

**Plumbing and Pipe Fitting - National Technical
Certificate (NTC) and Advanced National Technical
Certificate (ANTC)**

NATIONAL BOARD FOR TECHNICAL EDUCATION, KADUNA

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General Information

Entry qualifications

Craft Programme

Candidates must not be less than 14 years of age and should have successfully completed three years of secondary education or its equivalent. Specific 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 WAEC Craft certificate, city & Guild Craft 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 25% of the total hours required for the programme;
- (b) Trade Theory, trade Practice and Related Studies which account for 70% 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.

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.

Behavioral 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 student on completion of a unit of work such as understanding the principles and application of:

- (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 the student should demonstrate as a result of the educational process to ascertain that the general objectives of course/performance 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 student with complete secondary education in critical subjects like English language, Physics, Chemistry 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 may be for the above average student. Hence is hoped that Students who successfully complete their trade, training and general may be able to compete with their secondary school counterparts for direct entry into the universities, 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 Award

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

Level Technical Programme Certificate

- | | |
|-------------------|---|
| 1. Craft Level | National Technical Certificate |
| 2. Advanced Craft | Advanced national Technical Certificate |

CERTIFICATE ATTENDANCE

This Institution can award a certificate of attendance to student who successfully complete one or more modules

Guidance Notes for Teachers Training 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 goal and objectives of each module is 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 13 weeks, the course should be offered for 23 hours a week. This can be scheduled in sessions of 5 hours in the day leaving the remaining hours for general education. However, properly organised 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 5 hours include the trade theory and practice. It is left to the teacher to decide when the class should be held in the workshop or in a lecture room.

INTEGRATED APPROACH IN THE TEACHING OF TRADE CALCULATION

Theory, Trade Science and Trade Calculation

Traditional approach of teaching trade science and trade calculation as separate and distinct subject in technical college programmes is not relevant to the new programme as it will amount to a duplication of the teaching of mathematics, physics and chemistry subjects in the course. The basic concepts and principles in mathematics and physical science are the same as in trade calculation and trade science. In the new scheme therefore, mathematics, physics and chemistry will be taught by qualified persons in these fields 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

NTC

Assessment Profile:-

Assessment of this module should be based on 60% Practical 40% Theory.

Theory should be assessed by the use of objective tests which consist of multiple choice, true false questions which should cover the underpinning knowledge across the range of the curriculum. Theory questions should be designed to assess knowledge and understanding. Where possible the under pinning knowledge assessed should relate to the practical tasks assessed.

Practical content should be assessed by the use of practical learning tasks which reflect the competence outlined at the beginning of each module.

ANTC

Assessment Profile:-

Assessment of this module should be based on 60% Practical 40% Theory. Theory should be assessed by the use of short and long answer questions which should cover the underpinning knowledge across the range of the curriculum. Theory questions should be designed to assess knowledge, understanding and application. Where possible the under pinning knowledge assessed should relate to the practical tasks assessed.

Practical content should be assessed by the use of practical learning tasks which reflect the competence outlined at the beginning of each module.

PROGRAMME: National Technical Certificate In Plumbing And Pipe Fitting

GOAL: This programme is designed to produce a craftsman in Plumbing & Pipe Fitting whose knowledge and skills will be developed so that he will be capable of installing and maintaining all types of water, drainage, sanitation, heating & ventilation systems.

Curriculum Table (ANTC)

PROGRAMME ANTC IN PLUMBING AND PIPE FITTING

S/N	MODULE CODE	MODULE TITLE	ONE YEAR						CONTACT HOURS
			TERM 1		TERM 2		TERM 3		
1	CWS 20	HOT AND COLD WATER SERVICES, HEATING AND VENTILATION	2	5	2	5	2	5	252
2.	CSD 22	SANITATION AND DRAINAGE II	2	5	2	5	2	5	252
3.	CFW 23	FABRICATION AND WELDING	2	5	2	5	2	5	252
4.	CBM 22	ENTERPRENUERSHIP	2	-	2	-	2	-	72
5.	CBS 20	BUILDING SCIENCE	2	1	2	1	2	1	108
6.	CMA 20	MATHEMATICS	3	-	3	-	2	-	96
7.	CEN 20	ENGLISH LANGUAGE	1	-	1	-	1	-	36
8.	CEC 400	ECONOMICS	2	-	2	-	2	-	72
9.	ICT 21	AUTO CAD I	1	2	-	-	-	-	36
10.	ICT 22	AUTO CAD II	-	-	1	2	-	-	36
		TOTAL	14	18	14	18	13	16	1214

Curriculum Table (NTC)

PROGRAMME: NTC PLUMBING AND PIPE FITTING

S/N	Module Code	Module Title	YEAR ONE						YEAR TWO						YEAR THREE						Contact Hours
			Term m	Term T	Term P	Term T	Term P	Term T	Term P	Term T	Term P	Term T	Term P	Term T	Term P	Term T	Term P	Term T	Term P		
1.	CMA 12-15	MATHEMATICS	2		2		2		2		2		2		2		2		2		216
2	CEC11- 13	ECONOMICS	2		2		2		2		2		2		2		2		2		216
3.	CEN11- 17	ENGLISH	2		2		2		3		3		3		3		3		3		288
4.	CPH 10-12	PHYSICS	2	0	2	0	2	0	2	1	2	1	2	1	2	1	2	1	2	1	288
5.	CCH 11-12	CHEMISTRY	2	0	2	0	2	0	2	1	2	1	2	1	2	1	2	1	2	1	288
6.	ICT 11- 15	COMPUTER							1	2	1	2	1	2	1	2	1	2			180
7.	CBE 11	BUILDING DRAWING		2		2		2	1	2											180
8.	CTD11- 13	DRAWING COURSES		3		3		3		3		3		3		2	-	2	-	2	288

S/N	Module Code	Module Title	YEAR ONE						YEAR TWO						YEAR THREE						Contact Hours	
			Term	Term	Term	Term	Term	Term	Term	Term	Term	Term	Term	Term	Term	Term	Term	Term	Term	Term		
			T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P		
9.	CBC11	INTRODUCTIION TO BUILDING CONSTRUCTION	2	1	2	1	2	1	0	2	0	0	0	0								132
10	CME 11	GENERAL METAL WORK I	2	5	2	5																168
11.	CME 12	GENERAL METAL WORK II					2	3														80
12.	CWS 10	COLD AND HOTWATER SUPPLY													1	3	2	2	2	2		144
13.	CBW 11	GAS AND BRONZE WELDING													1	2	1	2				72
14.	CWS 12	GAS AND STEAM WORK							1	3	1	3	1	3	2	2	2	2	2	2		288
15	CSD 11	SANITATION AND DRAINAGE I							3		3	3										108
16.	CBM 11	ENTREPRENEURSHIP							2		2		2	-	-		-					72
		TOTAL		12		12	14	7	17	2	16	10	16	8	19	10	18	9	7	7	2916	

Introduction to Building Construction

COURSE:	BUILDING CONSTRUCTION
MODULE:	CBC 11 - INTRODUCTION TO BUILDING CONSTRUCTION
CONTACT HOURS:	3HRS/WEEK
GOAL:	This module is designed to introduce the trainee in the building trades to basic construction principles, materials and methods so that he can appreciate the roles of the various trades in the building industry.

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

1. Understand basic workshop and site safety principle and methods and their application
2. Know the use of common hand and machine tools used in building construction.
3. Understand the use of materials and basic processes in carpentry and joinery.
4. Understand the basic principles of site preparation.
5. Understand setting out principles and be able to apply them to set out a simple rectangular building on site.
6. Understand basic principles and methods of foundation construction.
7. Understand the principles of ground and upper floor construction in timber and concrete.
8. Understand the principle of constructing load bearing walls.
9. Know materials and methods used in providing opening in a building.
10. Understand the function and principles of construction of basic roof types.
11. Understand the basic principles of design and construction of stairs.
12. Understand the application of common types of finishes in the building trade
13. Understand the basic principles of installation of various types of services in dwellings.

PRACTICAL COMPETENCE:

On completion of this module, the student will be able to:

1. Understand habitual maintenance of hygiene and safety at work place.
2. Identify, use and maintain basic hand/machine tools used in building construction.
3. Prepare site for setting out.
4. Set out simple rectangular building using project drawing.
5. Organise and execute strip foundation laying under supervision.
6. organise and execute concrete ground floor laying operations under supervision.
7. Set out and erect simple straight walls.
8. Organise and execute the painting of a small dwelling using specified paint.
9. Interpret electrical circuit symbols and/drawing.

PROGRAMME: NTC IN PLUMBING AND PIPE FITTING			
Module: - INTRODUCTION TO BUILDING CONSTRUCTION		Module Code: CBC II	Contact Hours:3 hrs/week
Course Specification: Theoretical/Practical Contents			
General Objective: 1.0 Understand Basic Workshop And Site Safety Principles And Methods To Be Able To Undertake Their Application.			
Week Term 1	Specific Learning Outcome	Teachers Activities	Resources
1-2	<p>1.1 Define and enumerate various hazards in the workshop environment relating same to a construction site situation, and stating their causes and method of prevention.</p> <p>1.2 Identify dangerous components of construction tools and equipments e.g. drilling machines, grinding, machine and circular saw etc.</p> <p>1.3 Name dangerous gases and liquids in common use in the workshop or construction site e.g. paint frames, flammable liquids, acetylene etc.</p>	<ul style="list-style-type: none"> • Teacher should arrange to use slide, video films, Computer simulation etc. to show and explain proper handling of construction tools and equipments and how to prevent accidents both in the workshop and on site. • Various movable hand tools and machines should be displayed and show to students and the methods of safe handling explained. • Show films and photo clips of the hazards that can be caused by poisonous and dangerous gases e.g paint fumes, carbon mono oxide etc. 	<ul style="list-style-type: none"> • Slide, video player and Television, video films (related to the subject, formatted diskets etc. • Drilling, grinding, cutting machine, circular saw, molding, machine etc. • Films, clips, videos, films, television monitor etc. • Chalkboard, copied notes, etc.
	<p>1.4 Define and cite relevant clauses in the factory act on Health, Safety and Welfare Regulations for workers on a construction site.</p> <p>1.5 Apply appropriate First Aid Treatment on a victim in need of First Aid. e.g. burns, shocks, accident victims etc.</p>	<ul style="list-style-type: none"> • Use dummy to practicalise the application of 1st Aid on victims, this could be done in the classroom to reinforce the knowledge being imparted to students. 	<ul style="list-style-type: none"> • Dummy, first Aid box well equipped with drugs, bandage, cotton wool, Iodine etc. • Safety signs, hand gloves, boots protective clothing goggles etc. • Circular saws, and drilling machine etc.

PROGRAMME: NTC IN PLUMBING AND PIPE FITTING			
Module: - INTRODUCTION TO BUILDING CONSTRUCTION		Module Code: CBC II	Contact Hours:3 hrs/week
Course Specification: Theoretical/Practical Contents			
	1.6 Undertake habitual maintenance of health, safety and general welfare of the individual. Identify what safety is and how to prevent accidents, generally.	<ul style="list-style-type: none"> • Assess the students 	<ul style="list-style-type: none"> • First aid box, different drugs, banadage other first aid mateirals.
General Objective: 2.0 KNOW THE USE OF COMMON HAND TOOLS IN BUILDING TRADES			
Week	Specific Learning Outcome	Teachers Activities	Resources
3	2.1 Identify and describe the basic hand tools in plumber's work and state their functions. 2.2 Identify and describe the basic hand tools in Brick/Block work and state their functions. 2.3 Define and identify basic hand tools in carpentry and joinery and state their functions.	<ul style="list-style-type: none"> • Teacher should show students basic workshop hand tools related to a plumber's work e.g. rench, yarn, diving machine etc. • Show and practically handle Brick/Block work tools with students, naming each tool and asking the students to identify same. • Teacher should show and demonstrate the use of basic carpentry hand tools to the students e.g. hammer, pinches, drill etc. 	<ul style="list-style-type: none"> • Basic hand tools for: <ul style="list-style-type: none"> • joiners and carpenters • bloc/brick layers • painters • - plumbers
	2.4 Describe and identify the basic hand tools in painting and Decorating and state their functions. 2.5 Understand the repair, routine care and maintenance of hand tools in use in the workshop.	<ul style="list-style-type: none"> • Show students the basic hand tools in. • 2.1 to 2.5 • Assess the students 	- do -

PROGRAMME: NTC IN PLUMBING AND PIPE FITTING			
Module: - INTRODUCTION TO BUILDING CONSTRUCTION		Module Code: CBC II	Contact Hours:3 hrs/week
Course Specification: Theoretical/Practical Contents			
General Objective: 3.0 UNDERSTAND THE USE OF MATERIALS AND BASIC PROCESSES IN CARPENTRY & JOINERY.			
Week	Specific Learning Outcome	Teachers Activities	Resources
4	3.1 Identify and know various types of Nigerian Timbers and state their characteristics and uses. 3.2 Describe methods of timber conversion and preservation.	<ul style="list-style-type: none"> Teacher should bring various types of timbers (pieces) to class and identify same to students by name and characteristics. Describe wood presentation process. 	<ul style="list-style-type: none"> Material (timber) Wood Preservatives
5	3.3 Identify various types of manufactured boards and state their uses. 3.4 Construct simple carcass joints using a variety of materials/tools.	<ul style="list-style-type: none"> Bring pieces of various types of boards e.g. plywood, particle board etc. to the class for identification and state their uses. Assess the students. 	<ul style="list-style-type: none"> Plywood Particle Board.
General Objective: 4.0 UNDERSTAND THE BASIC PRINCIPLES OF SITE PREPARATION. YEAR ONE			
Week	Specific Learning Outcome	Teachers Activities	Resources
6-7	4.1 Define vegetable soil and identify same State the reasons for removing vegetable soil or top -soil before setting out. 4.2 Identify and know hand tools and mechanical plants used for excavation. 4.3 Explain the importance of site investigation and preparation prior to setting out. 4.4 Describe site preparation and procedures prior to setting out.	<ul style="list-style-type: none"> Use question and answer technique to describe vegetable soil and reasons for removal before setting out. Show student various hand tools used for earth excavation e.g auger, excavator, shovel, digger etc. Take a visit to new construction site with the students. Assess the students 	<ul style="list-style-type: none"> Vegetable soil. Digger, trowel, excavator, auger etc.

