery • Primary Cell • Primary Board • Components Cell • Chalkboard

PROGRAMME: NTC IN RADIO, TV & ELECTRONIC WORK			
Course: CEI II - BASIC ELECTRICITY		Course Code: CEI II	Contact Hours: 2-1 HRS
Course specification: Theoretical Content Year I, Term I			
General Objective 3.0: Understand the construction of resistors, inductors and capacitors and explain their functions.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
9-11	3.1 Identify the various types and sizes of the following: a. Resistors b. Capacitors c. Inductors.	• Define and show resistors, capacitors and inductors. State their units and symbols	• Capacitors • Inductors • Resistors
	3.2 Identify the following resistors: a. Composition type resistor b. Wire wound type resistor c. Variable resistors d. Fixed resistors	• Show students various types of resistors	• Resistors
	3.3 State the function of the following: a. Resistor b. Capacitor c. Inductor in a Circuit 3.4 Describe the constructional detail of the following: a. Resistors b. Capacitors c. Inductors 3.5 Explain the meaning of power rating of a resistor 3.6 Identify the power rating of different resistance types. 3.7 Explain the practical application of various types of resistors 3.8 Identify the working Voltage of a capacitor	• Explain and show how each can be connected and their function. • Describe on chalkboard the constructional detail of the three. • Explain power rating of resistor. • Show how to identify the power rating of each resistor. • Explain the application of resistor in a circuit. • Explain the maximum working voltage of a capacitor.	• Resistors • Capacitors • Indicator • Chalk • Chalk Board • Resistor • Chalk Board • Chalk Board • Cell

PROGRAMME: NTC IN RADIO, TV & ELECTRONIC WORK			
Course: CEI II - BASIC ELECTRICITY		Course Code: CEI II	Contact Hours: 2-1 HRS
Course specification: Theoretical Content Year I, Term I			
General Objective: 4.0 Know the values of resistor(s).			
Week	Specific Learning Outcome:	Teachers Activities	Resources
	4.1 Explain the colour coding system of <ul style="list-style-type: none"> a. resistors b. capacitors 4.2 Calculate the following: <ul style="list-style-type: none"> a. Resistance of a resistor using colour codes b. capacitance of a capacitor using colour codes 4.3 Identify the tolerance of resistors and capacitors. 4.4 Calculate the value of the tolerance of any <ul style="list-style-type: none"> a. Resistor using colour codes b. Capacitors using colour codes 	<ul style="list-style-type: none"> • Show and explain how to identify colour coding of resistor. • From colour code, show how to calculate the values of resistor and capacitor • Show and calculate the tolerance of resistors and capacitors • Show and calculate the tolerance of resistors and capacitors. 	<ul style="list-style-type: none"> • Chalkboard • Textbooks • Calculator • Chalk Board • Color coded resistors • Chalk Board • Chalk Board • Color coded Resistors

PROGRAMME: NTC IN RADIO, TV & ELECTRONIC WORK			
Course: CEI II - BASIC ELECTRICITY		Course Code: CEI II	Contact Hours: 2-1 HRS
Course specification: Theoretical Content Year I, Term I			
General Objective 5.0: State Ohm's law and apply it to calculate resistance, voltage and current, Year 1 Term 2 Contact Hour: 1-2			
Week	Specific Learning Outcome:	Teachers Activities	Resources
1-7	5.1 Define Ohm's law 5.2 Calculate Resistance, Voltage or Current using Ohm's law e.g. $R = V/I$ 5.3 Connect: <ol style="list-style-type: none"> resistors in series resistors in parallel series and parallel connection 5.4 Connect: <ol style="list-style-type: none"> batteries in series batteries in parallel batteries in series-parallel connection 5.5 Connect capacitors in series and parallel and capacitors in series parallel connection as above. 5.6 State the implication of the connections mode in 5.3 - 5.5 5.7 Calculate the inductance, capacitance connected in series and parallel. 5.8 Define Kirchoff's laws: - <ol style="list-style-type: none"> Current law Voltage law 5.9 Solve simple numerical problems involving 5.8(a) & 5.8(b) above. 5.10 Define Superposition theorem 5.11 Solve simple numerical problems to illustrate Superposition theorem	<ul style="list-style-type: none"> Define Ohm's Law Work some calculations on Ohm's law Show how resistor can be connected in series, parallel and series-parallel and perform calculations. Refer students to batteries connected in the three modes by asking questions. Show capacitor in series, parallel and in series-parallel. Explain the implication of modes 5.3 - 5.6 Work samples of Capacitors and inductor in series parallel. Define the laws. Use vector diagram to explain the current law e.g. $I_1 + I_2 + I_5 = I_3 + I_4$ Define the voltage laws. Draw a simple circuit to illustrate the law, State the laws. Draw a simple circuit to illustrate the law Super position theorem. Use simple circuit to illustrate the theorem. 	

PROGRAMME: NTC IN RADIO, TV & ELECTRONIC WORK			
Course: CEI II - BASIC ELECTRICITY		Course Code: CEI II	Contact Hours: 2-1 HRS
Course specification: Theoretical Content Year I, Term I			
General Objective 6.0: Distinguish between AC and DC current and Voltage.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
1-7	6.1 Explain the difference between AC and DC. 6.2 Explain the characteristic of alternating current.	<ul style="list-style-type: none"> • With the aid of a diagram explain the difference between AC to DC. • Explain fully AC. 	<ul style="list-style-type: none"> • Lesson note • Chalkboard
	6.3 Define peak value, mean value, RMS value, Frequency of Wave. 6.4 Calculate peak value from RMS values of Current, and voltage, and vice versa 6.5 Describe the simple treatment of R, L, C in AC circuit. 6.6 Explain the concept of resistance in Ac circuit. 6.7 Calculate inductive and capacitive reactance. $X_L = 2\pi fL$ (Inductive reactance) $X_C = 1/2\pi fC$ (Capacitive reactance)	<ul style="list-style-type: none"> • Draw diagrams to explain AC variables like RMS, mean value, etc. • Work some samples on how to calculate the variables above • Explain the effect of AC on R, L, C in parallel i.e. voltage and current relationships • Explain resistor in AC circuit. • Explain inductive and capacitive reactance and work some calculation on X_L, X_C, (like X_C above) 	<ul style="list-style-type: none"> • Chalk Board • Signal Generator • Oscilloscope • Chalk Board • Chalk Board

PROGRAMME: NTC IN RADIO, TV & ELECTRONIC WORK			
Course: CEI II - BASIC ELECTRICITY		Course Code: CEI II	Contact Hours: 2-1 HRS
Course specification: Theoretical Content Year I, Term I			
General Objective: 7.0 Understand the principles of transformer, its construction and operations.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
8-13	<p>7.1 Explain the concept of Magnetism</p> <p>a. temporary and permanent magnets</p> <p>b. magnetic field</p> <p>c. magnetic poles</p> <p>d. law of attraction and repulsion</p> <p>7.2 Explain the effect of fields as applied to electro-magnetism</p> <p>7.3 State the colour code used for the winding of transformer.</p> <p>7.4 Describe with the aid of sketches the principles of operation of a single phase, double wound transformer.</p> <p>7.5 State the reasons for laminating the core of a transformer.</p> <p>7.6 Explain the types of losses in transformers</p> <p>a. State ways to reduce them.</p> <p>7.7 Calculate transformer efficiency</p> <p>7.8 Construct a simple single phase double wound transformer</p> <p>7.9 Identify the following types of transformers:</p> <p>a. Auto-transformer;</p> <p>b. C-Core transformer;</p> <p>c. Toroidal transformer.</p> <p>d. Rudolf transformer</p> <p>e. Audio transformer</p> <p>f. 3-phase transformer</p> <p>g. Current transformer;</p> <p>h. State the uses of each type of transformer</p>	<ul style="list-style-type: none"> Define magnet and explain temporary, permanent and natural magnet. Define laws of magnet, show diagram where necessary. Show and explain magnetic fields. Explain fully mode of winding of transformer. $\frac{VP}{VS} = \frac{NP}{NS}$ <p>Explain</p> <ul style="list-style-type: none"> Show lamination and explain reasons for lamination. List and explain iron and copper loss and how to reduce them Explain efficiency and work some sample on efficiency Demonstrate how to construct double wound transformer. Explain fully different type of transformers e.g. power, isolation auto etc. Make available for inspection a number of examples 	<ul style="list-style-type: none"> Bar magnet Horseshoe magnet Soft Iron DC Power Coil Compass Copper Coil Chalk Board A transformer Chart Calculator Chalkboard Textbook -do- Lesson plan -do- Different types of transformers

PROGRAMME: NTC IN RADIO, TV & ELECTRONIC WORK			
Course: CEI II - BASIC ELECTRICITY		Course Code: CEI II	Contact Hours: 2-1 HRS
Course specification: Theoretical Content Year I, Term I			
General Objective 8.0: Analyse, connect and carry out simple calculations on simple electrical circuit.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
1-13	8.1 Explain the difference between series and parallel circuit 8.2 Calculate the total resistance in a series d.c. circuit 8.3 Calculate the voltage drop across each resistor of a series circuit 8.4 Calculate the total resistance of a parallel circuit 8.5 Investigate by experiment, the effect of resistors in series and in Parallel. 8.6 Calculate the current in each arm of a parallel circuit. 8.7 Investigate the effect of capacitor in an electric circuit. 8.8 Calculate the total voltage and current in series and parallel connected cells. 8.9 Calculate the voltage and current in a series and parallel circuit. 8.10 Investigate the current and voltage relationship in: <ol style="list-style-type: none"> an inductive circuit e.g. current leads the applied voltage. Capacitive circuit, e.g. current lags the applied voltage The combination of capacitance and inductance <ol style="list-style-type: none"> in series in parallel. 	<ul style="list-style-type: none"> Define an electric circuit and state the difference between series and parallel circuit. Give students calculation Work samples on Vd on each resistor in a circuit. Request students to work some calculation Carry out experiment to show the effect of resistor in series and in parallel. Show how to calculate the current in each arm. Ask question on connection of capacitor. Calculate voltage and current in series and parallel cells. Calculate voltage & current in series and parallel circuit. Define Pf and show its effect on phasor diagrams with calculations. Define impedance, give the symbols, unit and formula Calculate impedance Draw and explain resonance in series and parallel and simple calculations. Define Qf, B.W. and Fr. State the relationship among the three. Do some calculations on the three. 	<ul style="list-style-type: none"> Chalkboard Textbooks/Notes Calculator Notes Resistors DC power supply Multimetre Chalk Board Chalk Board Chalk Board Chalk Board Textbooks Note Calculator Chalk Board Chalk Board Chalk Board

PROGRAMME: NTC IN RADIO, TV & ELECTRONIC WORK			
Course: CEI II - BASIC ELECTRICITY		Course Code: CEI II	Contact Hours: 2-1 HRS
Course specification: Theoretical Content Year I, Term I			
General Objective 8.0: Analyse, connect and carry out simple calculations on simple electrical circuit.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
	8.11 Calculate impedance in an AC circuit 8.12 Explain the meaning of resonance in: a. a series circuit b. a parallel circuit 8.13 Explain the simple meaning of a. Q factor b. Bandwidth 8.14 Calculate resonant frequency.		
General Objective 9.0: Interpret basic electronic signs and symbols			
Week	Specific Learning Outcome:	Teachers Activities	Resources
1	9.1 State the common abbreviations used in electrical and electronic circuits. I = current A = Amp C = Capacity V = Voltage	<ul style="list-style-type: none"> List and show various abbreviations used in electrical and electronics circuits. 	<ul style="list-style-type: none"> Textbooks Note
	9.2 Draw the graphical symbols for components, units and systems used in electronics/electrical system e.g. transistor, amplifiers, switch, socket outlet, etc.	<ul style="list-style-type: none"> Ask questions on symbols used on electrical and electronics. 	<ul style="list-style-type: none"> Chalkboard Charts

PROGRAMME: NTC IN RADIO, TV & ELECTRONIC WORK			
Course: CEI II - BASIC ELECTRICITY		Course Code: CEI II	Contact Hours: 2-1 HRS
Course specification: Theoretical Content Year I, Term I			
General Objective 10.0: Understand the operation, uses and limitations of indicating instruments and operate them.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
3-13	10.1 Describe the functional part of the multi-meter 10.2 Set and read the meter for: a. AC and DC voltage measurement b. Resistance measurement c. AC and DC current measurement 10.3 Use the Ohmmeter to test semiconductor devices. 10.4 Recognize a fault condition of meter	<ul style="list-style-type: none"> • Describe the parts, operation and uses of multimeter. • Demonstrate how to use the instrument in measuring current voltage and resistance both on AC and DC • Show how to use the multimeter to test diode, transistors etc. • Explain how to identify fault and how to rectify such. 	<ul style="list-style-type: none"> • Multimeter - digital and analogue • Ohmmeter • Chalkboard • Note. • Chalk Board • Diode • Transistor

PRACTICAL CONTENT FOR BASIC ELECTRICITY CEI 11 MODULE
ALL EXPERIMENTS MUST BE PERFORMED BY STUDENTS

Week	EXPERIMENTS	TEACHER'S ACTIVITIES	RESOURCES
1-12	<p>Demonstrate by experiment Resistors in Series and in Parallel</p> <p>Demonstrate by experiments the effect of connecting capacitors in series and in parallel</p> <p>Demonstrate by experiment Ohms law: $R = V/I$</p>	<ul style="list-style-type: none"> • Circuit Resistors in Series and then in parallels with meters and power supply. • Current capacitors • In series • In parallel. • Measure current and voltage • Current resistor R in series with ammeter. Measure current I in R and measure voltage V across R 	<ul style="list-style-type: none"> • DC Ammeters, DC Voltmeters, Resistors power supply unit. • Capacitors, DC Ammeters DC Voltmeters, Power supply. • Ammeter • Rheostat • Power supply dc.
1-12	<p>Demonstrate by experiment - Kirchoff's laws</p> <p>Demonstrate by experiment the Superposition theorem.</p> <p>Demonstrate by experiment self induction. Natural induction of a coil</p> <p>R & L in series AC circuit, R&C in series AC circuit</p> <p>R & L in parallel AC circuit and R&C in parallel AC circuit</p> <p>Demonstrate by experiment series Resonance in Ac and Parallel resonance in AC.</p> <p>Plot graphs for both series and parallel resonance.</p> <p>Determine the Q-factors</p>	<ul style="list-style-type: none"> • Wire sot and take readings • Move permanent in and out of the coil and note deflection on the metre. • Connect the circuit and demonstrate variations of frequency at constant voltage 	<ul style="list-style-type: none"> • Kirchoff's laws unit. • Solenoid • Permanent bar magnet • Components, Signal generator • AC micrometer, AC Voltmeter (oscilloscope) capacitor, sine wave, signal generator.

EVALUATION GUIDE FOR MODULE CEI II - BASIC ELECTRICITY

The student will be assessed on the basis of demonstrating an understanding of basic electrical theory
 Students will be graded on the following Criteria:

1. Tools,
2. Assignments and
3. Terminal Examinations:
4. The laboratory reports should also be assessed and graded.

Electronic Devices and Circuits

PROGRAMME:	National Technical Certificate in Radio, TV and Electronic Work
MODULE:	CRT 12 - Electronic Devices and Circuits
DURATION:	180 HRS
PRE-REQUISITE:	CEI 11
GOAL:	The module is intended to provide the trainee with the knowledge and skills to enable him understand the functions and characteristics of electronic devices and circuits.

GENERAL OBJECTIVES:

On completion of this module, the trainee should be able to:

- 1.0 Understand the basic principles and characteristics of common electronic devices, including thermal devices.
- 2.0 Know the application of the characteristics of common Electronic Devices.
- 3.0 Know the interpretation of Integrated circuit (IC), semi conductors and oscilloscopes.
- 4.0 Understand the principles of construction and operation of power supply and be able to construct simple power supply unit
- 5.0 Know the basic principles of design of simple electronic circuits.
- 6.0 Know the operation of Common Oscillator Circuits.
- 7.0 Know the use of binary numbers in Electronic circuits.
- 8.0 Understand the principles of modulation and detection.
- 9.0 Know the various acoustic Devices/Equipment.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN RADIO, TELEVISION AND ELECTRONIC WORK			
COURSE: CRT 12 ELECTRONIC DEVICES AND CIRCUITS		Course Code: CRT - 12	Contact Hours: 3-2
Course Specification: Practical Content			Year I, Term I
General Objective 1.0: Understand the basic principles and characteristics of common electronic devices including thermal devices			
Week	Specific Learning Outcome	Teachers Activities	Resources
1-4	<p>1.1 Explain the basic concept of</p> <p>a. Electronic Emission</p> <p>b. Semi conductor</p> <p>1.2 Explain the operations, characteristics and limitations of thermionic diode</p> <p>1.3 Explain the operations, characteristics and limitations of semi-conductor diode.</p> <p>1.4 Explain the effect of load on the characteristics of semi-conductor</p> <p>1.5 Define rectification and describe rectification in a diode circuit.</p> <p>1.6 Set up rectifying circuits.</p> <p>1.7 Describe the effect of filter elements on D.C. output voltage for half wave Rectifiers on Ripples.</p> <p>1.8 Describe the effect of filter elements on D.C. output voltage for full wave Rectifiers on Ripples.</p>	<ul style="list-style-type: none"> • Explain the types of electronic emission and semi-conductor materials (silicon, germanium) • Make a graphical representation of typical familiar V/I curve for a diode. • Use chart to explain the effect of load on the characteristics. Set up a circuit to demonstrate the effect of load on the characteristics. • Explain the concept of rectification. • Involve students in setting up of Rectifier circuits. • Let the students build a simple smoothing circuit and apply it at the output of the rectifier circuits. • Let the student build up simple smoothing/filtering circuit and apply it at the output of the rectifier circuits • Discuss the differences in operation and state the advantages and disadvantages of semi-conductor diodes over thermionic diodes 	<ul style="list-style-type: none"> • Chalk Board and pictorial aids, slides. • Semi conductor diode, pictorial chart & chalkboard. • Chart experiment kit and power-supply • Use pictorial diagram to show different types of Rectification • Practical Rectifier circuits and oscilloscope. • Chalk Board, Chart and practical circuits. Thermionic diode