PROGRAMME: NTC IN PLUMBING AND PIPE FITTING			
Module: - INTRODUCTION TO BUILDING CONSTRUCTION		Module Code: CBC II	Contact Hours:3 hrs/week
Course Specification: Theoretical/Practical Contents			
General Objective 5.0: Understand Setting Out Principles And Be Able To Apply Them To Set Out Simple Rect. Angular Building On Site.			
Week	Specific Learning Outcome	Teachers Activities	Resources
8-12	5.1 Define and explain the principles of setting out of buildings. 5.2 Sketch, and describe the method of pegging out the perimeter walls of a building. 5.3 Explain with sketches the use of timber profiles in setting out. 5.4 Identify and explain the basic equipment required for setting out on site. 5.5 Set out a simple rectangular building on site.	<ul style="list-style-type: none"> • Describe the basic equipment needed for setting out and use sketches where necessary. • Set out a simple rectangular building with the students participation. • Assess the students 	<ul style="list-style-type: none"> • Chalkboard, sketches etc. • Pegs, profile, nails, line, T-square, Iron square etc. • Setting out equipment etc.
13	EXAMINATIONS: PRACTICAL 60% THEORY 40%		
General Objective 6.0: UNDERSTAND BASIC PRINCIPLES OF CHOICE & CONSTRUCTION OF FOUNDATIONS.			
Week	Specific Learning Outcome	Teachers Activities	Resources
1-2	6.1 Define and explain the functions of foundation and describe the different types of foundations indicating their suitability. 6.2 Describe equipment and methods used in excavating foundation trenches. 6.3 Sketch and describe temporary supports to the sides of deep trenches in various soils. 6.4 Describe the equipment and methods used in mixing concrete on site.	<ul style="list-style-type: none"> • Show pictures of excavating machines • Explain the functions of the equipment. • Assess the students 	<ul style="list-style-type: none"> • Chalkboard etc. • Films, clips, pictures, sketches etc. • Concrete mixer, coarse aggregate, fine aggregate, cement, water etc. • Digger, shovels profile, line etc.
3-4	6.5 Explain batching of concrete by weight and by volume and compare the two Method 6.6 Organise and execute strip foundation laying under supervision by the teacher.	<ul style="list-style-type: none"> • Explain batching with regards to concrete work. • Explain the difference between batching by volume and by weight. • Assess the students 	<ul style="list-style-type: none"> • Cement • Motar • Aggregates • Equipment and tools • Water

PROGRAMME: NTC IN PLUMBING AND PIPE FITTING			
Module: - INTRODUCTION TO BUILDING CONSTRUCTION		Module Code: CBC II	Contact Hours:3 hrs/week
Course Specification: Theoretical/Practical Contents			
General Objective: 7.0 Understand The Principles Of Ground And Upper Floor Construction In Timber Concrete.			
Week	Specific Learning Outcome	Teachers Activities	Resources
5-6	7.1 Describe and state the various functions of floors 7.2 Describe various types of floor and the methods of construction. 7.3 Describe various types of floorings and their application. 7.4 Organise and execute concrete Ground floor laying operations.	<ul style="list-style-type: none"> • Teacher should identify the various types of floors available and describe the functions of each type to the student. • This should be demonstrated by laying blocks to a level e.g D.P.C. level and concreting the floor as practical to show the students how it is done. • Assess the students 	<ul style="list-style-type: none"> • Concrete aggregates etc. • Visit to a construction site.
General Objective 8.0: Understand The Principle Of Constructing Load Bearing Walls.			
Week	Specific Learning Outcome	Teachers Activities	Resources
7-8	8.1 List the principal functions of external walls and internal walls. 8.2 Describe various types of wall units in common use. 8.3 List typical mixes for mortar used for bonding wall units in 8.2 above. 8.4 Describe the procedures and precautions involved in mixing of concrete and mortar on site. 8.5 Explain the function, method of placing and position of D.P.C. in walls. 8.6 Set out and erect simple straight walls.	<ul style="list-style-type: none"> • Describe D.P.C. and differentiate between D.P.C. and D.P.M. • Demonstrate and explain the activities in 8.1 to 8.6 • Assess the students. 	<ul style="list-style-type: none"> • Block, Cement, etc.

PROGRAMME: NTC IN PLUMBING AND PIPE FITTING			
Module: - INTRODUCTION TO BUILDING CONSTRUCTION		Module Code: CBC II	Contact Hours:3 hrs/week
Course Specification: Theoretical/Practical Contents			
General Objective 9.0: KNOW MATERIALS AND METHODS USED IN FIXING OPENINGS.			
Week	Specific Learning Outcome	Teachers Activities	Resources
2 9-10	<p>9.1 Identify Nigerian timbers and timber products suitable for window and door construction.</p> <p>9.2 State the functions of openings in dwellings e.g. light, ventilation, privacy, exclusion of external weather.</p> <p>9.3 Describe with sketches various types of timber and metal doors and windows including their mode of operation.</p> <p>9.4 Describe various types of ironmongery and state their uses.</p> <p>9.5 Explain the need for the provision of weathering structures (e.g sill) at openings and describe with sketches structures used in simple dwellings.</p>	<ul style="list-style-type: none"> • Explain the difference between wooden shutter windows and doors, steel windows and doors, crittal- Hope type Windows and doors. • Alluminium projected windows and sliding doors etc. • Assess the students 	<ul style="list-style-type: none"> • Pictures/Posters • Charts • Door/window Schedules (Manufacturer's)
General Objective 10.0: UNDERSTAND THE FUNCTION AND PRINCIPLES OF CONSTRUCTION OF BASIC ROOF TYPES.			
Week	Specific Learning Outcome	Teachers Activities	Resources
11-12	<p>10.1 Define and describe with sketches, basic roof types and profiles e.g. beam and slabs as in concrete flat roofs, lattice and similar guiders, trusses (Howe truss, double roof, truss rafter, standard fink french Truss, North light truss, couple, umbrella, bow string, etc), portal frames, shell roofs, folded plates etc.</p> <p>10.2 Describe the materials maximum allowable span and application of the various roof types in 10.1.</p> <p>10.3 Name and define various roof coverings suitable for tropical use and identify the areas suitable for their use in Nigeria.</p>	<ul style="list-style-type: none"> • Show the pictorial representation of the various roof types to the student while describing each. • Give notes accordingly. • Assess the students. 	<ul style="list-style-type: none"> • Pictures, Charts, Drawings, film clips

PROGRAMME: NTC IN PLUMBING AND PIPE FITTING			
Module: - INTRODUCTION TO BUILDING CONSTRUCTION		Module Code: CBC II	Contact Hours:3 hrs/week
Course Specification: Theoretical/Practical Contents			
13	EXAMINATIONS: PRACTICAL 60% THEORY 40%		
General Objective 11.0: UNDERSTAND THE BASIC PRINCIPLES OF DESIGN AND CONSTRUCTION OF STAIRS.			
Week	Specific Learning Outcome	Teachers Activities	Resources
1-4	11.1 Describe with the aid of sketches, the different types of stairs e.g. straight flight, dog-leg open well, spiral etc. 11.2 Explain with sketches the design standards for the construction of stairs e.g. riser, tread relationship, minimum headroom, standard sizes of structural members etc. 11.3 Explain and define the basic principles of construction of a straight flight timber/concrete/steel stairs.	<ul style="list-style-type: none"> • Differentiate between timber, concrete and steel stair cases. • Explain and give notes on each activity. • Assess the students. 	<ul style="list-style-type: none"> • Charts, and diagrams of stairs.
General Objective 12.0: UNDERSTAND THE APPLICATION OF COMMON TYPES OF FINISHES IN BUILDING TRADE.			
Week	Specific Learning Outcome	Teachers Activities	Resources
5-7	12.1 List external and internal wall finishes and explain their applications, e.g. paint, wall paper, premix finishes, etc. 12.2 State the function of ceiling in houses. 12.3 Describe with sketches various types of ceiling construction and ceiling finishes in the tropics e.g. normal ceiling, suspended ceiling etc. 12.4 List various types of finishes for joinery works and explain their application e.g. vanish, polish, paint etc. 12.5 Organise and execute the painting of a small dwelling using specified paint.	<ul style="list-style-type: none"> • Guide the students. • Explain and demonstrate the activities in 12.1 to 12.5 and give notes accordingly. • Assess the students. 	<ul style="list-style-type: none"> • Berger paint, other brand names.
	Carry out the assignment using two different brand names to test their quality and efficiency.		

PROGRAMME: NTC IN PLUMBING AND PIPE FITTING			
Module: - INTRODUCTION TO BUILDING CONSTRUCTION		Module Code: CBC II	Contact Hours:3 hrs/week
Course Specification: Theoretical/Practical Contents			
General Objective 13.0: UNDERSTAND THE BASIC PRINCIPLES OF INSTALLATION OF VARIOUS TYPES OF SERVICES IN DWELLING.			
TERM	Specific Learning Outcome	Teachers Activities	Resources
3 Week			
8 - 10	<p>13.1 Explain the basic principles of a good drainage system.</p> <p>13.2 Describe with sketches the installation standards relating to cold and; hot water supply.</p> <p>13.3 Sanitary wares; fittings e.g. sinks, bath, W.C. shower, wash hand basin, Urinals, etc.</p> <p>13.4 Explain with sketches construction standards relating to the construction of domestic drainage system, e.g. Inspection chamber/cesspool, septic tank, soakaway.</p> <p>13.5 Explain the functions of good or insulation and lighting in dwellings.</p> <p>13.6 Describe the different modes of supply and installation systems of electricity in dwellings e.g. simple phase, 3- phase supply (conduit or surface wiring system)</p>	<ul style="list-style-type: none"> • State the use of hand gloves and wearing of rubber shoes to prevent shock. • Explain and demonstrate the activities in 13.1 to 13.9 and give notes accordingly. • Assess the students. 	<ul style="list-style-type: none"> • Hand gloves, shoes etc.
11 - 12	<p>13.7 Identify and describe various electrical fixtures stating their functions and explain their installation principles.</p> <p>13.8 List the precautions to be taken to ensure safe electrical installation in dwellings.</p> <p>13.9 Interpret electrical circuit symbols and drawings.</p>	<ul style="list-style-type: none"> • Use a detailed Electrical drawing to teach the student the key. • Assess the students. 	<ul style="list-style-type: none"> • Electrical drawing of a typical building.
13	<p>REVISION AND EVALUATION</p> <p>EXAMINATIONS:</p> <p>PRACTICAL 60%</p> <p>THEORY 40%</p>		

General Metal Work I

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN ENGINEERING CRAFT PRACTICE			
Course: General metal Work I		Course Code: CME 11	Contact Hours 3hrs/wk
Module Specification: PRACTICAL/KNOWLEDGE REQUIREMENTS			
General Objective 1.0: On completion of the following practical task, the trainee will demonstrate the following abilities:			
Week	Specific Learning Outcome	Teachers Activities	Resources
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"> • Show a film on industrial safety • Demonstrate how to treat energy cases like artificial respiration cold compress, etc • Assess the students. 	<ul style="list-style-type: none"> • Hand tools files, hacksaw • Television, Video machines • Posters on artificial respiration

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN ENGINEERING CRAFT PRACTICE			
Course: General metal Work I		Course Code: CME 11	Contact Hours 3hrs/wk
Module Specification: PRACTICAL/KNOWLEDGE REQUIREMENTS			
General Objective 2.0: Measuring, Marking out, striking and cutting.			
Week	Specific Learning Outcome	Teachers Activities	Resources
4-6	<p>2.1 Describe the essential features and use of the following</p> <p>a) micrometer b) vernier calliper c) Venier height gauge d) combination set</p> <p>2.2 Maintain and care for the instruments lifted above</p> <p>2.3 Perform marking out exercise on plane surfaces including profiles</p> <p>2.4 File a piece of metal to given specifications using any of the following: Cross filing, draw filing, filing square and flat surfaces</p> <p>2.5 Test surface for flatness using surface plate and try square and state precautions to be taken to avoid pinning</p> <p>2.6 Maintain files in good working conditions</p> <p>2.7 Apply various hammers and mallets e.g ball pein, rubber mallets, etc for engineering purposes</p> <p>2.8 Select and instill hacksaw blade correctly</p> <p>2.9 Cut metal and other engineering materials to given specification using the adjustable hacksaws, junior hacksaws, piercing saw, etc drills and Drilling.</p> <p>Assess the students</p>	<ul style="list-style-type: none"> • Demonstrate how to use micrometer, venier 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 practise 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 competent • Demonstate the application of hammers and mallets for engineering purposes • Demonstrate how a hacksaw blade can be inserted correctly • Demonstrate how to use adjustable hacksaw, junior hacksaw piercing • Students should be allowed to practice till competent 	<ul style="list-style-type: none"> • Micrometer, vernier calipers, vernier height gauge, combination sets • Steel rules, dividers, punches, trammel, scribe angle plate, vee block center square • Flat fill, hand file, engineers square, tray square • File card, flat file • Ball pein hammers, mallet • Hacksaw blade, Hack frame

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN ENGINEERING CRAFT PRACTICE			
Course: General metal Work I		Course Code: CME 11	Contact Hours 3hrs/wk
Module Specification: PRACTICAL/KNOWLEDGE REQUIREMENTS			
General Objective 3.0: Machine Tools			
Week	Specific Learning Outcome	Teachers Activities	Resources
7-9	<p>3.1 Setting up and operate a drilling machine in given situations</p> <p>Note Setting up drilling machine should include</p> <ol style="list-style-type: none"> change of spindle speed adjustment of drilling table to required height and angle, holding of work on drilling table to required height and angle, holding of work on drilling table using appropriate Install up the drill bit in chuck <p>3.2 Sharpen a twist drill currently to manufactures' specification</p> <p>3.3 Perform with facility the following operations:</p> <ol style="list-style-type: none"> drilling blind holes drilling round stock counterboring and counter-sink drilling large diameter holes <p>3.4 List the operation square and cut internal through and blind) and external threads by hand method and state precautions to taken when taping 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, scribing block or measurement transfer.</p>	<ul style="list-style-type: none"> Demonstrate how to set up and operate a drilling machine in given situation Students to practice till 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 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 students. 	<ul style="list-style-type: none"> Bench drill pillar drill, drill bits Bench drill, pillar drill, twist drill, flat drill, counter sink drill, counterbore drill, center drill 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

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN ENGINEERING CRAFT PRACTICE			
Course: General metal Work I		Course Code: CME 11	Contact Hours 3hrs/wk
Module Specification: PRACTICAL/KNOWLEDGE REQUIREMENTS			
General Objective 4.0: Lathe and Lathework			
Week	Specific Learning Outcome	Teachers Activities	Resources
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 in 3-jaw-chuck</p> <p>4.3 Select appropriate cutting tool and set them up to center height for turning or facing operations</p> <p>4.4 Carry out chuck work involving facing, step turning, undercutting radiusing, chamfering, parting off and knuring Note Components should be produced to specified tolerance and finish</p> <p>4.5 Produce simple components involving taper turning using the compound slide</p>	<ul style="list-style-type: none"> • Guide the students to sharpen cutting tool for plain turning shouldering, parting off and facing operations and allow students to practice till competent • Demonstrate how to set-up rough and turned stock in a 3-jaw-chuck and operate lathe. Allow students to practice till competent • Guide the students to select appropriate cutting tools and set them up to center height for lathe work (turning or facing) • Guide students to produce simple engineering components like open ended spanner, engineers square, tool makers clamp, center square, etc. • Make a simple precision 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 exercises that will guide students to produce components involving taper turning using the compound slide. Assess the students 	<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 traveling steading • Round nose turning tool, fine finishing tool, form tool, parting off tool, boring tool, bar of good length and 4mm diameter, Live/dead centers catch plates • Standard exercises or prepared
Assessment profile: Practical to take 60% of the overall assessment			

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN MECHANICAL ENGINEERING CRAFT PRACTICE

Course: General Metal Work I

Course Code: CME 11

**Contact Hours
7hrs/wk**

Course Specification: Knowledge Requirement

General Objective: 1.0 understand workshop safety rules and application in machine shop

Week	Specific Learning Outcome:	Teachers Activities	Resources
1	<p>1.1 State sources of hazards in the workshop and how to prevent them. e.g</p> <ul style="list-style-type: none"> a. handling and using hand tools, portable power tools and machines; b. stepping on or striking obstructions left on floors or benches; c. lifting, moving and storing materials or jobs; d. using inflammable or corrosive liquids and gases; e. inhaling vapours or fumes; <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. 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 answer, determine whether the students grasped the topic • Show a film on industrial safety. • Through question and answer determine • comprehension. • Demonstrate how to treat emergency cases • like artificial respiration, cold compress etc. • List the safety equipment and wears that are essential in the workshop. • Give detail notes and explanation in each topic a-e. • Use questions and answers to determine • comprehension. • Assess the students 	<ul style="list-style-type: none"> • Safety posters, common hard tools like files hacksaw • Television, Video machine. • Overall, goggles, gloves, hardshoes, head shield, fire extinguishers.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN MECHANICAL ENGINEERING CRAFT PRACTICE			
Course: General Metal Work I		Course Code: CME 11	Contact Hours 7hrs/wk
Course Specification: Knowledge Requirement			
	<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>1.4 Understand appropriate procedures in the events of a workshop accident</p>	<ul style="list-style-type: none"> • Give detail notes and explanation on appropriate. • procedures to be taken in the event of workshop accident • accident • Give detail 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 	
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	Resources
2	<p>2.1 Examples of procedures may include:</p> <ul style="list-style-type: none"> i) application of first aid to the victim; ii) removal or rectification of the accident; iii) reporting the accident to the appropriate authority; iv) keeping a record of accidents for management use. Ferrous and Non-Ferrous Metals <p>2.2 Explain the meaning of the following general physical properties of metals: ductility, malleability, strength, toughness, brittleness, elasticity, plasticity.</p>	<ul style="list-style-type: none"> • Give detailed notes and explanations for the topics in 2.0 • Assess the students 	

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN MECHANICAL ENGINEERING CRAFT PRACTICE

Course: General Metal Work I

Course Code: CME 11

**Contact Hours
7hrs/wk**

Course Specification: Knowledge Requirement

	<p>2.3 Describe the basic composition and properties of plain carbon steels, cast iron and alloy steel and state their application in the engineering industry.</p> <p>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 Irons - gray cast iron malleable cast iron, alloy cast irons (spheroidal and acicular) Alloy Steels - High speed steels, high tensile steels, tungsten, carbide, stainless steels, stellite</p> <p>2.4 Outline:</p> <p>a. the cupola process of manufacture of cast iron; c. the direct reduction process of manufacture of steel.</p> <p>Note: A visit to a steel manufacturing plant is recommended.</p> <p>2.5 Describe the physical properties and applications of non-ferrous metals below: copper, tin, zinc, aluminium and aluminium alloys brass (muntz metal, cartridge brass, gilding etc) metal, bronze (manganese bronze, tinmetal, bell metal, aluminium bronze, phosphor bronze and lead. Benchwork and Tools:</p>	<ul style="list-style-type: none"> • 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, carbide, stainless steels • Give notes and explanation on the cupola process, the blast furnace and the direct reduction process of manufacture of steel. • This can be preceded by film show and a visit to be manufacturing plant. • Give detail notes and explanations describing the physical properties and applications of the following non-ferrous metals: copper, tin, zinc, aluminium, aluminium alloys, brass, (muntzmetal, cartridge brass gilding metal) etc. bronze, manganese bronze bell metal, aluminium bronze phosphor bronze and lead. Assess the students 	<ul style="list-style-type: none"> • Video and television including cassettes on production processes.
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PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN MECHANICAL ENGINEERING CRAFT PRACTICE

Course: General Metal Work I

Course Code: CME 11

**Contact Hours
7hrs/wk**

Course Specification: Knowledge Requirement

General Objective 3.0: Select and use common measuring, marking out, cutting and striking tools.

Week	Specific Learning Outcome:	Teachers Activities	Resources
3	<p>3.1 Explain with examples the difference between "line" and "end" measurement.</p> <p>3.2 Explain the use of datum points, datum lines and datum faces in marking out.</p> <p>3.3 Describe, the functions and application of the following instruments used in metal-work, steel rule, dividers, calipers (inside, outside and odd-legs), trammel, scribe angle plate, vee-block, centre square.</p> <p>3.4 Describe the various types of files, stating their grades and applications.</p> <p>Note: Types of files should include: flat, square, round, half round, three square, warding pollar, mill and rasp.</p> <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 vise, explain its clamping power and demonstrate the technique of holding work in the vise for filing, tapping and designing operations.</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, tapping sawing etc.</p> <p>3.8 Describe and use the following tools:</p> <ol style="list-style-type: none"> cold chisels (flat, cross, cut half round, diamond-point) centre punch and dot punch scrappers (flat, triangular, half round) power hack saw 	<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 detail 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 notes that will describe the various types of files stating their grades and applications. By type it means: flat, square round, halfround, three square, warding, mill and rasp. • Prepare detail notes that will classify the common files used in the metal work as well as stating the composition of materials used for their manufacture. • Assess the students 	<ul style="list-style-type: none"> • Steel rule, divides calipers, trammel, scribe angle plate vee block, centre square. • Micrometer vernier callipers vernier height gauge combination set • Flat file, hard file, round file square, half round, triangular warding, mill file, rasp file. • Flat file, handfile engineers square. • Surface plate try square (engineers square) • File card • Flat file • Bench vice.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN MECHANICAL ENGINEERING CRAFT PRACTICE

Course: General Metal Work I

Course Code: CME 11

**Contact Hours
7hrs/wk**

Course Specification: Knowledge Requirement

4	<p>3.9 Describe the various parts of a hack saw and their function.</p> <p>3.10 Describe the common types of hacksaw blades, their range of pitches and their applications.</p> <p>3.11 How a bench vice is used and demonstrate the technique of holding work in the vice for filing, tapping and designing operations.</p> <p>3.12 Prepare detail notes that will describe the functions of the various parts of a bench vice, its holding power while performing various operations.</p> <p>3.13 State the safety precautions to be observed when using a hand hacksaw</p>	<ul style="list-style-type: none"> • Show a bench vice and demonstrate the work in the vice for filing, tapping and designing operations • Prepare detail notes that will describe the functions of the various parts of a bench vice, its holding power while performing various operations • Assess the students • Prepare detail notes and demonstrations that will describe the uses of: cold chisels, centre punch dot punch, scrapers and power hacksaw. • Prepare notes that will describe the various parts of a hacksaw and their functions. • Show sample 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 detail notes and explanation, stating the safety precautions to be observed when using a hand hacksaw. • Prepare notes that will describe the uses of various hacksaws. <p>Assess the students</p>	<ul style="list-style-type: none"> • Bench vice. • Ball pein hammers mallets. • Cold chisels, centre punches, dot punch, scrapers power hacksaw blades. • Hacksaw blade • Hacksaw frame • Adjustable hacksaw junior hacksaw piercing saw. • Bench drill • Pillar drill. • List drill, flat drill counter sink drill, counter bore drill combination centre drill.
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PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN MECHANICAL ENGINEERING CRAFT PRACTICE

Course: General Metal Work I

Course Code: CME 11

**Contact Hours
7hrs/wk**

Course Specification: Knowledge Requirement

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	Resources
5-6	<p>4.1 Identify the various types of drilling machines.</p> <p>4.2 Describe, with sketches, the main features of a bench or pillar drilling machine.</p> <p>4.4 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>4.5 Explain the effects of the following faults in a ground twist drill bit:</p> <ol style="list-style-type: none"> point angle too acute; point angle too obtuse; cutting edges at unequal angles; insufficient lip clearance; excessive lip clearance. <p>4.6 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> $\pi = 3.142$ <p>4.8 State the cause and remedy of drilling faults such as:-</p>	<ul style="list-style-type: none"> • Prepare detailed notes and demonstrations that will describe and uses of the following: cold chisels, center punch, dot punch, scrapers, and power saw. • Prepare notes that will describe the various parts of hacksaw and their functions • Show samples of hacksaw blades as well as notes that will describe the common range of pitches of the hacksaw blade and their applications • Show different types of drilling machines • Make notes and drawings that will identify the various types of drilling machines. • Prepare detail notes and drawings that will describe the main features of a bench or pillar drilling machine. • Solve many problems for students to practise. • 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, counterbore drill and combination 	<ul style="list-style-type: none"> • Ball peen hammers, mallet, cold chisels, dot/center punches, hacksaw and hacksaw blades • Drilling machines and its accessories.