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN RADIO, TELEVISION AND ELECTRONIC WORK			
COURSE: CRT 12 ELECTRONIC DEVICES AND CIRCUITS		Course Code: CRT - 12	Contact Hours: 3-2
Course Specification: Practical Content			Year I, Term I
General Objective 2.0: Know the application of the characteristics of common Electronic Devices			
Week	Specific Learning Outcome	Teachers Activities	Resources
5-7	<p>2.1 Explain the operation, characteristics and limitations of the triode and transistor.</p> <p>2.2 Explain mode types of transistor and use of heat sink.</p> <p>2.3 Show graphically the effect of load on gain of a transistor.</p> <p>2.4 Determine transistor parameters</p> <p>2.5 Select transistor equivalent replacement using transistor manual.</p> <p>2.6 Describe the operation of photoelectric devices like solar battery, light dependent resistor and diodes.</p> <p>2.7 Describe the structure and design of Cathode Ray Tube</p>	<ul style="list-style-type: none"> • Explain the transistor configurations (i) Common Emitter (ii) Common Base (iii) Common collector • Determine transistor parameters. $I_e = I_c + I_b$ Calculations of V_{cc}, V_{CE}, V_{be} etc. • Describe how to select equivalent replacement using transistor manual. 	<ul style="list-style-type: none"> • Transistor P.N.P., Power transistor on Heat sink. • Pictorial charts. • Transistor manual.
8-10	<p>2.8 Describe the construction, application of special solid state devices:</p> <ol style="list-style-type: none"> Diode Zener diode Tunnel diode Light emitting diode Unijunction Field effect transistor Thyristor 	<ul style="list-style-type: none"> • Set up laboratory experiment to plot characteristics of transistor. • Explain the working of these photoelectric devices: solar battery, light dependent resistor and diodes. • Give explanation on structure and design of cathode ray tube. • Show their different symbols and explain their application. 	<ul style="list-style-type: none"> • Resources • Variable power supply, Ammeter, graph sheets. • Solar cell. Light dependent resistor and diode. • Vectoral diagrams of the devices. • Well sketched diagram of a cathode ray tube on Poster. • Diode, Light emitting diode, transistor, zener diode.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN RADIO, TELEVISION AND ELECTRONIC WORK			
COURSE: CRT 12 ELECTRONIC DEVICES AND CIRCUITS		Course Code: CRT - 12	Contact Hours: 3-2
Course Specification: Practical Content			Year I, Term I
General Objective 3.0: Know the Interpretation of Integrated Circuit (IC), Semiconductors, Oscilloscopes.			
Week	Specific Learning Outcome	Teachers Activities	Resources
11-13	3.1 Identify Ic symbol in circuit diagram 3.2 Identify Ic pins 3.3 Identify and test the various types of semiconductor device: - e.g. Transistor 3.4 Identify and test transistor terminals. 3.5 Describe the functional parts of the oscilloscope. 3.6 Determine various waveforms using the oscilloscopes.	<ul style="list-style-type: none"> • Present different type of IC (s) physically and explain the application • Present an IC to students and show them the various pins. Use also the IC manual for further identification • Use meters to identify the types of Transistors P.N.P. and N.P.N. • Use meter to identify the base, emitter and collector and transistor condition. • Present an oscilloscope and use it to describe the functional parts. • Apply various signals to the oscilloscope to illustrate the waveforms. 	<ul style="list-style-type: none"> • IC Manual Life IC symbol on a chart • IC Manual and several IC(s) • Tests meters Transistor tester, Test meter • Transistor manual several transistors. • Oscilloscope and stabilized power supply. • Oscilloscope and signal generator.
General Objective 4.0: Understand the Principles of Construction and Operation of Power Supply. Year 2, Term 2. CONTACT HR: 3-2			
Week	Specific Learning Outcome	Teacher's Activities	Resources
1-6	4.1 Describe the principle of Operation of a power supply unit. 4.2 Identify power supply in a schematic diagram. 4.3 Identify half wave and full wave rectification. 4.4 Construct a stabilized low-voltage D.C. power supply unit. 4.5 Differentiate between half and full wave rectifiers and state their advantages and disadvantages. 4.6 Explain the effect of capacitors and inductor in a power supply.	<ul style="list-style-type: none"> • Introduce a power supply unit to the students. • Show with the aid of a schematic diagram the place of a power supply in a complex circuit. • Illustrate the concept of half-wave and full-wave rectification. • Supervise the construction of a stabilized low-voltage power supply unit. • Distinguish between half-wave and full-wave rectifier circuits, stressing the advantages and disadvantages. 	<ul style="list-style-type: none"> • Schematic diagrams of:(i) half-wave rectifier(ii) full-wave rectifier. Graph sheets, oscilloscopes, capacitors, inductors, zener diodes and transistors, various transformers:(i) step up and(ii) step down. - do - - do -

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN RADIO, TELEVISION AND ELECTRONIC WORK			
COURSE: CRT 12 ELECTRONIC DEVICES AND CIRCUITS		Course Code: CRT - 12	Contact Hours: 3-2
Course Specification: Practical Content			Year I, Term I
	4.7 Explain the waveform at various points of power supply.	<ul style="list-style-type: none"> • Show samples of capacitors & inductors used in power supply and illustrate their effect on the output of a power supply. • Explain the waveforms of various stages of a power supply and monitor them on an oscilloscope. 	
7-9	4.8 Explain the difference between regulator and stabilizer. 4.9 Switched mode Power supply. Cover theory of operation, and evaluate performance using a circuit diagram. 4.10 Distinguish between power supply with transformer and Power supply without transformer.	<ul style="list-style-type: none"> • Explain the function of a regulator and a stabilizer in a power supply unit. • Exhibit power supply: (i) with transformer and (ii) without a transformer. • Illustrate the concept of design of simple electronic circuit e.g. power supply unit, AF amplifier oscillator, alarm, integrating and differentiate circuits. 	<ul style="list-style-type: none"> • Power supply with and without transformer • Simple circuits presented.
General Objective 5.0: Know the basic Principles of design of simple electronic circuits			
Week	Specific Learning Outcome	Teachers Activities	Resources
9-13	1.1 Students to construct electronic project., e.g. stabilized Power supply, single stage amplifier, an oscillator, etc	<ul style="list-style-type: none"> • Provide full construction information including circuit parts list, printed circuit board details, sheet metal details, etc. 	Project Components

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN RADIO, TELEVISION AND ELECTRONIC WORK			
COURSE: CRT 12 ELECTRONIC DEVICES AND CIRCUITS		Course Code: CRT - 12	Contact Hours: 3-2
Course Specification: Practical Content			Year I, Term I
General Objective: 6.0 Know the Operation of Common Oscillator Circuits. Year 2, Term 3.			
CONTACT HOUR: 2-3			
Week	Specific Learning Outcome	Teachers Activities	Resources
1-4	<p>6.1 Explain concept of Oscillation</p> <p>6.2 Draw the diagram and explain the operation of the following oscillators.</p> <p>a. L.C. Oscillator</p> <p>b. Hartley Oscillator</p> <p>c. Colpitt Oscillator - Crystal control Oscillator</p> <p>d. Tuned anode Oscillator - Tuned grid Oscillator</p> <p>e. R.C. Oscillators</p> <p>f. Multivibrators</p> <p>g. Tuners</p> <p>6.3 Identify the fq of an oscillator as the channel frequency of a TV or Radio station. Examples of TV and Radio tuners and their operation.</p> <p>6.4 Define and explain (a) Astable multivibrator (b) bistable vibrator, (c) monostable multivibrators</p> <p>6.5 Construct a signal injector using a multi-vibrator circuit (flips flop)</p>	<ul style="list-style-type: none"> • Demonstrate the concept of Oscillation using stone in water medium, using fork, string and wind instruments. • Demonstrate using switches and electric bulbs the operation of a bistable multivibrator and observe the output from the scope. • Illustrate the circuit diagram of various multivibrators and explain why they are so-called. • Provide examples of radio and TV tuners. • State the applications of multivibrators. • Supervise the construction of a multivibrator circuit (flip-flop) 	<ul style="list-style-type: none"> • Stone and water bowl, turning fork, guitar, etc. circuit diagrams of oscillators i.e., Lc oscillator, Hartley, Colpitt, Crystal controlled, tuned and tuned grid, signal generator. • Switches, bulb, connecting leads & oscilloscope. • Circuit diagrams. • Power supply, transistors resistors, capacitors, visual boards, connecting leads, and soldering iron and lead.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN RADIO, TELEVISION AND ELECTRONIC WORK			
COURSE: CRT 12 ELECTRONIC DEVICES AND CIRCUITS		Course Code: CRT - 12	Contact Hours: 3-2
Course Specification: Practical Content			Year I, Term I
General Objective 7.0: Know the use of Binary numbers in Electronic circuits			
Week	Specific Learning Outcome	Teachers Activities	Resources
5-6	7.1 Explain the use of binary number in electronic circuits. 7.2 Identify simple logic circuit of (I) AND (II) OR (III) NOT	<ul style="list-style-type: none"> • Introduce binary and logic concepts and their application to electronics circuits. • Students to connect up logic gates to illustrate the following functions: AND, OR and NOT gates • Write the truth tables for AND, OR and NOT gates 	<ul style="list-style-type: none"> • Symbols and diagrams of logic circuits • Logic gate symbols • Truth table for the logic gates mentioned. • Logic gates
General Objective 8.0: Understand the Principles of Modulation and Detection			
Week	Specific Learning Outcome	Teachers Activities	Resources
7-9	8.1 Explain the principles of modulation and demodulation. 8.2 Explain the purposes of modulation and demodulation. 8.3 Draw the modulation envelop. 8.4 Identify demodulation and modulation circuits in AM radio sets. 8.5 Identify demodulation and Modulation circuits, in F.M. radio sets. 8.6 Explain how signals are detected.	<ul style="list-style-type: none"> • Define Modulation and Demodulation and explain the principles of modulation. • Discuss the need for and the effects of amplitudes and frequency modulation for long distance broadcasting. • Sketch diagrams of modulated waves to illustrate the concept of modulation and demodulation as applied to F.M. and AM systems. • Dismantle an AM radio set and identify. • Demodulation circuit • Modulation circuit (mixer) • Dismantle an FM radio set and identify • (I) Demodulation circuit • Modulation circuit (mixer) • Discuss how signals are detected in 	<ul style="list-style-type: none"> • Charts showing modulated and demodulated envelopes. • FM & AM R.F. signal generator, oscilloscope, signal tracer • AM Radio receiver, set of screwdrivers. • FM Radio receiver, set of screw drivers • Schematic diagrams. • Demodulated envelope. • Am and Fm trainers • Oscilloscope.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN RADIO, TELEVISION AND ELECTRONIC WORK			
COURSE: CRT 12 ELECTRONIC DEVICES AND CIRCUITS		Course Code: CRT - 12	Contact Hours: 3-2
Course Specification: Practical Content			Year I, Term I
		<ul style="list-style-type: none"> • AM receiver, and • FM receiver by using schematic diagrams • Using AM and FM trainers observe waveforms using an oscilloscope. 	
General Objective 9.0: Know the various Accoustics Devices/Equipment			
Week	Specific Learning Outcome	Teachers Activities	Resources
10-13	<ul style="list-style-type: none"> a. Loud speaker b. Microphone c. Tape recorder and d. Turntable e. Pick up f. Public Address System (PAS) g. Compact Disc (CD) h. Video Cassette Recorder (VCR) 9.1 Set up and operate a public address system. 9.2 Troubleshoot and repair faulty P.A.S.	<ul style="list-style-type: none"> • Identify the circuit symbols for the accoustic devices mentioned and state the function performed by each. • Discuss the working principles of these devices. • Set up a Public address system incorporating microphones, amplifiers turntable and loudspeaker, with stabilized power supply source. • Teachers are to alert students about risk of laser rod on function compact disc players. 	<ul style="list-style-type: none"> • Loudspeaker, microphone tape recorder, turntable, pick up, PAS, Compact, disc, VCR, charts. • Microphones, Amplifier turntable and loudspeaker. • Fault PAS Equipment.