	<ul style="list-style-type: none"> a. drill breaking; b. drill coloured blue; c. walls of drilled hole left rough; d. chipped cutting lips. <p>4.9 State the safety precautions to be observed when using a drilling machine.</p> <p>4.10 Explain the purpose of reaming and describe different types of hand and machine reamers.</p> <p>4.11 Ream to given specification by hand and machine method.</p>	<p>center drill.</p> <ul style="list-style-type: none"> • Assess the students. 	
PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN MECHANICAL ENGINEERING CRAFT PRACTICE			
Course: General Metal Work I		Course Code: CME 11	Contact Hours 7hrs/wk
Course Specification: Knowledge Requirement			
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	Resources
7	<p>5.1 Sketch the thread forms below and state their applications:-</p> <ul style="list-style-type: none"> a. the ISO metric thread b. the unified thread c. Whitworth and British fine threads d. British Association (BA) thread e. British Standard pipe f. Square thread g. Acme thread h. Buttress thread. <p>5.2 Sketch and state the functions of:-</p> <ul style="list-style-type: none"> a. taps (taper tap, second tap, plug) b. tap wrench c. die and die stock. <p>5.3 Explain the meaning of tapping size or tapping drill and estimate its value in given situations using formulae such as:-</p>	<ul style="list-style-type: none"> • Give detailed notes with diagrams that will show the various forms of trade and their uses. • Prepare notes that will state the functions of taps, tap wrench, die and die stock. • Give detailed notes that will explain the meaning of tapping size or tapping drill and estimate its values using the formula: <ul style="list-style-type: none"> • $T = D - P$ • Where T = tapping diameter • D = thread top diameter and • P = Pitch • Prepare notes that will state precautions to be taken when tapping on bench. • Give notes and diagrams that will describe and differentiate types of 	<ul style="list-style-type: none"> • Diagrams/charts of thread forms • Parallel reamers taper reamers twist drills. • Rivet sets, drills.

	<p>$T = D - P$</p> <p>Where T = tapping diameter</p> <p>D = thread top diameter</p> <p>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.</p> <p>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 use.</p> <p>5.7 Calculate the diameter of rivet and riveting allowance in given situations.</p>	<p>rivets, rivet sets, and its uses and guide the students to calculate the diameter of rivet and riveting allowance.</p> <ul style="list-style-type: none"> Assess the students. 	
PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN MECHANICAL ENGINEERING CRAFT PRACTICE			
Course: General Metal Work I		Course Code: CME 11	Contact Hours 7hrs/wk
Course Specification: Knowledge Requirement			
General Objective 7.0: Understand the ISO tolerances and fits and its application in engineering production.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
8	<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 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 important 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 MECHANICAL ENGINEERING CRAFT PRACTICE

Course: General Metal Work I

Course Code: CME 11

**Contact Hours
7hrs/wk**

Course Specification: Knowledge Requirement

General Objective 7.0: Produce simple Engineering Components on the bench production

Week	Specific Learning Outcome:	Teachers Activities	Resources
9	<p>7.1 Explain layout procedures from working drawing of simple engineering components or tools such as:-</p> <ul style="list-style-type: none"> e. open ended spanner f. engineer's try square g. tool maker's clamp h. plate bracket or gusset (involving rounds, angles, holes) i. 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 7.0 • Assess the students. 	<ul style="list-style-type: none"> • Lesson notes • Diagrams and charts.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN MECHANICAL ENGINEERING CRAFT PRACTICE

Course: General Metal Work I

Course Code: CME 11

**Contact Hours
7hrs/wk**

Course Specification: Knowledge Requirement

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	Resources
10	<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>8.3 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> <p>8.4 Explain the difference between the centre lathe, capstan lathe, in terms, of their main features and functions.</p> <p>8.5 Name types of cutting fluids used for lathe turning operations and state their composition and purposes.</p> <p>8.6 Outline safety precautions to be observed when working on the lathe</p> <p>8.7 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, stellite, cemented carbide, diamond.</p> <p>8.8 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 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. • 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"> • Centre lathe and accessories like catch plates, face plates, centers, fixed and traveling steadies. • Charts of center lathe and capstan lathe. • Round nose turning tool, finishing tool, site finishing, knife tool, form tool, parting off tool, and boring tool.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN MECHANICAL ENGINEERING CRAFT PRACTICE

Course: General Metal Work I

Course Code: CME 11

**Contact Hours
7hrs/wk**

Course Specification: Knowledge Requirement

11-12	<p>8.9 Differentiate between various tool shapes and state their uses e.g. 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> <p>8.12 Calculate the cutting speed and feed for given turning operation.</p> <p>8.13 Estimate the rate of metal removal and time required for carrying out specified turning operations.</p> <p>8.14 State precautions to be observed when turning between centres.</p> <p>8.15 Set up the lathe for and carry out basic turning operations between centres.</p> <p>8.16 Compute required taper dimensions from given data using taper ratio angle formulae i.e.</p> $\text{TaperRatio} = \frac{d_2 - d_1}{L}$ <p>OR</p> $\frac{\tan\theta}{2} = \frac{d_2 - d_1}{2}$ <p>where θ = taper angle d1 - small end diameter d2 = large end diameter L = length of taper</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 to 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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General Metal Work II

COURSE:	GENERAL METAL WORK
MODULE:	CME 12 GENERAL METAL WORK II
PRE-REQUISITE:	CME 11
CONTACT HOUR:	5 HOURS/WEEK
GOAL:	The module is designed to introduce the trainee to basic processes in mechanical engineering such as forging, sheet-metal work and welding.

General Objectives:

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

1. Understand the basic principles and processes of heat treatment of metal in the workshop.
2. Produce simple engineering components by forging.
3. Understand the basic principles and techniques of gas and metal arc welding and apply them in fabricating simple metal components.

PRACTICAL COMPETENCE:

On completion of this module students will be able to:

- Carry out heat treatment of metal in the workshop
- Produce simple engineering components by forging
- Carry out gas/arc welding and apply them in fabricating simple engineering components

PRACTICAL TASKS

General Objective 1.0: On completion of the following practical task, the trainee will demonstrate the following abilities:			
Week	Specific Learning Outcome	Teachers Activities	Resources
1-2	<p>1.1 Carry out the following heat treatment processes, Hardening, tempering, annealing normalizing, case hardening on given plain carbon steel, engineering component or tool</p> <p>1.2 Anneal copper, brass and aluminium for various purposes</p>	<ul style="list-style-type: none"> • Demonstrate heat treatment processes and explain the stages • Demonstrate the annealing process on brass, copper and aluminium for various purposes. • Assess the students. 	<ul style="list-style-type: none"> • Furnace, Forge tongs
General Objective 2.0: Forging Processes			
Week	Specific Learning Outcome:	Teachers Activities	Resources
3-4 5-8	<p>2.1 Select appropriate forging tools and produced to specification given engineering components by forging processes</p> <p style="padding-left: 40px;">a. upsetting - drawing down</p> <p style="padding-left: 40px;">b. setting down - twisting</p> <p style="padding-left: 40px;">c. forge welding (scarf and spice welds)</p> <p style="padding-left: 40px;">d. bending, turning closed ring e. forming an eye</p>	<ul style="list-style-type: none"> • Demonstrate with appropriate forging tools how to produce some engineering components and let the student practice till they become competent • Assess the students 	<ul style="list-style-type: none"> • Anvil, swage block, leg vice, forging hammers hot set cold set, sets of hammer, punchers, drifts, fillers, top swage, bottom swage, flatter, open tongs, hallow bit

General Objective 3.0: Welding Processes			
Week	Specific Learning Outcome:	Teachers Activities	Resources
9-12	<p>3.1 Set up and operate gas or metal arc welding equipment in given situations. Note: Equipment operation should include choice of correct nozzles or electrode. Adjustment for correct gas pressure/flame or voltage</p> <p>3.2 Prepare joints for welding in given situations</p> <p>3.3 Weld given components by arc or gas welding methods, and state safety precautions to be observed</p>	<ul style="list-style-type: none"> List and identify gas metal arc welding equipment. Demonstrate the use of both gas and metal welding equipment; and all the students to practice Demonstrate to the students how to prepare joints for welding purposes Guide students to weld various components using both gas and arc welding process and state safety precautions to students to practise till competent 	<ul style="list-style-type: none"> Oxygen and a castylene cylinders with regulations arc welding equipment goggles, shield, electrodes, diagrams and charts various welding joints
Assessment: Practical - 60% of overall assessment			

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN MECHANICAL ENGINEERING CRAFT PRACTICE			
MODULE: GENERAL METAL WORK II		MODULE CODE: CME 12	CONTACT HOURS: 5hrs/wk
MODULE SPECIFICATION: KNOWLEDGE REQUIREMENTS			
General Objective: 1.0 Understand The Basic Principles And Processes Of Heat Treatment Of Metal In The Workshop.			
Week	Specific Learning Outcome	Teacher Activities	Learning Resources
1-4	<p>1.1 Explain briefly the structural behaviour of plain carbon steel as it is heated from room temperature to about 1000°C.</p> <p>a. hardening b. tempering c. annealing d. normalising e. case-hardening.</p> <p>1.3 Explain the meaning of hardening metal work.</p> <p>1.4 Outline safety precautions relating to heat treatment processes apply them in given situations.</p>	<ul style="list-style-type: none"> • Prepare detail notes that will explain the structural behaviour of plain carbon steel as it is heated from room temperature to about 1000°C. • Prepare detail notes that will explain the meaning of hardening in metalwork. • Prepare notes that will outline safety precautions relating to heat treatment processes. • Assess the students 	<ul style="list-style-type: none"> • Recommended Text books • Lesson notes, etc

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN MECHANICAL ENGINEERING CRAFT PRACTICE

MODULE: GENERAL METAL WORK II

MODULE CODE: CME 12

**CONTACT HOURS:
5hrs/wk**

MODULE SPECIFICATION: KNOWLEDGE REQUIREMENTS

General Objective 2.0: Understand the techniques of producing simple engineering components by forging.

Week	Specific Learning Outcome	Teacher Activities	Learning Resources
5-6 7-8	<p>2.1 Explain with outline sketch the main features and working principles of the black smith's forge.</p> <p>2.2 Describe and state the functions of common forging tools. e.g anvil, swage block, leg vice, forging hammers, hot and cold sets, set hammer, punches and drifts, hardie, fullers, top and bottom swages flatter, tongs (open mouth, closed mouth, hollow bit, etc.).</p> <p>2.3 Describe with sketches the following forging operations:</p> <p>f. upsetting</p> <p>g. drawing down</p> <p>h. setting down</p> <p>i. twisting</p> <p>j. forge welding (scarf and splice welds)</p> <p>k. bending</p> <p>l. forming closed ring</p> <p>m. - forming an eye.</p>	<ul style="list-style-type: none"> • Prepare detail notes and diagrams that will explain the main features and working principles of the black smith's forge. • Prepare notes and diagrams that will describe the functions of common forging tools. • Prepare detail notes that will describe the following forging operations: upsetting, drawing down, setting down, twisting, forge welding, bending, forming closed ring, forming an eye. • Assess the students. 	<ul style="list-style-type: none"> • Recommended textbooks, lesson notes, charts, etc.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN MECHANICAL ENGINEERING CRAFT PRACTICE			
MODULE: GENERAL METAL WORK II		MODULE CODE: CME 12	CONTACT HOURS: 5hrs/wk
MODULE SPECIFICATION: KNOWLEDGE REQUIREMENTS			
General Objective 3.0: Understand the basic principles and techniques of gas and metal arc welding and apply them in fabricating simple metal components.			
Week	Specific Learning Outcome	Teacher Activities	Learning Resources
	<p>3.1 Describe the equipment and explain the basic principles and application of gas and metal arc welding.</p> <p>3.2 State the safety precautions to be observed and apply them in given welding situations.</p> <p>3.3 Differentiate between various tool shapes and state their uses. e.g round nose rougher, fine finishing, side finishing, knife tool, form tool, parting off tool, boring tool, etc.</p>	<ul style="list-style-type: none"> • Prepare detail notes and diagrams that will describe the equipment and explain the basic principles and application of gas and metal arc welding. • Prepare diagrams of joints that the students will practice. • Prepare detail notes that will state the safety precautions to be observed during welding. • Assess the students. 	<ul style="list-style-type: none"> • Oxygen cylinder acetylene cylinder regulations arc welding set goggles, shield electrode. • Diagrams and charts of various welding joints, and techniques.

Cold and Hot Water Supply

PROGRAMME:	NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING
COURSE:	PLUMBING AND PIPE FITTING
MODULE:	CWS 10 COLD AND HOT WATER SUPPLY
CONTACT HOURS:	4HRS/WEEK
GOAL:	This module is designed to enable the trainees understand the principles and techniques involved in the installation of cold and hot water supply to building from source and install and maintain the system.

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

1. Understand the sources and properties of water.
2. Identify sources of impurities and contamination of water and precaution to be taken.
3. Understand the general principles of the layout of domestic and public water supply system.
4. Understand the principles of constant and intermittent systems of public and domestic water supply and apply the principles in installing various pipes and public hot and cold water supply systems.
5. Understand the principles of domestic hot and cold water and install various systems of domestic cold and hot water.
6. Understand the principles of operation and uses of taps, valves, and cocks in public and domestic supply.
7. Identify and remedy faults and defects in water supply system.
8. Understand and carry out water supply system to rural areas.
9. Understand the safety precautions to be observed in the installation and use of domestic hot water supply.
10. Know how to plan and carry out public and domestic hot water installation.

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

- 1 Carry out simple treatment of water such as filtration, sedimentation and boiling.
- 2 Select and fix appropriate fittings i.e bends, tees, flanges, etc and valves i.e slice, air, gate, non-return valves, pumps and maintain them.
- 3 Carry out various methods of joining cast iron, asbestos, cement, steel and concrete pipes used for public water supply.
- 4 Install a direct or indirect domestic hot and cold water supply system.

5 Identify and remedy faults such as air-locks, worn out valves, leakages, etc in cold water supply system.

6 Cite and install appropriate hot water heaters.

7 Test the completed hot water installation for safety and efficient working of the system.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: COLD AND HOT WATER SUPPLY		Course Code: CWS 10	Contact Hours 4hrs/week
Course Specification: Theoretical/Practical Content			
General Objective 1.0: Understand the Sources and Properties of Water			
Week	Specific Learning Outcome	Teachers Activities	Resources
1	1.1 Explain the source of water in nature, i.e. rainfall, rivers, lakes, wells, etc. 1.2 State the properties of water from wells, rivers, lakes and rain. EVALUATION - Oral Questions and class Test.	<ul style="list-style-type: none"> Analyse sources of water Explain the activities in 1.1 to 1.2 and give notes accordingly. Visitation to nearby rivers, wells etc 	<ul style="list-style-type: none"> Samples of soil component vehicles Simple test of properties of water.
General Objective 2.0: Identify Sources of impurities and contamination of water and precautions to be taken			
Week	Specific Learning Outcome	Teachers Activities	Resources
2-5	2.1 State the sources of impurities in water from wells, rivers and rain. 2.2 State the precautions to be taken to prevent contamination of water supplies. 2.3 Enumerate types of hardness and softness of water, e.g. temporary and permanent hardness. 2.4 Carry out simple treatment of water such as filtration, sedimentation, boiling. EVALUATION: Class Assessment	<ul style="list-style-type: none"> Explain processes of hardness and softness of water. (Temporary and permanent) Demonstrate simple experiment (filtration and sedimentation and boiling) Assess the students. Visit to water treatment station 	<ul style="list-style-type: none"> Samples of water purification media Vehicles

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: COLD AND HOT WATER SUPPLY		Course Code: CWS 10	Contact Hours 4hrs/week
Course Specification: Theoretical/Practical Content			
General Objective 3.0: Understand the general Principles of the Layout of Public and Domestic Water Supply system.			
Week	Specific Learning Outcome	Teachers Activities	Resources
	<p>3.1 Explain with and without diagram the general principles under lying the layout of public and domestic water supply system.</p> <p>3.2 Select a suitable type of storage tank and reservoir</p> <p>3.3 Select the various types of materials used for pipe work in public water supply i.e. cast iron, asbestos, steel, concrete and plastics.</p> <p>3.4 Plan and carry out the installation of tank and service mains, and select suitable materials for the construction of cistern for cold water supply.</p> <p>3.5 Select the types of supports and protections required at various positions of the installation of trunk and service mains.</p> <p>3.6 Select and fix the appropriate fittings i.e. bends, tees flanges, etc. and valves, i.e. sluice, air valve, gate valve, non-return valves, etc.</p> <p>EVALUATION: Take Home Assignment: Student to analyse the processes of simple water treatment plant</p>	<ul style="list-style-type: none"> • Assist the students to identify the materials and explain their importance. • Carry out simple cold water installation using a storage tank. • Prepare detailed notes for the students. 	<ul style="list-style-type: none"> • Brochure of appliance and soil structures • Samples of valves • Fittings on display • Vehicles • Simple installation involving using of GRP/PVC pipes and storage tank • Tools - Diecing machine • Stilson wrench, ¾ Hammer foot print, screwdriver, standing vice, hacksaw, etc

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: COLD AND HOT WATER SUPPLY		Course Code: CWS 10	Contact Hours 4hrs/week
Course Specification: Theoretical/Practical Content			
General Objective 4.0: Understand the Principles of Constant and Intermittent System of Public and Domestic supply, and Apply the Principles in installing various pipes and public hot and cold water supply systems			
Week	Specific Learning Outcome	Teachers Activities	Resources
10-12	<p>4.1 Explain the principle of constant and intermittent system of public cold water supply.</p> <p>4.2 Identify various classes of pipe and their uses e.g. Classes A, B, C.</p> <p>4.3 Select the various jointing compound suitable for cast iron, asbestos cement, steel and concrete pipes used for public water supply.</p> <p>4.4 Carry out various methods of jointing cast iron, asbestos, cement, steel and concrete pipes used for public water supply.</p> <p>4.5 Install a public, cold water supply systems</p> <p>4.6 Read and interpret blue print of public and domestic cold water supply system layout.</p> <p>EVALUATION: Classwork and Assignment</p>	<ul style="list-style-type: none"> • Define the intermittent and constant system • Analyse and identify colours for pipe classes • Mention types of jointing compounds for different types of public water pipes • Carry out simple joints on various public water pipes • Make a simple diagram of public cold water supply system. • Prepare notes for her students. 	<ul style="list-style-type: none"> • Brochures of water fittings to assist in the identification • Sample of jointing compounds • Common tools for cold water pipe jointing, such as yarn, thread tape, jointing paste - caulking tools, hammer, chisel, ladle, cracking knives, lead-wool, cement, flanges, etc.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: COLD AND HOT WATER SUPPLY		Course Code: CWS 10	Contact Hours 4hrs/week
Course Specification: Theoretical/Practical Content			
General Objective 5.0: Understand the Principles of Domestic hot and cold water and install various systems of domestic cold and hot water supply			
Week	Specific Learning Outcome	Teachers Activities	Resources
13-16	<p>5.1 Explain the principles of direct and indirect domestic cold and hot water supply system</p> <p>5.1 Select fittings and valves required for carrying out service connections to water mains.</p> <p>5.2 Select appropriate pipes and fittings for cold and hot service pipes</p> <p>5.3 Carry out connections of service pipe to water mains</p> <p>5.4 Explain the need for valves in a water supply system and install them on the service pipes.</p> <p>5.5 Carry out various types of joints in domestic cold and hot water supply pipes such as mild steel, (galvanised) copper, plastics.</p> <p>5.6 Explain the need for support and protection of pipe runs within buildings</p> <p>5.7 Install a direct or indirect domestic hot and cold water supply system.</p> <p>EVALUATION: Oral questions and Workshop Assignment.</p>	<ul style="list-style-type: none"> • State the students the principles of direct and indirect cold and hot water supply • Explain principles behind water circulation • Lay water main and attempt service connection • Test the system for leakage • Enumerate the needs and emphasise the importance of adequate pipe supports. • Prepare notes. • Practical: Students to practise pipe connections with flanged joints and gaskets 	<ul style="list-style-type: none"> • Brochures of water fittings to assist in the identification • Samples of jointing compounds • Common tools for cold water pipe jointing, such as yarn, thread tape, mait, caulking tools, hammer, chisel, ladle, cracking knives. • Lead wool, cement, flanges, gaskets etc

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: COLD AND HOT WATER SUPPLY		Course Code: CWS 10	Contact Hours 4hrs/week
Course Specification: Theoretical/Practical Content			
General Objective 6.0: Understand the Principle of Operation and uses of taps, valves, and cocks in public and domestic supply			
Week	Specific Learning Outcome	Teachers Activities	Resources
17-21	<p>6.1 Explain the principles of operation of bib, pillar, globe taps, stop valve, high and low pressure ball valves, gate valves, drain cocks and plug cocks.</p> <p>6.2 Sketch and label including sectional sketches, the following valves, taps and cocks enumerated above in (6.1)</p> <p>6.3 Select and install the appropriate valves and taps required in any water supply cistern</p>	<ul style="list-style-type: none"> • Show examples of stated valves, explain their differences. • Dismantle different valves and assist students to understand their working principles. • Make pictorial and sectional sketches of the taps and valves. • Select appropriate valves for various positions. • Prepare notes for students. • Assess students. 	<ul style="list-style-type: none"> • Sectional samples of valves on display. • Brochures to assist • Appropriate layout drawing to assist.
General Objective 7.0: Identify and remedy faults and defects in water supply system.			
Week	Specific Learning Outcome	Teachers Activities	Resources
22	<p>7.1 Identify causes of noises in cold and hot water systems and rectify them</p> <p>7.2 Identify and remedy other types of faults such as air-locks, worn-out valves, leakages, etc. - in cold water supply system.</p> <p>EVALUATION: Classwork Assignment: Students to dismantle and couple samples of valves</p>	<ul style="list-style-type: none"> • Establish sources of noises and prescribe remedies • Prepares notes for students. 	<ul style="list-style-type: none"> • Samples of affected valves and pipes on display. • Possible diagram indicating the position of noises.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: COLD AND HOT WATER SUPPLY		Course Code: CWS 10	Contact Hours 4hrs/week
Course Specification: Theoretical/Practical Content			
General Objective 8.0: Understand and carry out water supply system to rural areas.			
Week	Specific Learning Outcome	Teachers Activities	Resources
23-24	<p>8.1 Explain the sources of water supply in rural area, wells, streams, etc.</p> <p>8.2 Understand the types and principles of operations of pumps, e.g. jack, lift, lift and force, semi-rotary pumps and hydraulic ram.</p> <p>8.3 Sketch and label the following, jack, lift, lift and force, semi-rotary pumps and hydraulic ram.</p> <p>8.4 Explain the importance and the siting of essential valves used for efficient performance of pumps, e.g. foot valves, air-vessels, etc.</p> <p>8.5 Install the pumps and valves and maintain them when necessary.</p> <p>EVALUATION: Project Assignment: Student to draw the layout of a cold water supply to a storey building showing all the plumbing fittings</p>	<ul style="list-style-type: none"> • Review the sources of water supply and identify one for rural areas. • Identify various types of pumps suitable for a specific job. • Identify the importance and use of essential supporting valves • Assist the student in installing pumps using valves and tools. • State common faults in pumps installation and prescribes solution to the faults. • Assess 	<ul style="list-style-type: none"> • Samples of various pumps and brochures • foot valves, non-return valve, jet valve, air valve, suction and delivery pipes, flanges and fittings • Tools, various sizes of spanner, wrenches, screwdriver, hammer, lift rope, etc.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: COLD AND HOT WATER SUPPLY		Course Code: CWS 10	Contact Hours 4hrs/week
Course Specification: Theoretical/Practical Content			
General Objective 9.0: Understand the Safety Precautions to be observed in the Installation and use of Domestic Hot Water Supply.			
Week	Specific Learning Outcome	Teachers Activities	Resources
25-30	<p>9.1 Explain the main provisions of the model and relevant local bye-laws on hot water installation.</p> <p>9.2 State reasons for installing safety valves, control valves, air release valves and gauges etc and install these items in a hot water supply system.</p> <p>9.3 State the danger associated with the storage and use of fuels, e.g. electricity, gas, oil, etc.</p> <p>9.4 State reasons for installing thermostats and thermometer in the water heating system.</p> <p>9.5 Describe the danger associated with boiler and cylinder explosions.</p> <p>EVALUATION: Assignment - (Sketches and Drawing). Student to draw clearly the cold water supply to and hot water extraction from an electric heater showing all the valves, fittings or pipe accessories, thermostat, thermometer etc</p>	<ul style="list-style-type: none"> • State the disadvantages and advantages of using various fuels mentioned in 9.3 • Analyse, select and install thermostat and thermometer in water heating system. • Explain possible causes of boiler and cylinder explosion and prescribe precautions. • Prepare notes. • Assess the students. 	<ul style="list-style-type: none"> • Copies of various bylaws to be studied • Specimen of various valves • Samples of thermometer and thermostat.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: COLD AND HOT WATER SUPPLY		Course Code: CWS 10	Contact Hours 4hrs/week
Course Specification: Theoretical/Practical Content			
General Objective 10.0: Plan and carry out Public and Domestic Hot Water Installation			
Week	Specific Learning Outcome	Teachers Activities	Resources
31-36	<p>10.1 Read and interpret blue print of public and domestic hot water system layout.</p> <p>10.2 Position and support the components of the hot water installation e.g boiler, feed tank and hot water storage cylinder</p> <p>10.3 Carry out necessary pipe work to the components.</p> <p>10.4 Explain reasons for and carry out complete insulation to all components of the hot water installation</p> <p>10.5 Describe the different types of electric and gas water heaters</p> <p>10.6 Explain the working principles of the different types of electric and gas water heaters.</p> <p>10.7 State the ratings and efficiency of a common immersion and gas heaters and appropriate capacity for any given job</p> <p>10.8 Cite and install appropriate hot water heaters</p> <p>10.9 Test the completed hot water installation for safety and efficient working of the system.</p> <p>EVALUATION: Class Test.</p>	<ul style="list-style-type: none"> • Interpret the blue print and understand the use scale drawing. • Explain the need and method of carrying out heat preservation (installation) • Explain working principles of electric and gas water heater • Carry out the installation of the two types of heaters (practical) • Assist students to perform the installations. • Terminal Examination. 	<ul style="list-style-type: none"> • Enough copies of blueprints to go round the students • Boiler, Cylinder, Feed tank, Gas water, heater, electric water heater • Solid fuel • Insulation materials.

Gas and Steam

PROGRAMME:	NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING
COURSE:	GAS AND STEAM WORK CODE: CWS 12
CONTACT HOURS:	4HRS/WEEKS
GOAL:	The course is designed to provide the trainee with the knowledge and ability to plan, fabricate and install gas, and steam pipe work.