Radio Communication

PROGRAMME:	National Technical Certificate in Radio, TV & Electronic Work
MODULE:	CRT 13 - Radio Communication
DURATION:	240 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:	
<ol style="list-style-type: none">1 Understand the basic principles of radio transmission and reception.2 Know how to trouble shoot or trace faults and repair radio sets.	

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN RADIO, TELEVISION AND ELECTRONIC WORK			
COURSE: CRT 13 RADIO COMMUNICATION		Course Code: CRT 13	Contact Hours: 3-2
Course Specification Practical Content Year 2, Term 3			
General Objective 1.0: Understand the basic principles of radio transmission and reception			
Week	Specific Learning Outcome:	Teachers' Activities	Resources
1-13	1.1 Explain the basic principles of radio transmission. 1.2 Draw and explain with simple block diagram, the function and operation of radio, transmitter. 1.3 Draw and explain with simple block diagram the function and operation of radio receiver. 1.4 Explain the importance of carrier and modulation in transmitting and receiving signal. 1.5 Explain the process of tuning and selectivity in a radio set. 1.6 Explain the series/parallel LC Circuits and Resonance.	<ul style="list-style-type: none"> • Explain electromagnetic wave, radio wave and calculation of frequency and wavelength. • Present block diagram and use it to explain the function and operation of radio transmitter. • Explain the block diagram of radio receiver outlining the functions and operation • Organize a visit to a radio transmitting station. • To illustrate this, use a typical tuning circuit in a radio set. • Explain resonance and how to achieve resonance with LC circuits. 	<ul style="list-style-type: none"> • Chalk board • Pictorial block diagram. • A radio set with particular reference to tuning section.
1-13	1.7 Explain the use of series/parallel-tuned circuits in Radio Communication. 1.8 Draw the schematic and diagram and explain the operation of: <ul style="list-style-type: none"> a. RF stage (Aerial Input circuits) b. Mixer (Acceptor and Rejector circuits) 1.9 Draw the schematic diagram and explain the operation of <ul style="list-style-type: none"> a. Local oscillator b. IF (IF filter). 	<ul style="list-style-type: none"> • Introduce the concept of tuned circuits and its function in Radio Communication calculation or importance. • Distinguish between block and schematic diagrams. • Explain the operation of RF and mixer. • Identify these stages on a radio set. • Explain the operation of Local Oscillator and IF stage. • Explain the operation of detector stage, A.G.C. in radio communication. • State the full meanings of A.F.C. and A.G.C. and their importance in a radio receiver. 	<ul style="list-style-type: none"> • Variable capacitors, inductors, signal generator. • Radio set, • Oscilloscope, signal generator. • Radio set • Oscilloscope, signal generator. • Schematic diagram and pictorial diagram.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN RADIO, TELEVISION AND ELECTRONIC WORK			
COURSE: CRT 13 RADIO COMMUNICATION		Course Code: CRT 13	Contact Hours: 3-2
Course Specification Practical Content Year 2, Term 3			
1-13	<p>1.10 Draw the schematic diagram and explain the operation of</p> <p style="padding-left: 40px;">a. Detector /A.G.C. (Image suppressor)</p> <p style="padding-left: 40px;">b. A.G.C. (Amplifier etc. cross modulation).</p> <p>1.11 Explain the importance of A.F.C. in radio receiver, and compare the functions of A.G.C. and A.F.C.</p>	<ul style="list-style-type: none"> • Also compare their functions. 	
General Objective 2.0: Know how to trouble shoot or trace faults and repair radio sets. Year 3, Term 1 Contact Hours: 2-3			
Week	Specific Learning Outcome:	Teachers' Activities	Resources
1-13	<p>2.1 State the advantages of superhetrodyne receiver.</p> <p>2.2 Distinguish between an AM and FM Receiver.</p> <p>2.3 Explain the method of detection in AM and FM receiver: Limiter</p> <p>2.4 Explain the difference between Domestic receiver and Communication receiver.</p> <p>2.5 Interpret radio set schematic diagram.</p> <p>2.6 Explain workshop safety precaution in Radio, Television workshop.</p>	<ul style="list-style-type: none"> • Introduce the concept of superhetrodyne and use it to compare Tuned radio frequency (TRF) • Explain the concept and phenomenon of AM and FM. • Explain the difference between AM and FM detector circuits. Explain use of limiter circuit in FM. • Explain that communication receiver receives and transmits while domestic receiver receives only. • Explain how to read radio set schematic diagram. • Enumerate safety rules and regulations in Radio TV workshop. • Introduce these equipment signal tracer, signal gen., IF sweep generator, meters Lop antenna, Frequency counter ad Non-magnetic Screw driver. 	<ul style="list-style-type: none"> • Block diagram of TRF and superhetrodyne. • Chalkboard and demonstration receiver in FM and AM. • Schematic/block diagram of limiter circuit. • Domestic receiver communication receiver. • Various schematic diagrams of radio sets. • Safety wears, shoes, and gloves goggles.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN RADIO, TELEVISION AND ELECTRONIC WORK			
COURSE: CRT 13 RADIO COMMUNICATION		Course Code: CRT 13	Contact Hours: 3-2
Course Specification Practical Content Year 2, Term 3			
	2.7 Identify the following faults finding equipment: <ol style="list-style-type: none"> a. Signal tracer b. Signal generator c. IF sweep generator d. Meters e. Loop antenna f. Frequency counter g. Non-magnetic screw driver 		<ul style="list-style-type: none"> • Signal tracer, signal generator, if sweep generator, meters, loop antenna, frequency counter and Non-magnetic screwdriver.
General Objective 2.0: Know how to trouble shoot or trace faults and repair radio sets. Year 3, Term 2. Contact Hours: 1-4			
Week	Specific Learning Outcome:	Teachers' Activities	Resources
1-13	2.8 Explain/Describe the faultfinding technique in radio servicing. 2.9 Diagnose fault in a radio receiver using faultfinding technique. 2.10 Repair and maintain radio receiver observing safety precautions. 2.11 Align a radio receiver as specified by the manufacturers features.	<ul style="list-style-type: none"> • List faultfinding techniques (I) check the plug manpower supply flow chart technique signal tracing technique signal injecting, etc. • Teacher creates faults in radio set for students to trace the faults. • Provide sets for faultfinding and repairs. • Demonstrate (alignment of IF & RF using the necessary equipment and tools for FM & AM radio receivers. 	<ul style="list-style-type: none"> • Flow chart, signal tracer, signal Injector. • Signal tracer, signal generator, IF sweep generator, meters loop antenna, frequency counter and Non-magnetic screwdrivers. • IF signal generator for both AM & FM, FM radio receiver AM radio receiver power supply.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN RADIO, TELEVISION AND ELECTRONIC WORK			
COURSE: CRT 13 RADIO COMMUNICATION		Course Code: CRT 13	Contact Hours: 3-2
Course Specification Practical Content Year 2, Term 3			
General Objective 2.0: Know how to trouble shoot or trace faults and repair radio sets Year 3, Term 3			
Contact Hour: 1-4			
Week	Specific Learning Outcome:	Teachers' Activities	Resources
1-13	2.12 Dismantle and re-assemble power supply stage in radio set. 2.13 Dismantle and re-assemble RF stage in a radio set. 2.14 Dismantle and re-assemble IF and detector stage. 2.15 Dismantle and re-assemble AF Amp and L/Speaker. 2.16 Install and maintain a car radio 2.17 Differentiate between the various types of aerials used in radio and TV receptions. 2.18 Construct different types of aerials used in radio & TV. 2.19 Operate and use the following equipment to clear fault in a radio set: <ol style="list-style-type: none"> a. Signal tracer b. Signal generator c. IF sweep generator d. Meters e. Loop antenna f. Frequency counter g. Non-magnetic screw drivers 	<ul style="list-style-type: none"> • Explain the process of dismantling and re-assembling power supply in a radio set. • Explain the process of dismantling, and re-assembling RF stage in a radio set. • Explain the process of dismantling and re-assembling these stages in a radio set. • Explain the process involved in dismantling and re-assembling these stages. • Explain the process involved in installing and maintaining a car radio. • Explain and identify the parts, functions of various types of aerials used in radio & TV reception. • Explain the process involved and also state the materials. 	<ul style="list-style-type: none"> • Radio set, screwdrivers. • Car radio, screwdrivers, spanners. • Various types of aerial and schematic diagrams. • Signal tracer, signal generator, IF sweep generator meters, loop antenna, frequency counter and non-magnetic screwdriver.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN RADIO, TELEVISION AND ELECTRONIC WORK

COURSE: CRT 13 RADIO COMM.

Course Specification: Practical Content

General Objective:

Week	Specific Learning Outcome:	Teacher's Activities	Learning Resources
1-12	<p>Organize a visit to a radio and TV transmitting stations. Illustrate. Students to:</p> <ol style="list-style-type: none"> a. Illustrate and identify typical tuning circuit in a radio set. b. Identify variable, ganged capacitors and inductors in turning section. c. Identify these stages: RF (Aerial Input circuits) and Mixer in radio set. d. Identify and explain local oscillators and IF (IF filter) e. Identify these stages f. Detector g. AVC 	<ul style="list-style-type: none"> • Show the difference between FM and AM in components, based with and circuits. • Allow students to perform all experiments. 	<ul style="list-style-type: none"> • FM and AM receiver. • Measuring instruments and tools.

Radio and Audio Frequency Amplifiers

PROGRAMME:	National Technical Certificate in Radio, TV & Electronic Work
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 Amplifier and their operation.
GENERAL OBJECTIVES:	
On completion of this module, the trainee should be able to:	
Understand the Principles of Amplifier and their operation.	

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN RADIO, TELEVISION AND ELECTRONIC WORK			
COURSE: CRT 14 RADIO & AUDIO FREQUENCY AMPLIFIERS		Course Code: CRT 14	Contact Hours: 3-2
Course Specification: Practical Content YEAR 2, TERM 3			
General Objective: 1.0 Understand the principles of amplifier and their operation			
Week	Specific Learning Outcome:	Teacher's Activities	Learning Resources
1-13	1.1 Describe the operation of various classes of amplifier e.g. Class A, AB, Class B, Class C. 1.2 Explain the meaning of frequency response of amplifier. 1.3 Distinguish between power and voltage amplifiers. 1.4 Explain the operation of AF Amplifiers 1.5 Explain the operation of IF amplifier 1.6 Explain the operation of RF amplifier 1.7 Explain the operation of single stage and push pull amplifiers	Students to: <ul style="list-style-type: none"> • Set up the following classes of amplifiers with proper attention to their respective bias system; - class A amplifier, - class B Amplifier, and - Class C amplifier - class AB amplifier. • Set up an AF amplifier circuits to demonstrate the frequency response. • Set up (I) a voltage amplifier circuit and illustrate the difference between the two types. • Explain the spectrum of (I) Audio frequency (AF) (2) Intermediate frequency (IF) (3) Radio frequency (RF) 	<ul style="list-style-type: none"> • Amplifier Components.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN RADIO, TELEVISION AND ELECTRONIC WORK			
COURSE: CRT 14 RADIO & AUDIO FREQUENCY AMPLIFIERS		Course Code: CRT 14	Contact Hours: 3-2
Course Specification: Practical Content YEAR 2, TERM 3			
Week	Specific Learning Outcome: At the end of this model the students should be able to perform the following tasks:	Teachers' Activities	Resources
1-12	<p>EXPERIMENT I</p> <ul style="list-style-type: none"> a. Dismantle and re-assemble power supply in a radio set. b. Dismantle and re-assemble RF stage in a radio set. c. Dismantle and re-assemble IF and detector stages in a radio set. d. Dismantle and re-assemble AF amplifier stage and loudspeaker. e. Install and maintain a car radio. f. Identify type aerials used in radio and TV and their parts. 		<ul style="list-style-type: none"> • Make available appropriate tools.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN RADIO, TELEVISION AND ELECTRONIC WORK			
COURSE: CRT 14 RADIO & AUDIO FREQUENCY AMPLIFIERS		Course Code: CRT 14	Contact Hours: 3-2
Course Specification: Practical Content YEAR 2, TERM 3			
Week	Specific Learning Objective: At the end of this model the students should be able to perform the following tasks:	Teacher's Activities	Resources
1-12	<p>EXPERIMENT II</p> <ul style="list-style-type: none"> a. FM and AM demonstration receivers to be distinguished b. Explain the differences between FM and AM radios set schematic diagram. c. Introduce fault finding equipment d. Signal tracer, signal generator, IF sweep generator, meters, loop antenna, frequency counter and non-magnetic tools for RF tuning. e. Demonstrate how to use the equipment listed in Week 5 to diagnose faults in a radio set. f. Observe safety precautions while repairing and maintaining radio receiver. g. Alignment of IF and RF using necessary equipment: - IF signal generator and power supply. 		

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN RADIO, TELEVISION AND ELECTRONIC WORK			
COURSE: CRT 14 RADIO & AUDIO FREQUENCY AMPLIFIERS		Course Code: CRT 14	Contact Hours: 3-2
Course Specification: Practical Content YEAR 2, TERM 3			
Week	Specific Learning Objective: At the end of this module the students should be able to perform the following tasks	Teachers' Activities	Resources
	EXPERIMENT III		
1-12	Students to: <ol style="list-style-type: none"> a. Illustrate and identify typical tuning circuit in a radio set. b. Identify variable, ganged capacitors and inductors in tuning section. c. Identify these stages: RF (Aerial input circuits) and mixer in radio set. d. Identify and explain local oscillators and IF (IF filter) e. Identify these stages: <ul style="list-style-type: none"> - Detector - AVC 	<ul style="list-style-type: none"> • Organize a visit to a radio and TV transmitting stations. • Show and explain each stage. 	<ul style="list-style-type: none"> • AM & FM radio receivers. • Test equipment.
	<ol style="list-style-type: none"> f. Obtain different type of aerials used in Radio & TV g. Be able to identify various types of radio and TV aerial. h. Operate and use the following equipment to clear faults in a radio receiver: <ul style="list-style-type: none"> - Signal tracer - Signal generator - IF sweep generator - Meters - Loop antenna - Frequency counter - Non-magnetic screw driver 	-do-	-do-

Satellite Transmissions and Reception

PROGRAMME:	National Technical Certificate in Radio, TV & Electronic Work
MODULE:	CRT - 15 Satellite Transmissions and Reception. (TV, CCTV & ANCILLARY TECHNOLOGY)
DURATION:	300 Hours
PRE-REQUISITE:	
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 Basic Concept of Satellite Transmission and Reception.	
2.0 Know the Principles of Operation of TV.	
3.0 Understand the principles of TV camera and closed circuit TV.	

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN RADIO, TELEVISION AND ELECTRONIC WORK			
COURSE: CRT 15 SATELITE TRANSMISSION AND RECEPTION. (TV, CCTV & ANCILLARY TECHNOLOGY)		Course Code: CRT 15	Contact Hour: 2-3
Course Specification YEAR 2, TERM 2			
General Objective 1.0: Understand the Basic Concept of Satellite Transmission and Reception			
Week	Specific Learning Outcome:	Teacher's Activities	Learning Resources
1-13	<p>1.1 Explain the basic principle of Radio and Television transmission using repeater stations for a wider area coverage (terrestrial transmission).</p> <p>1.2 Explain the basic concept of image formation at the focal point of a concave mirror.</p> <p>1.3 Explain Multicast transmission over microwave frequencies e.g.</p> <p>a. Voice (Telephones)</p> <p>b. Video (Television)</p> <p>c. Data (Facsimile).</p>	<ul style="list-style-type: none"> • Relate Repeater Stations to Geo-Stationary Satellite parked in space for purpose of global (wider) coverage of transmission. (Satellite transmission). • Demonstrate reception of long distance Radio frequency on a Satellite Radio. • Explain and Relate the concave mirror to a parabolic receiving antenna with the Low Noise Amplifier placed at the focal point to pick up signal at a line-of-sight. • Organise a visit to a Satellite T.V. and Radio transmitting station. (AIT, MINAJ, NTA). • Demonstrate to students Satellite transmission 	<ul style="list-style-type: none"> • Chalk Board • Satellite Radio Receiver (World Receiver set). • TV Broadcast Stations
12-13	<p>1.4 Introduce and Explain the functions of:-</p> <p>Parabolic antenna dish</p> <p>Low Noise Down Converter - Amplifier (LND, LNC, LNA, LNB, etc)</p> <p>Coaxial Cable</p> <p>Satellite Receivers/Decoders</p>	<ul style="list-style-type: none"> • Explain using diagram, reception and processing of signal from Satellite to Television • Calculate the focal point (F) of any parabolic dish antenna using $F = \frac{2\pi d}{D^2}$ (formula to be verified please) Where <ul style="list-style-type: none"> d = Diameter of dish D = depth of dish. • Students to: <ul style="list-style-type: none"> • Assemble and Install a Knocked down C - band • Parabolic dish antenna directed at any or many free to air Satellite. 	<ul style="list-style-type: none"> • Satellite location and footprint manual • Plan (magnetic) • Measuring tape (steel) • Complete set of spanners • 2.0 meter Knocked down parabolic dish antenna. C - Band • Low Noise Down converter (LND) • Coaxial Cable <ul style="list-style-type: none"> • Satellite Receiver • Colour Television.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN RADIO, TELEVISION AND ELECTRONIC WORK			
COURSE: CRT 15 SATELITE TRANSMISSION AND RECEPTION. (TV, CCTV & ANCILLARY TECHNOLOGY)		Course Code: CRT 15	Contact Hour: 2-3
Course Specification YEAR 2, TERM 2			
• CABLE TELEVISION Year 2 Term 3 Contact Hours 2-3			
1-4	1.5 Explain the General principle of Television signal distribution through Coaxial cables.	• Carry out a two point distribution from one signal source NCR to two Television.	• Chalk Ink Board • Video Cassette Recorder • Mini T.V. Signal Sender
5-8	1.6 Explain Television signal distribution through Wireless transmitter (Multiple Channel, Multiple Distribution System MMDS).	• Explain with the aid of diagram MMDS transmission and reception • Demonstrate to student using wireless T.V. Sender, signal distribution from a source to multiple points.	• Television • Coaxial Cable • T.V. Connectors and necessary tools.
9-13	1.7 Explain types of receiving antenna and their components a. Yagi b. Concave antenna c. MMDS LND.	• Explain with the aid of diagram the various antenna designs.	• Chalk Board
General Objective 2.0: Principles of Operation of TV			
Week	Specific Learning Outcome:	Teacher's Activities	Learning Resources
1-4 5-8 9-13	2.1 Describe the principles of a. Power supply b. R.F. amplifier c. Mixer and local oscillator. d. IF amplifier stages 2.2 Describe the principles of e. CRT circuit f. Sync stages g. Vertical and horizontal deflection circuits 2.3 Sound IF stage including speaker AF amplifier stages.	• Use a typical schematic diagram of a Black and White television receiver, isolate the mentioned stages and describe the operational principles of these stages.	• Schematic diagram, a typical black and white television receiver.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN RADIO, TELEVISION AND ELECTRONIC WORK			
COURSE: CRT 15 SATELITE TRANSMISSION AND RECEPTION. (TV, CCTV & ANCILLARY TECHNOLOGY)		Course Code: CRT 15	Contact Hour: 2-3
Course Specification YEAR 2, TERM 2			
General Objective 3.0: Understand the principles of camera and closed circuit TV. Year 3, Term 1 Contact Hours: 4-1			
Week	Specific Learning Outcome:	Teacher's Activities	Learning Resources
1-13	<p>3.1 Explain the basic Principle of Television Surveillance for security Explain the relative difference between</p> <ul style="list-style-type: none"> a. CCTV Monitor b. T.V. Receiver c. CCTV Camera d. Video Camera <p>Door Store TV.</p> <p>3.2 Explain the Principle and installation of security panel incorporating</p> <ul style="list-style-type: none"> a. Door Phone TV; and b. Door latching system 	<ul style="list-style-type: none"> • Explain using Diagram remote sensing of TV signal and transmission through Cable and wireless to Monitors • Explain the principle of magnetic door latching and practical installation of a complete system. 	<ul style="list-style-type: none"> • Chalk Ink Board • Television Receivers • Mini CCD Monitor Camera
1-13	<p>3.3 Explain how video signal produces good picture quality.</p> <p>3.4 Explain how picture and sound signals are processed in different stages of a black & white television set.</p> <p>3.5 Monitor the action of the controls on a television receiver.</p>	<ul style="list-style-type: none"> • Explain the need for the production of good quality pictures and how this is achieved using video signal (e.g. synch. Pulses-vertical & horizontal) • Using a block diagram chart, explain how sound and picture signals are processed in different stages of a black and white television receiver. • Use a Black and white television receiver to identify users and service controls, and observe the effect of each on the picture and sound quality. • Principles of these stages. 	<ul style="list-style-type: none"> • Chart on black diagram of a black & white TV receiver (PAL). • Black and white television receiver, VCR or transmitter signals from a station.