GENERAL OBJECTIVES: On completion of this course, the trainee should be able to:-

1. Understand the method of production and storage of liquefied petroleum gas and the safety precautions associated with it.
2. Understand the principles of luminous and bursen flames and carry out the installation of domestic gas cookers and heaters.
3. Understand the principles, functions and the constructional details of steel pipes and fittings used for steam and gas installations and carry out gas and steam work related to steel pipes and fittings in industries.
4. Know the various types of steel pipes and fittings used for steam and gas installations and be able to carry out gas and steam work related to steel pipes and fittings in industry.
5. Install a steam pipe system, providing adequate support and installation of the system.

PRACTICAL COMPETENCE On completion the students will be able to:

1. Install gas pipe work to feed suitable appliances.
2. To carry out installation of steam pipes
3. Carry out essential tests on completed installations.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: GAS AND STEAM WORK		Course Code: CWS 12	Contact Hours 4hrs/week
Course Specification: Theoretical Content			
General Objective: 1.0 Understand the method of Production and Storage of Liquefied petroleum Gas and the safety Precautions associated with this Operation.			
Week	Specific Learning Outcome	Teachers Activities	Resources
1-2	Liquefied Petroleum Gas 1.1 Explain the method of production and storage of liquid petroleum gases. 1.2 State the various types of liquid petroleum gases and their properties 1.3 State necessary safety precautions to be observed when storing and using L.P.G. EVALUATION: Teacher to ask relevant Questions - Verbal or Written on Production of L.P.G.	<ul style="list-style-type: none"> • Explain the origin of L.P.G. and explain their production principles • Emphasise the need for safety and enumerate the safety precautions to be observed when storing and using L.P.G. Prepare notes. <ul style="list-style-type: none"> • Assess the students 	<ul style="list-style-type: none"> • Charts and brochures depicting L.P.G. on display • L.P.G. Cylinder and their colour code.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: GAS AND STEAM WORK		Course Code: CWS 12	Contact Hours 4hrs/week
Course Specification: Theoretical Content			
General Objective 2.0: Understand the Principles of Luminous and Bunsen flames and carry out the installation and piping of Domestic Gas Cookers, heaters and Bunsen.			
Week	Specific Learning Outcome	Teachers Activities	Resources
	2.1 Explain the principles of luminous and Bunsen flames, combustion and oxidation 2.2 State the common products of combustion and how to get rid of them 2.3 Select the various types of fittings used with L.P.G. and their functions 2.4 Identify the different methods of gas installations and know their advantages and disadvantages. 2.5 Construct and position platforms for receiving gas cylinders 2.6 Install gas pipe work to feed suitable appliances 2.7 Test using soapy water to detect leakages and defective fittings. EVALUATION: Course work Assessment	<ul style="list-style-type: none"> • List out the product of combustion and how best to get rid of them • Enumerate various types of fittings used with L.P.G. and their functions • Demonstrate the construction of platforms for receiving gas cylinders and enumerate different methods of gas installations, stating the advantages and disadvantages • Assess the students 	<ul style="list-style-type: none"> • Charts and brochures • Bunsen Bonus, and laboratory experiment • Gas cooker • Sample of element • Spark lighter
General Objective 3.0: Understand the Principles, functions and the Constructional details of Steam Generator			
Week	Specific Learning Outcome	Teachers Activities	Resources
	3.1 Identify the types of steam generators 3.2 Explain the working principles of a steam generator 3.3 Describe the functions and constructional details of a steam generator EVALUATION: Course work Assessment	<ul style="list-style-type: none"> • Enumerate different types of steam generators and explain their functions • Give or produce pictorial and sectional sketches of steam generators, assess the students 	<ul style="list-style-type: none"> • Brochures • Charts.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: GAS AND STEAM WORK		Course Code: CWS 12	Contact Hours 4hrs/week
Course Specification: Theoretical Content			
General Objective 4.0: Know the various types of steel pipes and fittings used for steam and gas installations and carry out gas and steam work related to steel pipes and fittings in industry			
Week	Specific Learning Outcome	Teachers Activities	Resources
8-12	<p>4.1 Explain the importance and usage of steam in manufacturing industry.</p> <p>4.2 Differentiate the various types of steam e.g. wet, dry and superheated with facility</p> <p>4.3 State the purpose and types of insulation of steam pipes and fittings</p> <p>4.4 Carry out insulation of steam pipes</p> <p>4.5 Select various types of pipes used for gas, water and steam installations</p> <p>4.6 Select and describe the various types of valves used in steam installations.</p> <p>4.7 Explain the reasons for insulating a steam pipe</p> <p>EVALUATION:</p> <p>a. Visitation to a boiler house</p> <p>b. Assessment report of each student on a visit to boiler house</p> <p>c. Workshop practical.</p>	<ul style="list-style-type: none"> • Enumerate the process of steam generation and identify various types, stressing the importance of each • Explain the purpose of insulation and enumerate different types of insulating materials used for steam/heating work and their applications • State the various classes of pipes used for gas, and steam installations and describe the various valves and fittings used for steam installation. Prepare notes. Conduct visit to a boiler house • Demonstrate simple steam methods of steam pipeline insulation emphasising the needs for brackets and fittings depicting the methods of positioning and securing, assess the students 	<ul style="list-style-type: none"> • Charts and brochures • Sample of insulating materials, different valves on display • Vehicles • Brackets, fittings, • Pipes, • Insulator, • General Tools

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: GAS AND STEAM WORK		Course Code: CWS 12	Contact Hours 4hrs/week
Course Specification: Theoretical Content			
General Objective 5.0: Install a Steam pipe system, providing adequate support and insulation of the System.			
Week	Specific Learning Outcome	Teachers Activities	Resources
13-15 16-18 19-20	5.1 Construct and position platforms for receiving gas cylinders 5.2 Install gas pipe work to feed suitable appliances 5.3 Test using soapy water to detect leakages and defective fittings. 5.4 Carry out insulation of steam pipes 5.5 Set out pipe-line from the source to the point of use. 5.6 Fix on correct bracket or clips along the pipe-lines to support steam pipes 5.7 Lay pipes on to bracket and secure firmly 5.8 Join steam pipe 5.9 Select and apply suitable materials to insulate a steam pipe system 5.10 Carry out essential tests on completed installation. 5.11 Construct an apron to shield the cylinders from the rain and direct ray of sun EVALUATION: terminal Exams.	<ul style="list-style-type: none"> • Teacher to demonstrate the practical activities to students to practise till they become competent. • Assess the students 	<ul style="list-style-type: none"> • Angle Iron • Metal sheets • Valves, pipes • Set of Welding and Cutting tools • Diecing machine • Oxy-acetylene • Screws. Hacksaw complete with blade • Set of machination tods • Pipe cutters • Gas cylinders • Pressure hoses • Control valves, D-clips • Soap, form, water

Gas and Bronze Welding

PROGRAMME:	ATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING
COURSE:	GAS AND BRONZE WELDING COURSE CODE: CBW11
CONTACT HOURS:	3RS/WEEK
GOAL:	The module is designed to provide the trainee with the knowledge and techniques of gas and bronze welding to enable him carry out all gas and bronze welding operations in normal plumbing work.

GENERAL OBJECTIVES: On completion of this module, trainee should be able to:-

1. Understand and apply the general safety precautions related to gas and bronze welding.
2. Know and apply successfully various gas welding processes/operations including the acetylene and oxy-fuel gas cutting processes.
3. Understand the process of manufacture and storage of oxygen and acetylene and associated safety measures.
4. Assemble oxygen and acetylene equipment ready for welding operations.
5. Understand the general principle of brazing and bronze welding and use them in joining metals to a high degree of efficiency.
6. Know and weld together the different types of non-ferrous and ferrous metals.
7. Understand and apply the fuel gas cutting metals to given specification.
8. Know the various welding dejects and rectify them.

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

1. Select, use and care for protective wears for carrying out gas welding operations.
2. Weld metals together in down-hand or flat position/leftward and rightward techniques.
3. Carry out bronze welding on prepared joints using slightly oxidizing flame as appropriate and observing necessary safety precautions.
4. Weld stainless steel components using appropriate welding rods, techniques and observing safety precautions.
5. Detect welded joints defects and rectify them.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: GAS AND BRONZE WELDING		Course Code: CBW 11	Contact Hours 3hrs//week
Course Specification: Theoretical/Practical Contents			
General Objective: 1.0 Understand and apply the general safety precautions related to Gas and BronzeWelding			
Week	Specific Learning Outcome	Teachers Activities	Resources
1-2	1.1 Understand the essence and emphasis on safety precautions 1.2 Carry, transport and store full and empty gas cylinders safely using appropriate equipment 1.3 Apply appropriate safety precautions while carrying out the following: a. Gas welding operations on containers which have been emptied of chemicals, inflammable or explosive liquids b. Gas welding near containers with inflammable materials, e.g petrol tank c. Gas welding in confined spaces	<ul style="list-style-type: none"> • Emphasise the importance of separation of empty and full cylinders and explain the essence of safety - in carrying and transporting of cylinder bottles. • Prepare explosive containers ready for welding operation • Teacher to provide insulative shield for welding; welding goggles, gloves, etc. e.g. when welding near inflammable materials 	<ul style="list-style-type: none"> • Insulating shield • Fans • Extractors • Safety signs, information sheet and postals • Welding goggles, • Shield overall • Arching tables, • Trolling, etc.
3	1.4 Select, use and care for protective wears for carrying out the following gas welding operations, e.g. Welding goggles Welding shields Gloves Boots, etc. 1.5 Display safety signs - prohibition, mandatory, warning and information signs.	<ul style="list-style-type: none"> • Explain the importance of fans and cathode extractors when welding in a confined area • Teacher to display safety signs - i.e. prohibition signs, mandatory signs, warning signs and information signs. • Emphasise the importance and use of protective wears, e.g. welding goggles, gloves, booths, nose covers, etc. • Assess the students. 	<ul style="list-style-type: none"> •

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: GAS AND BRONZE WELDING		Course Code: CBW 11	Contact Hours 3hrs//week
Course Specification: Theoretical/Practical Contents			
General Objective 2.0: Know and apply successfully various gas welding processes/operations including the acetylene and oxy-fuel gas cutting processes.			
Week	Specific Learning Outcome	Teachers Activities	Resources
4-6	<p>2.1 Identify the following gas welding equipment, describing their features, functions, applications and care:</p> <ol style="list-style-type: none"> generators regulators blow pipes nozzles hoses gas cylinders and their colours economizers check valves <p>2.2 Differentiate between the following types of generators, stating their merits and demerits.</p> <ol style="list-style-type: none"> Carbide to water generator Calcium carbide to-water generator <p>2.3 Identify the main parts of the generator e.g.</p> <ol style="list-style-type: none"> hydraulic back pressure valve purifiers carbide trays etc. <p>2.4 Distinguish between high and low pressure systems of welding.</p> <p>2.5 State the properties of calcium carbide</p>	<ul style="list-style-type: none"> Identify the welding component and explain the differences Explain the difference between the two low pressure gas generating equipment. State the advantages and the disadvantages of the two low pressure generating equipment Analyse the properties of calcium carbide and process of generating acetylene from carbide Prepare detailed notes. Assess the students. 	<ul style="list-style-type: none"> Gas generator Gas regulator Blow pipes, Nozzles Pressure hoses Gas cylinders Economizers Check valves Carbide trays Calcium carbide Pressure valve Purifiers

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: GAS AND BRONZE WELDING		Course Code: CBW 11	Contact Hours 3hrs//week
Course Specification: Theoretical/Practical Contents			
7-9	<p>2.6 Generate acetylene using calcium carbide guiding against danger or over-charge</p> <p>2.7 Identify types of welding rods stating their properties, compositions, and uses Differentiate between welding and cutting torches</p> <p>2.8 Identify the following flames and describe how they are derived in the oxy-acetylene welding process:</p> <p style="padding-left: 20px;">a. oxidizing flame b. carbonising flame c. neutral flame</p> <p>2.9 State the instances of the application/uses of the type of flames named in (2.8) above</p> <p>2.10 Light the welding torch and adjust the flame to each of the types named in 2.8 above</p> <p>2.11 Prepare plate surfaces and run beads:</p> <p style="padding-left: 20px;">a. without filler rods b. with filler rods</p> <p>2.12 Make neat labelled sketches indicating the conventional symbols for the welded joints, e.g. butt joint, fillet joint and lap joint.</p> <p>2.13 Prepare plate surfaces for the following welding joints and tack weld i. Butt joints, ii. Fillet joint iii. Lap joint</p> <p>2.14 Weld metals together in down-hand or flat position</p> <p>2.15 State the functions of backing bars and strips</p> <p>2.16 Apply backing bars and strips according to instructions.</p>	<ul style="list-style-type: none"> • Identify different welding rods and enumerate their properties composition and uses. • Identify and differentiate between welding and cutting torches • Explain and demonstrate simple processes of gas welding with or without filler • Identify convectional welding symbols and preparation of plate surfaces for carrying out various joint e.g butt and fillet joints. • Demonstrate different welding methods, and emphasise the functions of backing bars and strips. • Prepare detailed notes. • Assess the students. 	<ul style="list-style-type: none"> • Calcium carbide • Carbide trays • Posters and brochures • Listing and identifying part of welding equipment • Set of welding wedge • Cutting tools • Materials • Welding rods, sparklighter • Posters indicating different welding joints.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: GAS AND BRONZE WELDING		Course Code: CBW 11	Contact Hours 3hrs//week
Course Specification: Theoretical/Practical Contents			
General Objective 3.0: Understand the Process of Manufacture and Storage of Oxygen and Acetylene and Associated Safety Measures.			
Week	Specific Learning Outcome	Teachers Activities	Resources
10	3.1 Explain the various methods of manufacture and storage of oxygen and acetylene 3.2 Identify the difference between the equipment for oxygen and acetylene 3.3 State the safety precautions: a. during handling b. during storage c. During assembly and use. EVALUATION: Oral quize with Intermittent Questions	<ul style="list-style-type: none"> • Enumerate the principal components of manufacture of oxygen and acetylene gas (carbide) • Identify the difference between oxygen and acetylene equipment; and emphasise all safety precaution during handling, storage, assembly and use of oxygen and acetylene. • Visitation trip to Industrial Gas manufacturing companies • Assess the students. 	<ul style="list-style-type: none"> • Vehicles
General Objective 4.0: Assemble oxygen and Acetylene Equipment ready for Welding Operation.			
Week	Specific Learning Outcome	Teachers Activities	Resources
11-12	4.1 Position and secure the acetylene welding cylinders 4.2 Clean the outlet of cylinder of foreign body and fix on the pressure regulators 4.3 Identify the correct hose pipes and fixing them on to pressure regulators 4.4 Fix on the welding blow pipe to the hose pipe and attaching correct nozzle 4.5 Test the completely assembled equipment for leakages using soapy water 4.6 State the functions of the various components, viz a. regulators b. blow-pipe c. nozzles d. hoses, etc. 4.7 Carry out oxy-acetylene welding on any materials applying left ward and rightward techniques	<ul style="list-style-type: none"> • Assemble oxy-acetylene welding equipment • Prepare detailed notes for the students to copy after explaining the activities on 4.1 to 4.7 • Assess the students. 	<ul style="list-style-type: none"> • Silver solder • Brazing welding rods • Bend bolt • Tapping hammer • Brazing spectacle • Flux • Bronze materials • Filler rods • Gas - oxy-acetylene • Safety posters

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: GAS AND BRONZE WELDING		Course Code: CBW 11	Contact Hours 3hrs//week
Course Specification: Theoretical/Practical Contents			
General Objective 5.0: Understand the General Principle of Brazing and Bronze welding and use these Methods in Joining Metals to a high degree of Efficiency			
Week	Specific Learning Outcome	Teachers Activities	Resources
13-15	5.1 Know the relationship and differences between brazing/silver soldering and bronze welding 5.2 Light a flame necessary for successful brazing and bronze welding 5.3 State the composition of the various types of fluxes and filler rods used for brazing and bronze welding 5.4 Prepare metal/edges for brazing 5.5 Braze joints using oxy-acetylene flame/brazing lamp, observing necessary safety precautions 5.6 Prepare joints for bronze welding e.g. bell mouth, branch joints, joint etc. 5.7 Carry out bronze welding on prepared joints using slightly oxidizing flame as appropriate and observing necessary safety precautions. 5.8 Explain the importance of using bronze welding for the welding of dissimilar metals; e.g. <ol style="list-style-type: none"> copper and steel cast iron and copper galvanized materials EVALUATION: Students Assessment, through identification of already stated equipment and materials. Students to carry out bronze welding on prepared joints	<ul style="list-style-type: none"> • Explain difference between silver soldering and bronze welding and demonstrates how to obtain suitable flames for brazing and bronze welding • Explain the purpose of flux and enumerate the different various types of fluxes and filler rods used for brazing and bronze welding • Demonstrate the method of preparing metal for brazing and carryout brazing joint using oxy-acetylene flame or brazing lamp • Observe necessary precautions • Students to prepare the following bronze welding joint - bell mouth, branch joint, etc • Set slightly oxidising flame and proceed to carry out bronze welding on prepared welding joint, observing necessary safety precautions. • Explain the importance of bronze welding for successful welding of dissimilar metals; e.g. copper and steel, cast iron and copper, and galvanize materials. • Prepares notes for the students. • Assess the students. 	<ul style="list-style-type: none"> • Oxy-acetylene equipment • Brazing lamp • Brazing rod, fluxes, (paste and powder type). • Pipe expander • Abrasive papers, taping hammer, bend bolt, etc. • Copper plates or rod • Cast iron plates • Galvanized sheet • Steel plates/rod • Safety materials

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: GAS AND BRONZE WELDING		Course Code: CBW 11	Contact Hours 3hrs//week
Course Specification: Theoretical/Practical Contents			
General Objective 6.0: Know and weld together the different types of Non-ferrous and ferrous Metals			
Week	Specific Learning Outcome	Teachers Activities	Resources
16-18 19-20	<p>6.1 Identify the following non-ferrous metals:</p> <ol style="list-style-type: none"> Copper Aluminium Brass Bronze, etc <p>6.2 Describe the composition and state the mechanical properties of the above named non-ferrous metals. Mechanical properties to include</p> <ol style="list-style-type: none"> Ductility Malleability Hardness; etc. <p>6.3 State the properties and composition of fluxes used for welding non-ferrous metals</p> <p>6.4 Prepare and weld non-ferrous metals using appropriate fluxes</p> <p>6.5 Prepare bronze components for welding, avoiding sharp edges and weld to specification.</p> <p>6.6 Identify and state the type, composition and properties of stainless steels used in metal work.</p> <p>6.7 Prepare stainless steel components for welding</p> <p>6.8 Weld stainless steel components using appropriate welding rods, techniques and observing safety precautions.</p> <p>6.9 Explain the effect of welding together two different metals.</p> <p>EVALUATION: Students Assessment, through identification or already stated equipment and materials.</p>	<ul style="list-style-type: none"> • Explain the different between ferrous and non-ferrous metals • Identify and state the compositions/mechanical properties of - Brass, Bronze, and stainless steel • Prepare non-ferrous materials for welding - emphasising suitable fluxes, composition and properties. • Demonstrate the process of preparation and welding of bronze components • Emphasise the properties of stainless steel and show the technique and material for a successful welding • Narrate the effect of welding two dissimilar metals together i.e. Electrolytic corrosion. • Prepare detailed notes for the students. • Assess the students. 	<ul style="list-style-type: none"> • Oxy-acetylene equipment • Brazing lamp • Brazing rod, fluxes, (paste and powder type) • Pipe expander • Abrasive papers • Taping hammer, bend bolt, etc. • Bronze plate • Bronze plates • Stainless Steel Materials • Coppers Materials • Aluminium Materials • Various types of Welding rods • Safety Posters • Safety materials

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: GAS AND BRONZE WELDING		Course Code: CBW 11	Contact Hours 3hrs//week
Course Specification: Theoretical/Practical Contents			
General Objective 7.0: Fuel Gas Cutting Process			
Week	Specific Learning Outcome	Teachers Activities	Resources
21	7.1 State the principles and applications of fuel-gas cutting process e.g. <ul style="list-style-type: none"> a. Manual b. Machine 7.2 Describe various fuel gases used in oxy-fuel cutting: <ul style="list-style-type: none"> a. acetylene b. propane c. butane d. coal gas, etc. 7.3 State the advantages and disadvantages of using the above mentioned, fuel-gases for oxy-fuel cutting operations, EVALUATION: Assessment of Simple Practical Project	<ul style="list-style-type: none"> • Explain oxidation principles behind fuel-gas cutting and state the different methods of cutting • Enumerate different fuel gases used in oxy-fuel cutting and explain their advantages and disadvantages. • Identify manual and machine cutting equipment. • Prepare detailed notes. • Assess the students. 	<ul style="list-style-type: none"> • Oxy-fuel cutting equipment • Colour code for different fuel-Gases

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: GAS AND BRONZE WELDING		Course Code: CBW 11	Contact Hours 3hrs//week
Course Specification: Theoretical/Practical Contents			
General Objective 8.0: Know the various Welding Defects and Rectify Them.			
Week	Specific Learning Outcome	Teachers Activities	Resources
22-24	<p>8.1 Determine welded joints defects by the known methods e.g.</p> <p style="padding-left: 40px;">a. non-destructive test</p> <p style="padding-left: 40px;">b. destructive test</p> <p>8.2 Rectify welded joint defects enumerated above</p> <p>8.3 State the main causes of defects in welded joints.</p> <p>EVALUATION: Visual examination of the Cutting Parts.</p> <p>PRACTICAL EXERCISES</p> <p>8.4 Production and storage of oxygen and Acetylene gas using Calcium carbide and electrolysis of water. Position, assemble and test gas welding equipment ready for welding operation</p> <p>8.5 Preparation of plate surfaces for the following welding joint and Tack and weld</p> <p style="padding-left: 40px;">a. Butt joint</p> <p style="padding-left: 40px;">b. fillet joint</p> <p style="padding-left: 40px;">c. Lap joint</p> <p style="padding-left: 40px;">d. Prepare joints for bronze welding e.g bell mouth branch joint, V joint.</p>	<ul style="list-style-type: none"> • Explain and demonstrate method of non destructive and destructive testing of welded joints • Demonstrate how to rectify the enumerated defect • State and explain the causes of defect in welded joints. • Prepare detailed notes for the students. • Assess the students. 	<ul style="list-style-type: none"> • Hacksaw • File • Table Vice • Gammer ray • Or ex-ray machine • Etching fluid • Hammer

Sanitation and Drainage I

PROGRAMME:	NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING
COURSE:	SANITATION AND DRAINAGE I COURSE CODE 11
CONTACT HOURS:	3HRS/WEEK
GOAL:	The module is designed to provide the trainee with the knowledge and skills to install, test and maintain sanitary and drainage systems in a building.

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

- 1 Understand the principles of sanitation in buildings, their classification and differentiate various types of sanitary appliances and properties of materials used in siting appliances in the building.
- 2 Install sanitary appliances and test the system for leakages, security, efficiency, etc.
- 3 Understand the functions of traps used in sanitary appliances and fix traps in sanitary system.
- 4 Know the methods and techniques of installing waste and soil pipes above ground level.
- 5 Understand the basic principles of good drainage, the layout of simple drainage system and the properties of materials used.
- 6 Understand the purpose of septic tank and soak-away pit and their construction for domestic and small scale.
- 7 Carry out connections of the drainage system to cesspool.4555555555
- 8 Understand the principles of environmental sanitation and its application to the installation and test of a surface drainage system.