Television

PROGRAMME:	National Technical Certificate in Radio, Television and Electronic Work
MODULE:	CRT 16 - Television
DURATION:	180 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 Black and White Television set.
GENERAL OBJECTIVES:	
On completion of this module the student should be able to:	
1.0 Diagnose and clear faults of common types found in every section or stage in a black and white television set.	
2.0 Understand the basic concept of colour television	

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN RADIO, TV & ELECRONIC WORK			
COURSE: CRT 16 - TELEVISION		COURSE CODE: CRT 16	Year 2, Term 2 CONTACT HOURS 2-3
General Objective 1.0: Diagnose and clear faults of the common types found in every section or stage in a black and white television set.			
Week	Specific Learning Outcome	Teacher's Activities	Learning Resources
1-13	<p>1.1 Identify the normal operation at each stage of the television set, using a block diagram.</p> <p>1.2 Clear faults common to tuner and IF amplifier stages e.g. Raster without picture and sound, weak picture and sound, picture and sound come on different channels, interrupted operation of picture and sound.</p> <p>1.3 Clear faults common to Video Amp and CRT circuit such as: poor picture quality, no picture but with normal sound, tilted picture, low brightness and contrast.</p> <p>1.4 Clear fault common to sync stage such as: simultaneous vertical horizontal osc output, High voltage section.</p> <p>1.5 Operate the following instrument to clear faults in a television set:</p> <ol style="list-style-type: none"> Pattern generator IF sweep generator Dual trace oscilloscope EHT meter TV analyzer 	<ul style="list-style-type: none"> • Introduce techniques for trouble shooting in a television set. • List the common faults in the various stages of a television receiver starting with: <ul style="list-style-type: none"> - Tuner stage, - IF amplifier stage - Video Amplifier stage - CRT Circuit - Sync stage • Present the following trouble shooting instruments to the trainees: <ul style="list-style-type: none"> - Pattern generator - IF sweep generator - EHT meter - TV analyzer; • Demonstrate their operation and application. • Provide television sets and issue instructional guide for dismantling, installing and adjusting the CRT. Show the trainees the pre-set and non pre-set controls in a television receiver and their relative locations and functions a circuit diagram. 	<ul style="list-style-type: none"> • Black and white TV set. • Colour TV set • Signal Generator • Signal Tracer • Power Supply • Pattern Generator • IF Sweep Generator • Dual Trace Oscilloscope • EHT Meter • TV Analyzer • Trimmer Screw Driver (Non Magnetic) • Voltage Tester • Viewing Mirror • Demonstration Board(s) • Soldering Iron set.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN RADIO, TV & ELECTRONIC WORK			
COURSE: CRT 16 - TELEVISION		COURSE CODE: CRT 16	Year 2, Term 2 CONTACT HOURS 2-3
General Objective 1.0: Diagnose and clear faults of the common types found in every section or stage in a black and white television set.			
Week	Specific Learning Outcome	Teacher's Activities	Learning Resources
1-13	<p>1.6 Remove, install and adjust the cathode Ray Tube (CRT).</p> <p>1.7 Set correctly the pre-set and non pre-set controls on a television receiver.</p> <p>1.8 Carryout the following investigation:</p> <p style="padding-left: 40px;">a. Synchronizing pulse separator stage.</p> <p style="padding-left: 40px;">b. Field time base of a television</p>	<ul style="list-style-type: none"> • Provide television sets and issue instructional guide for dismantling, installing and adjusting the CRT. Show the trainees the pre-set and non pre-set controls in a television receiver and their relative locations and functions a circuit diagram. • Show the trainees how to monitor the performance of the following circuits/stages. <ul style="list-style-type: none"> - Synchronizing pulse separator - Field time base circuit - Line time base circuit 	<ul style="list-style-type: none"> • Hand Tools • Screwdrivers (assorted) • Allen Keys • Spanners (assorted) • Cutters • Strippers • Servicing Manuals • Circuit Diagrams

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN RADIO, TV & ELECTRONIC WORK			
COURSE: CRT 16 - TELEVISION		COURSE CODE: CRT 16	Year 2, Term 2 CONTACT HOURS 2-3
General Objective 2.0: Understand the basic concept of Colour Television. Year 3, Term 2. Contact Hours: 4-1			
Week	Specific Learning Outcome:	Teacher's Activities	Learning Resources
1-13	<p>2.1 State the primary colours: red, green and blue</p> <p>2.2 State the complementary colours: magenta, cyan, yellow, while</p> <p>2.3 Explain how picture and sound signals are processed in different stages of a colour television set.</p> <p>2.4 Explain the use of the Colour decoder:</p> <p style="padding-left: 20px;">a. Chrominance amplifier</p> <p style="padding-left: 20px;">b. Burst gate amplifier</p> <p>2.5 Explain the use of the colour decoder:</p> <p style="padding-left: 20px;">a. Phase detector</p> <p style="padding-left: 20px;">b. Colour killer</p> <p style="padding-left: 20px;">c. Delay line</p> <p>2.6 Explain the use of the colour decoder:</p> <p style="padding-left: 20px;">a. Phase shift network</p> <p style="padding-left: 20px;">b. Colour difference demodulator</p> <p style="padding-left: 20px;">c. RGB Metric and associated circuits</p> <p>2.7 Explain Colour mixing techniques used in television</p>	<ul style="list-style-type: none"> • Explain the primary colours and how complementary colours can be formed. • Describe the use of colour decoder at each stage. 	<ul style="list-style-type: none"> • Colour TV

Electrical/Electronics Drawing

PROGRAMME:	National Technical Certificate in Radio, Television & Electronic Work
MODULE:	CTD 14 - Electrical/Electronics Drawing
DURATION:	96 Hours
PRE-REQUISITE	CTD 11-13
GOAL:	This model is designed to enable the trainee understand the basic electrical/electronics symbols and diagrams
GENERAL OBJECTIVES:	
On completion of this model the students should be able to:	
<ol style="list-style-type: none">1. Understand the block and basic diagrams in circuit development.2. Understand the Electronics component symbols.3. Understand the Electrical component symbols.	

PROGRAMME: NTC IN RADIO, TV & ELECTRONIC WORK			
COURSE: ELECTRICAL/ELECTRONICS DRAWING		Course Code: CTD 14	Contact Hours: 1-2
Course Specification: Theoretical Content Year 2, Term 2			
General Objective 1.0: Understand the Block and Basic Diagrams in Circuit Development.			
Week	Specific Learning Outcome	Teacher's Activities	Learning Resources
1-7	<p>1.1 Explain the purposes of block flow and logic diagrams.</p> <p>1.2 Explain symbols used in preparation of block and logic diagrams.</p> <p>1.3 Explain how to plan an arrangement of block symbols to produce intelligible block and flow diagrams.</p> <p>1.4 Describe drafting procedure for preparation of easily understood block diagrams.</p> <p>1.5 Explain the elements of logic symbols diagrams</p> <p>1.6 Draw block diagrams for electronic systems e.g. radio, television etc.</p> <p>1.7 Draw flow diagrams for typical industrial production.</p>	<ul style="list-style-type: none"> • Explain to students 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 block, flow logic. • Explain the difference between flow diagrams and block diagrams used example to illustrate the difference. • Explain methods to be used to prepare good diagrams • Draw logic symbols and their functions using truth table • Draw block diagrams for common electronic systems e.g. Radio, TV. • Draw flow diagram for producing typical items in an industry. 	<ul style="list-style-type: none"> • Chalkboard • Drawing Instruments

PROGRAMME: NTC IN RADIO, TV & ELECTRONIC WORK			
COURSE: ELECTRICAL/ELECTRONICS DRAWING		Course Code: CTD 14	Contact Hours: 1-2
Course Specification: Theoretical Content Year 2, Term 2			
General Objective 2.0: Understand the Electronic Component Symbols			
Week	Specific Learning Outcome	Teacher's Activities	Learning Resources
8-12	<p>2.1 Explain the need for electronic symbols and schematic diagrams.</p> <p>2.2 Explain the basic functions of commonly used electronic component.</p> <p>2.3 Relate component symbol shape to component functions.</p> <p>2.4 Develop proficiency in drawing electronic symbols in acceptable standard form</p> <p>2.1 Learn to produce sketches of physical structures of common components e.g. Resistors, Capacitors, Transformers, Diodes, Transistors variable resistors, potentiometer, switches, batteries, microphone, recording, pick up lead aerial, play back pick up lead etc.</p>	<ul style="list-style-type: none"> • Explain why standard symbols are used in circuits. • Show as many components as possible and explain their functions. • Explain the functions of each component • Familiarise with common component symbols. • Sketch the exact physical resemblance of common components. 	<ul style="list-style-type: none"> • Chalkboard • Drawing Instruments • Electronics components
4-11	<p>2.2 Explain electronic symbols through circuit application e.g. in simple amplifier.</p> <p>2.3 Explain the purpose of schematic diagram</p> <p>2.4 Identify the basic elements needed in all electronic Circuit</p> <p>2.5 Identify the basic circuits, which make up a complete electronic device.</p> <p>2.10 Explain how to train a diagram of popular circuits e.g. single stage, common emitter amplifier, 2-stage common emitter amplifier, power supply chit receiver circuit, etc.</p>	<ul style="list-style-type: none"> • Explain how components are connected together to make a circuit using symbols. • Draw schematic diagram and explain how it functions. • Explain the elements needed in most basic circuit. • Identify stages needed in a typical electronic system. 	<ul style="list-style-type: none"> • Chalkboard • Drawing sheet • Chalkboard • Schematic diagram. • Chalkboard • Schematic diagram • Chalkboard • Schematic diagram • Prepared drawings.

PROGRAMME: NTC IN RADIO, TV & ELECTRONIC WORK		
COURSE: ELECTRICAL/ELECTRONICS DRAWING	Course Code: CTD 14	Contact Hours: 1-2
Course Specification: Theoretical Content Year 2, Term 2		
4-11	<p>2.11 Explain the need for conformity in drawing schematic drawings.</p> <p>2.12 Identify properly drawn schematic diagrams</p> <p>2.13 Explain symmetry and balance in drawing schematic diagram.</p> <p>2.14 Show symbol placement and space arrangement for maximum legibility</p> <p>2.14 Draw the stages of a schematic diagram in proper sequential manner</p> <p>2.15 Explain how to convert a bread-board circuit into a proper schematic diagram.</p>	<ul style="list-style-type: none"> • Explain how a signal can be traced in a schematic diagram using left right rule. Draw some of the circuits. • Explain the need for conformity when drawing schematic diagrams. • Show a schematic diagram indicating reference symbol positions. • Students to copy examples. • Explain the need for symmetry and balance when drawing schematic diagrams. Show examples. • Students must draw. • Draw schematic diagram in sequential manner and explain how signal flow through. Show how to make parts lists • Explain how to convert simple wiring diagram to schematic diagrams and vice versa.

PROGRAMME: NTC IN RADIO, TV & ELECTRONIC WORK			
COURSE: ELECTRICAL/ELECTRONICS DRAWING		Course Code: CTD 14	Contact Hours: 1-2
Course Specification: Theoretical Content Year 2, Term 2			
	General Objective 3.0: Understand the Electrical component symbols. Year 2, Term 3. Contact Hour: 1-4		
Week	Specific Learning Outcome	Teacher's Activities	Learning Resources
1-12	<p>2.16 Develop consistency in components cache or reference location on the schematic diagram.</p> <p>2.17 Explain the differences between industrial wiring and residential wiring diagrams compared to electronic wiring diagrams.</p> <p>2.18 Explain how to read industrial control wiring diagrams</p> <p>2.19 Identify electrical symbols used in power distribution diagrams.</p> <p>2.20 Explain the basic differences between AC and DC motors</p> <p>2.21 Explain the need for special starting circuits for industrial motors</p> <p>2.22 Explain the basic principles of operations of electrical protective devices using their circuits.</p> <p>2.23 Explain the difference between schematic and single diagrams</p> <p>2.24 Explain how to read single line diagrams</p> <p>2.25 Identify electrical symbols used in architectural plans</p> <p>2.26 Explain how basic lighting circuits are wired.</p> <p>2.27 Explain how to determine the wire size needed under different load conditions.</p> <p>2.28 Develop proficiency in the design of and wiring of residential circuits.</p>	<ul style="list-style-type: none"> • Explain the need to place cache by the particular side of a component. • Using examples explain the differences among industrial power and residential wiring diagrams compared to electronics wiring diagrams. • Showing industrial control wiring diagrams, Students should be made to draw simple industrial control wiring • List sketch and draw all common components and symbols used in power distributions diagrams. • Explain the differences between AC and DC motors • Draw diagrams for various starting methods and explain how they operate. • Students should draw the circuit. • List and sketch protective devices, draw their symbols. 	<ul style="list-style-type: none"> • Chalkboard • Schematic diagram. • Chalkboard • Drawings • Chalkboard • Single line diagram • Chalk board • List of electrical symbols drawing. • Chalk board • Plan of a house. • Plan of a house.

PROGRAMME: NTC IN RADIO, TV & ELECTRONIC WORK			
COURSE: ELECTRICAL/ELECTRONICS DRAWING		Course Code: CTD 14	Contact Hours: 1-2
Course Specification: Theoretical Content Year 2, Term 2			
		<ul style="list-style-type: none"> • Students must know how to do same. • Draw schematic and single line diagrams and explain the difference between them. • Produce single line diagram and show students how to read it. • List and draw electrical symbols used in architectural plans. • Show how lighting circuits and power circuits are wired. • Identify the difference between ring mains and radial wiring. Explain advantages of ring over radial. • Show how to determine wire sizes under different load conditions. • Explain how to design and wire residential circuits or houses. 	

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

Colour Television

PROGRAMME:	Advanced National Technical Certificate in Radio, TV & Electronic Work
MODULE:	CRT 21 - Colour Television
DURATION:	288 Hours
PRE-REQUISITE	CRT 16
GOAL:	This course is intended to provide the trainee with knowledge and skill to enable him install, and maintain coloured television set.
GENERAL OBJECTIVES:	
On completion of this module, the trainee should be able to:	
<ol style="list-style-type: none">1 Understand the process of receiving and reproducing sound and picture in colour television receiver.2 Diagnose and clear faults of the common types found in every stage of a colour television set.3 Understand the principles of colour mixing.	

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE IN RADIO, TELEVISION & ELECTRONIC WORK

COURSE: CRT 21 COLOUR TELEVISION Course Code: CRT 21 Contact Hours: 3-6

Course Specification: At the end of the course students will be able to understand the process of sound and picture reception and production in colour TV receiver.

General Objective: 1.0 Understand the process of receiving and producing sound and picture in a colour television receiver. Term 1

Week	Specific Learning Outcome:	Teacher's Activities	Learning Resources
1-3	1.1 Describe how sound and picture are transmitted and received using typical block diagram of a transmitter and receiver sets.	<ul style="list-style-type: none"> • Introduce the concept of colour television as distinct from black & white television. Then use typical block diagram to illustrate the concept of transmission and reception. 	<ul style="list-style-type: none"> • Block diagram of TV transmission /reception. Colour television receiver set.
4-6	1.2 Explain the following terms to illustrate picture quality of a colour television set:	<ul style="list-style-type: none"> • Discuss Hue control & Tint control. Ask questions pertaining to the discussion 	<ul style="list-style-type: none"> • Block diagram of TV transmission and reception • Block diagram depicting the processing of picture and sound at difference stages of colour television reception.
7-8	a. Hue control	<ul style="list-style-type: none"> • Discuss saturation & colour. Ask questions pertaining to the discussion. Illustrate the processing of picture & sound signals at different stages in colour television system. 	<ul style="list-style-type: none"> • Chrominance Amplifier unit
9-11	b. Tint control	<ul style="list-style-type: none"> • Present the topic on colour decoder and highlight the functional operations of the chrominance amplifier, and Burst gate amplifier. 	<ul style="list-style-type: none"> • Burst Gate Amplifier unit
12-13	c. Saturation and colour control	<ul style="list-style-type: none"> • Phase shift network and R.G.B. matrix and associated circuits. 	<ul style="list-style-type: none"> • Phase Detector unit
	1.3 Explain how picture and sound signals are processed at different stages of a colour television set.	<ul style="list-style-type: none"> • Introduce the theory of static and dynamic colour convergence. Follow up with questions and answers. 	<ul style="list-style-type: none"> • Delay line unit
	1.4 Explain the working principles of a colour decoder:	-do-	<ul style="list-style-type: none"> • R.G.B. Matrix & Associated circuits. • Diagram to illustrate the difference between static and dynamic colour convergence.
	a. Chrominance amplifier		<ul style="list-style-type: none"> • Colour television receiver (set)
	b. Burst gate amplifier		
	c. Phase detector		
	d. Colour killer		
	e. Phase shift network		
	f. R.G.B Matric & associated circuits		
	1.5 Differentiate between static and dynamic colour convergence.		

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE IN RADIO, TELEVISION & ELECTRONIC WORK			
COURSE: CRT 21 COLOUR TELEVISION		Course Code: CRT 21	Contact Hours: 3-6
Course Specification: At the end of the course students will be able to understand the process of sound and picture reception and production in colour TV receiver.			
General Objective 2.0: Diagnose and clear faults of the common type found in every stage of a colour television set. Term 2, Contact Hour: 2-6			
Week	Specific Learning Outcome:	Teacher's Activities	Learning Resources
1-13	2.6 Identify the symptoms in each stage of the television set. 2.7 Clear faults, in any of the stages. 2.8 Operate the colour bar generator. 2.9 Use de-gaussing coil and other television servicing equipment.	<ul style="list-style-type: none"> Enumerate the common faults in colour TV receiver. Provide the instrument for fault diagnosis/trouble shooting. Supervise students on trouble shooting practical. <ul style="list-style-type: none"> Drill students on the operation of colour bar generator. Demonstrate to the students the use of de-gaussing coil and other servicing equipments. 	<ul style="list-style-type: none"> Chart indicating common faults.\Colour bar generator. Fr-gaussing coil.
General Objective 3.0: Understand the principles of colour mixing			
Week	Specific Learning Outcome:	Teacher's Activities	Learning Resources
1-13	3.1 The primary, colour (i) red, (ii) green (iii) blue 3.2 The complementary colours magenta, cyan, yellow and white 3.3 Derive U components 3.4 Derive V components	<ul style="list-style-type: none"> Present chart on primary colour mixing Present chart on compliment colour mixing Recall colour ratio to derive U. Still to derive the value of V. 	<ul style="list-style-type: none"> Chart of primary colours. Chart of complimentary colours Formula for derivation U Formula for derivation of V.
General Objective 4.0: Diagnose and clear faults of the common type found in every stage of a colour television set. Term 3, Contact Hour: 2-6			
Week	Specific Learning Outcome:	Teacher's Activities	Learning Resources
	4.1 Identify faults on any colour television set. 4.2 Clear faults in any stage of colour television set. 4.3 Operate all colour television controls. 4.4 Operate all instrument use for the servicing of colour television sets.	<ul style="list-style-type: none"> Students to perform exercises 	<ul style="list-style-type: none"> Colour TV Tools Measuring Instruments

Radio and Electronic Systems

PROGRAMME:	Advanced National Technical Certificate in Television and Electronic Work.
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, tape recorders and double super-heterodyne receivers. set.
GENERAL OBJECTIVES:	
On completion of this module, the trainee should be able to:	
<ol style="list-style-type: none">1. Understand the working principle of hi-fidelity receiver and be able to align the set.2. Carry out the characteristic test on a tape recorder to ascertain the performance tuner.3. Understand the working principles of a double super-heterodyne receiver and be able to eliminate faults due to adjacent channel and image channel interference.4. Understand the working principles of a double super-het receiver and be able to eliminate faults.5. Understand the operation of audio and video equipment.	

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE IN RADIO, TELEVISION & ELECTRONIC WORK			
COURSE: CRT 22 RADIO AND ELECTRONIC SYSTEMS		Course Code: CRT 22	Contact Hours: 3-6
Course Specification			
General Objective: 1.0 Understand of the working principle of hi-fidelity receiver and be able to align the set. Term 1			
Week	Specific Learning Outcome:	Teacher's Activities	Learning Resources
1-13	1.1 Explain the working principles of an FM stereo receiver. 1.2 Explain the working principle of amplifiers and associated stereophonic system such as: - room equalizer, octave equalizer. 1.3 Carry out receiver performance test to verify the specification of the system e.g. sensitivity and selectivity 1.4 Carry out receiver performance test to verify the specification of the system e.g. sensitivity and selectivity.	<ul style="list-style-type: none"> • Introduce concept of FM transmission & reception using block diagram and explain the working principle. • Explain the working principle of amplifier and stereophonic system using schematic diagram. • Provide equipment & instrument for carrying out selectivity and sensitivity test in a stereo receiver system. • Provide equipment and instruments for carrying out the following tests <ul style="list-style-type: none"> • Image rejection ratio • Noise factor • Stereo decoder alignment 	<ul style="list-style-type: none"> • Block diagram & schematic diagram of FM stereo receiver. • Block diagram & schematic diagram of amplifiers, associated stereo phone system as room equalizer, octave equalizer • Filed strength meter, oscilloscope FM stereo receiver, voltmeter, ohmmeter, and Alignment kit. • Stereo demonstration board.

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE IN RADIO, TELEVISION & ELECTRONIC WORK			
COURSE: CRT 22 RADIO AND ELECTRONIC SYSTEMS		Course Code: CRT 22	Contact Hours: 3-6
Course Specification			
General Objective: 2.0 Carry out the characteristic test on a tape recorder to ascertain the performance tuner			
Week	Specific Learning Outcome:	Teacher's Activities	Learning Resources
1-13	2.1 Describe the construction and characteristic of audio and video tape recorder. 2.2 Describe the construction and characteristic of video compact disc (VCD) and player set. 2.3 Explain the meaning of equalization 2.4 Explain the need for and method of equalization. 2.5 Explain the need for the bias of the recording head. 2.6 Interpret the schematic diagrams of a cassette cartridge mechanism 2.7 Carry out these test on a tape recorder: a. Azimuth alignment test b. Bias oscillator tuning 2.8 Carry out WOW flutter effect tests on a tape recorder. 2.9 Carry out test to determine the signal to noise ratio on a tape recorder. 2.10 Carry out test on frequency response of tape pre-amplifier on a tape recorder.	<ul style="list-style-type: none"> • Introduce the phenomenon of audio and video recording using block and schematic diagrams to explain the system. • Introduce the phenomenon of video compact disc and player set. Using block and schematic diagrams. • Illustrate the concept of equalization. • Explain the need for and method of equalization • Discuss the need for bias for recording head. • Drill students on the interpretation of schematic diagrams for Cassette cartridge mechanism assign schematic diagrams to students for them to interpret. • Demonstrate how to carry out the azimuth alignment test and bias oscillator-tuning test. • Demonstrate how the carry out the WOW/flutter effect test. • Demonstrate how to carry out the test to determine the signal to noise ratio on a tape recorder. • Carry out the test on the frequency response of tape pre-amplifier stage. 	<ul style="list-style-type: none"> • Block schematic and circuit diagram of simple tape • Recording machine, video tape recorder video compact disc/player/VCD recorder. • Alignment set chart depicting frequency response of tape pre-amplifier • Recording head set, pictorial chart. • Recording head & pictorial diagram. • Cassette recorder, player set scheme. • Alignment kit and tape recorder. • Signal tracer, alignment kit and tape recorder. • Pictorial chart depicting frequency response of pre-amplifier stage of a tape recorder.

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE IN RADIO, TELEVISION & ELECTRONIC WORK			
COURSE: CRT 22 RADIO AND ELECTRONIC SYSTEMS		Course Code: CRT 22	Contact Hours: 3-6
Course Specification			
General Objective: 3.0 Understand the working principle of double super heterodyne receiver and able to eliminate faults due to adjacent channel and image channel interference. Term 2 Contact Hour: 3-5			
Week	Specific Learning Outcome:	Teacher's Activities	Learning Resources
1-13	3.1 Explain the working principles of a double super-heterodyne receiver 3.2 Draw and interpret the block diagram of a double super heterodyne receiver. 3.3 Clear faults due to adjacent channel interference and image channel interference.	<ul style="list-style-type: none"> • Illustrate with diagram the working principles of a double super heterodyne receiver. • Explain the block diagram of a double super heterodyne receiver. • Provide equipment and supervise student in clearing faults due to adjacent channel interference and image channel interference. 	<ul style="list-style-type: none"> • Double super heterodyne receiver set. • Block diagram of double super heterodyne receiver. • Alignment kit, signal, Non magnetic screw driver etc.
General Objective 4.0: Understand the working principles of a double super het receiver and be able to eliminate faults.			
Week	Specific Learning Outcome:	Teacher's Activities	Learning Resources
1-12	4.1 Operate all type of FM stereo receiver, amplifiers and equalizers 4.2 Repair and service stereo receiver, amplifier and equalizers 4.3 Operate all instrument needed for servicing and maintenance of stereo sets & video compact disc.	<ul style="list-style-type: none"> • Students to carry out exercises. 	<ul style="list-style-type: none"> • Tools • Amplifiers set • Radio set • Video • Measuring instrument.

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE IN RADIO, TELEVISION & ELECTRONIC WORK			
COURSE: CRT 22 RADIO AND ELECTRONIC SYSTEMS		Course Code: CRT 22	Contact Hours: 3-6
Course Specification			
General Objective 5.0: Understand the operation of audio and video equipment. Term 3 Contact Hours: 2-5			
Week	Specific Learning Outcome:	Teacher's Activities	Learning Resources
1-12	5.1 Operate all type of audio and video recording equipment. 5.2 Diagnoses of all fault in relation to audio and video equipment including VCD. 5.3 Repair of all electronics and mechanical fault related to video, audio and C.D. equipment. 5.4 Test and Measurement: - 5.5 Azimuth alignment 5.6 Bias oscillation tuning 5.7 WOW/Flutter effect test 5.8 Signal to noise ratio test 5.9 Frequency response test 5.10 Clear faults due to all types of interference (channel)	-do-	-do-

Guidelines for textbook writers

NATIONAL TECHNICAL CERTIFICATE AND ADVANCED NATIONAL TECHNICAL CERTIFICATE GUIDELINES FOR TEXT BOOK 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 font 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 be used 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 world'
- 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 be drawn from Nigeria wherever possible, so that the information is set in a country context.
- Each chapter should end with student self-assessment questions (SAG) so that students can check their own mastery 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

1. Electronics Engineering Fundamentals Vols. 1 and 2 - Engr. Mrs. T.O. Adeife Osemeikhian (1998) Oshogbo, Nigeria.
2. the Art of Electronics - Paul Horowitz (1996) Cambridge, London.
3. Basic Television 1-3 H.A. Cole (1972) London
4. Introductory Electricity and electronics - John Watson (1989) Macmillan, London.
5. Electronics 1-3 D.C. Green (1978) Pitman, London.

List of Laboratories

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

List of Equipment

1. Meters - Multimeter, ammeter, voltmeter, VTVM Wattmeter EHT meter probe, digital multi-meter.
2. Signal Generator LF Generator, RF generator (AM/FM) if sweep generator (455KHZ, 10.7MHZM, 36.5 MHZ) Pattern generator, PAL - color generator, TV - analyzer, signal tracer.
3. Oscilloscope with a 6MHZ BH & facilitating for (dual trace) extension triggers.
4. Frequency counter up to 300MHZ capability.
5. Variable dc power supply unit - short circuit protected.
6. Variable output auto-transformer/isolating transformer
7. Loop antenna
8. Portable drilling machine
9. Audio-visual equipment - projectors (technique aids)
10. A-V Equipment
11. Overhead projecting
12. Carousel projecting
13. 16mm projector (e.g. Bell and Howell)
14. VCR and its monitor
15. Illustrates colour charts
16. List of Tools
17. 1 set of screwdrivers - flats, large, medium and small Philips 3 types.
18. 2 set of spanners flat and box
19. Soldering iron stand
20. Wire stripper
21. Side cutters
22. Long nose pliers
23. Trimming tools
24. Pliers
25. Tweezers
26. Screws
27. Different stage of files
28. Electricity drill with set of bits
29. Assorted resistors (a) fixed (b) variable
30. Capacitors (a) fixed (b) variable
31. Inductors (a) air core (b) magnetic core
32. Transformer (a) LF power supply (b) HF (AF, IF)
33. Switches
34. Plugs (a) mains (b) phono etc (coax (d) DIN
35. Terminal tag
36. Copper clad boards (a) processed/unprocessed
37. Vero-board
38. IC sockets

39. Photo boards
40. Diodes (a) solid state (b) vacuum
41. Transistors
42. Valves
43. Cables/wires
44. Linear IC's
45. Digital IC's
46. TV set
47. Recorder
48. Amplifiers set.

List of Participants

UNESCO-NIGERIA PROJECT IN SUPPORT OF REVITALIZATION OF TECHNICAL AND VOCATIONAL EDUCATION (TVE) IN NIGERIA

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