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

1. Select and site sanitary appliances in different types of building.
2. Fix sanitary appliances and test them for leakages, security and efficiency.
3. Fix traps to the sanitary systems and test for efficiency.
4. Install and test soil and waste pipes above ground level.
5. Select and determine sizes of drain pipes
6. Carry out connections of drainage systems to septic tank and soak-away pits.
7. Carry out roof drainage and weathering
8. Join appropriate component and connect surface drainage to public sewer or soak-away.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: SANITATION AND DRAINAGE		Course Code: CSD 11	Contact Hours 3hrs/week
Course Specification: Theoretical/Practical Contents			
General Objective: 1.0 Understand the Principles of Sanitation in Buildings, their Classification and Differentiate Various Types of Sanitary Appliances and Properties of Materials used in Siting Appliances in the Building			
Week	Specific Learning Outcome	Teachers Activities	Resources
1-8	<p>1.1 Explain the Principles of Sanitation in buildings</p> <p>1.2 Classify and differentiate various types of sanitary fittings. E.g soil (W.C. Bidet Slop Sink) Waste appliances (Wash Hand Basin, Bath, Sink)</p> <p>1.3 Sketch, label and dimension, soil and waste appliances, etc.</p> <p>1.4 Select the materials and describe the process used for the manufacture of soil and waste appliances</p> <p>1.5 State the properties of the various materials used for the manufacture of waste and soil appliances</p> <p>1.6 Select and site sanitary appliances in different types of building</p> <p>1.7 Know the sizes of the sanitary appliances and various fixing levels</p> <p>1.8 Select the various sizes of pipes suitable for supplies and wastes of sanitary appliances to specification.</p> <p>EVALUATION: Site/Workshop Group Assessment.</p>	<ul style="list-style-type: none"> • Identify various appliances and analyse their materials of manufacture. • Explain the process of manufacturing appliances (practical) • Sketch and dimension appliances • Explain installation principles of sanitary appliances • Prepare detailed notes for the students. • Assess the students. 	<ul style="list-style-type: none"> • Chalkboard • Lesson plan • Manufacturer Brochures • Model of appliance on display • Tools - spirit level, cold chisel, rawl plugging, trowel, hammer, wrenches, plumbers' mait or tangit gum • Sanitary appliances • P.V.C. - soil and waste pipes • Supply pipes.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: SANITATION AND DRAINAGE		Course Code: CSD 11	Contact Hours 3hrs/week
Course Specification: Theoretical/Practical Contents			
General Objective: 1.0 Understand the Principles of Sanitation in Buildings, their Classification and Differentiate Various Types of Sanitary Appliances and Properties of Materials used in Siting Appliances in the Building			
General Objective: 2.0 Install Sanitary Appliances and Test the system for Leakages, Security, Efficiency, etc.			
Week	Specific Learning Outcome	Teachers Activities	Resources
9-12	<p>2.1 Read and interpret drawings of sanitary installation in a building plan</p> <p>2.2 Carry out necessary preparation relevant to the fixing of each sanitary appliances e.g. marking out, assembling the units raw plugging of walls and floor.</p> <p>2.3 Fix sanitary appliance to given specification</p> <p>2.4 Test finished sanitary installation for leakages, security, efficiency, etc.</p> <p>EVALUATION: Practical Exercises</p> <p>- Group Work Assessment As per the Installation of Sanitary Appliances.</p>	<ul style="list-style-type: none"> • Read, drawings and explain and interpret scaled drawings for the students • Assemble components and proceed to install sanitary appliances • Install appliances using correct sizes of pipes and positioning at correct levels. • Explain the testing and demonstrate the method of testing to detect leakages and ensure security and efficiency in the system. • Prepare detailed notes for the students. • Assess the students. 	<ul style="list-style-type: none"> • Essential tools for installation as listed above • Drawing of life sanitary Compartment to be studied and site inspection carried out • Test Media - Air test, Drain plug, Smoke rocket, Air pump to be made available. • U Gauge.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: SANITATION AND DRAINAGE		Course Code: CSD 11	Contact Hours 3hrs/week
Course Specification: Theoretical/Practical Contents			
General Objective 3.0: Understand the Functions of traps used in Sanitary Appliances and fix Traps in sanitary System			
Week	Specific Learning Outcome	Teachers Activities	Resources
13-20	3.1 Differentiate the various types of traps and their uses - bottle trap, running trap, 'P' and 'S' trap, etc. 3.2 Sketch and describe different types of traps. 3.3 Explain the functions of the water seals in traps. 3.4 Enumerate the causes of unsealing of traps and their remedies. 3.5 Fix traps to the sanitary systems and test for efficiency. EVALUATION: Group Work Assessment.	<ul style="list-style-type: none"> • Sketch various traps and understand their differences. • Define water seal and explain the functions of it in traps. • Demonstrate the positioning and fixing of traps, and carry out their test to ensure efficiency. • Prepare detailed notes for the students. • Assess the students. 	<ul style="list-style-type: none"> • Various traps e.g. Bottle trap, Running trap, 'S' trap, 'P' trap on display • General Welding Tools
General Objective 4.0: Know the Methods and Techniques of Installing Waste and Soil Pipes above Ground level			
Week	Specific Learning Outcome	Teachers Activities	Resources
21-22	4.1 Select the various types of soil and waste appliances. 4.2 Explain the Principles and arrangement of soil waste pipes above ground e.g. (one pipe, two pipe and single stack systems). 4.3 State the materials used for and the sizes of waste and soil pipes. 4.4 Install and test soil and waste pipes above ground level. EVALUATION: Group Work Assessment.	<ul style="list-style-type: none"> • Identify pipes that are suitable for use in soil and waste installations. • Explain the principles that govern the arrangement of piping under one pipe, two pipes and single stack system. • List the materials for soil and waste installation and enumerate their correct (sizing) sizes. • Prepare detailed notes for the students. • Assess the students. 	<ul style="list-style-type: none"> • Sample of various soil and waste pipes • Tools required for waste and soil pipe • Suitable testing media for the installation to be assembled.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: SANITATION AND DRAINAGE		Course Code: CSD 11	Contact Hours 3hrs/week
Course Specification: Theoretical/Practical Contents			
	General Objective 5.0: Understand the basic Principles of Good Drainage, the Layout of Simple Drainage System and the Properties of Materials Used.		
Week	Specific Learning Outcome	Teachers Activities	Resources
23-36	5.1 State the basic principles of good drainage system. 5.2 Explain the main provisions of the building regulation with regard to domestic drainage and apply them to drainage installation. 5.3 State the types of drainage systems i.e above ground and under ground types. 5.4 State the properties of and the materials used for drainage system, i.e. cast iron glazed stone-ware and P.V.C., etc. 5.5 Select and determine sizes of drain pipes. 5.6 Draw simple drainage layout and sketch drainage pipe joints, man holes, etc. EVALUATION: Group Work Assessment	<ul style="list-style-type: none"> • Explain basic principle of a good drainage system. • Put up a simple drainage layout, stating the correct sizes of pipes used. (practical) • Put up simple sketches of drain pipe joints and suitable drainage interceptions. (practical) • Prepare detailed notes for the students. Assess the students. 	<ul style="list-style-type: none"> • Suitable (materials) pipes and fittings for above and underground drainage. Tools required - As stated above suitable for drainage includes; diggers, Shovels, Cement, etc.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: SANITATION AND DRAINAGE		Course Code: CSD 11	Contact Hours 3hrs/week
Course Specification: Theoretical/Practical Contents			
	General Objective 6.0: Understand the Purpose of Septic Tank and soak-away pit and their Construction for Domestic and Small Scale Industrial Uses.		
Week	Specific Learning Outcome	Teachers Activities	Resources
37-45	<p>6.1 State the purpose of septic tank and soak-away drainage system.</p> <p>6.2 Explain the principles of constructing septic tanks and soak-away drainage system.</p> <p>6.3 Draw to scale a standard septic tank of domestic dwelling.</p> <p>6.4 Choose various recommended sizes of septic tank and soak-away for building.</p> <p>6.5 Carry out connections of drainage systems to septic tank and soak-away drainage system</p> <p>6.6 State the importance of ventilation in septic tanks.</p> <p>6.7 Select the appropriate types of soak-away pit construction for various soils.</p> <p>6.8 Explain the factors that govern the choice of type and size of soak away pits/septic tanks</p> <p>EVALUATION: Group Assessment and Individual Report on Septic Tank visited.</p>	<ul style="list-style-type: none"> • Explain the principles of construction and the operation of septic tank and soak-away drainage system. • Draw to scale the simple layout of standard septic tank and soak-away drainage system for a domestic building. • Determine the correct method of sizing septic tank and soak-away drainage system for various buildings. (practical) • Carry out drainage layout and connection to septic tank and soak-away drainage system. • Determine the different types of soak-away pit needed for various type of soil. • Prepare detailed notes for the students. • Assess the students. 	<ul style="list-style-type: none"> • Manual and Brochures • All normal tools needed for drainage installation as above • Visitation to mini-private septic-tank system

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: SANITATION AND DRAINAGE		Course Code: CSD 11	Contact Hours 3hrs/week
Course Specification: Theoretical/Practical Contents			
General Objective 7.0: Carry out Connections of the Drainage System to Cesspool.			
Week	Specific Learning Outcome	Teachers Activities	Resources
46-52	<p>7.1 State the purpose of a cesspool - drainage system.</p> <p>7.2 State the requirements for the location of a cesspool.</p> <p>7.3 Explain the principle of constructing a cesspool drainage system.</p> <p>7.4 Draw to scale a standard cesspool drainage system for domestic dwellings.</p> <p>7.5 Construct a standard cesspool drainage system for domestic dwellings.</p> <p>EVALUATION: Group Work Assessment.</p>	<ul style="list-style-type: none"> • Enumerate the principle involved in construction of a cesspool drainage system • Draw to scale a standard cesspool system • Explain the proper requirement for the location of a cesspool. • Demonstrate the construction of a standard cesspool drainage system for domestic dwellings. • Prepare detailed notes for the students. • Assess the students. 	<ul style="list-style-type: none"> • All Construction Tools as above.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: SANITATION AND DRAINAGE		Course Code: CSD 11	Contact Hours 3hrs/week
Course Specification: Theoretical/Practical Contents			
General Objective 8.0: Understand the Principles of environmental Sanitation and its Application to the Installation and Tests of a Surface Drainage System.			
Week	Specific Learning Outcome	Teachers Activities	Resources
53-72	8.1 State the importance of environmental sanitation. 8.2 List the materials used in surface drainage and state their properties 8.3 Make sketches showing half round, box, valley and ogee gutters. 8.4 Manufacture support for pipes and gutters for collecting rain water 8.5 Carry out roof drainage and weathering. 8.6 Join appropriate component and connect surface drainage to public sewer or soak-away. (Depending on the locality). EVALUATION: Group Work Assessment and Terminal Examination	<ul style="list-style-type: none"> • Fabricate common supports that can be used for pipe and gutter and guide students to do same. • Carry out installation of simple roof drainage • Effect discharges from the drainage in 8.5 above into public sewer or soak-away drainage system • Explain and prepare notes accordingly. • Assess the students. 	<ul style="list-style-type: none"> • Aluminium • P.V.C. • Galvanise iron • Flat bar • Screws and; • All common tools as listed above.

Hot and Cold Water Services, Heating and Ventilation(ANTC)

ADVANCED NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING

PROGRAMME:	ADVANCED NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING
COURSE:	HOT AND COLD WATER SERVICES, HEATING AND VENTILATION, CORUSE CODE: CNS 20]
CONTACT:	7HRS/WEEK
GOAL:	The module is designed to provide the trainee with the knowledge and skills to design, execute and maintain hot and cold water services and storage to buildings and carry out all required pipe fittings.

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

1. Plan and design various hot and cold water system for both domestic and industrial purposes in accordance with prevailing regulations and carry out installations and repairs.
2. Understand the method of selecting pumps for water supply purposes.
3. Understand the economic use of water and the installation of water meter for domestic and industrial purposes.
4. Demonstrate and understand the causes and prevention of water pollution.
5. Understand the uses and know the types of heating installations.
6. Understand the uses of steam calorifiers for heating water.
7. Understand the uses and types of space heaters and install it where necessary.
8. Understand the principles of solar heating system and carry out its installations.
9. Know the operational principles of air conditioners and install air cool engine.

PRACTICAL COMEPTENCE On completion of this course, the trainee should be able to:-

1. Carry out complete installation of a hot water supply system to specification.
2. Carry out elementary design of a scheme of water supply to multi-storey buildings and estimate of water consumption requirement for housing estate.
3. Carry out meter reading and costing.
4. Dis-infect polluted cold water installation system.
5. Select the appropriate valves used with calorifiers and their operational principles.
6. Carry out the installation of space heaters taking into consideration all necessary safety precautions associated with the installation and use of space heaters.
7. Select equipment, materials, fittings and design a simple scheme for air-conditioning installation.

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: HOT AND COLD WATER SERVICES, HEATING & VENTILATION		Course Code: CWS 20	Contact Hours 7hrs.week
Course Specification: Theoretical/Practical Contents			
General Objective: 1.0 Plan and Design various hot and cold water systems for both domestic and industrial purposes in accordance with prevailing regulations and carry out installations and repairs.			
Week	Specific Learning Outcome	Teachers Activities	Resources
1-5	<p>1.1 Know the purpose and carryout service installations to domestic and industrial buildings.</p> <p>1.2 Estimate the average daily water consumption requirements for different buildings.</p> <p>1.3 Carry out simple calculation of cold water pipe sizing using appropriate formulae and tables.</p> <p>1.4 Plan and design installation scheme completely.</p> <p>1.5 Prepare schedule of materials and fittings required for particular installations.</p> <p>1.6 Carry out installation to domestic, commercial and industrial buildings from a working drawing.</p> <p>1.7 Design indirect hot water system</p> <p>1.8 Design cylinder tank system of hot water supply.</p> <p>1.9 Design indirect hot water and heating system.</p> <p>1.10 State the principles and the uses of mixing valves</p> <p>1.11 Select the appropriate type of boiler for a particular installation. e.g material for manufacture rating, etc.</p> <p>1.12 Carry out complete installation of a hot water supply system to specification.</p>	<ul style="list-style-type: none"> • Ask students to estimate average daily water consumption requirement for different buildings • Ask students to plan and design of pipe sizing of installation scheme • Ask students to prepare the schedule of materials required for the designed installation • Ask students carry out design of an indirect hot water system • Ask students to plan and carry out installation of hot water supply system as specified • Explain all the activities in 1.1 to 1.12 and prepare detailed notes accordingly. 	<ul style="list-style-type: none"> • Chalkboard • Textbooks • Drawing Board and equipment • Computer with appropriate CADD programme (software and hardware)

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: HOT AND COLD WATER SERVICES, HEATING & VENTILATION		Course Code: CWS 20	Contact Hours 7hrs.week
Course Specification: Theoretical/Practical Contents			
General Objective 2.0: Understand the method of selecting pumps for water supply purposes			
Week	Specific Learning Outcome	Teachers Activities	Resources
6-10	2.1 Review previous knowledge on the operation of pumps 2.2 Explain the principles of operation of centrifugal pumps 2.3 Carry out simple calculations on pumps sizing and discharge using appropriate formulae 2.4 Understand the need for and provision of automatic controls for pumps 2.5 Carry out elementary design of a scheme of water supply to multi-storey buildings 2.6 Carry out the estimate of water consumption requirement for housing estate. EVALUATION: Group Discussion and assessment	<ul style="list-style-type: none"> • Ask students to explain operation principles of centrifugal pump • Ask students to carry out simple calculations on pump sizing and discharge using appropriate formulae (practical) • Ask students to carryout elementary design of a scheme of water supply to a multistorey building (practical) 	<ul style="list-style-type: none"> • Charts and brochures • Sample of Centrifugal pump • Calculator • Drawing equipment

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: HOT AND COLD WATER SERVICES, HEATING & VENTILATION		Course Code: CWS 20	Contact Hours 7hrs.week
Course Specification: Theoretical/Practical Contents			
General Objective 3.0: Understand the economic use of water and the installation of water meter for domestic and industrial purposes.			
Week	Specific Learning Outcome	Teachers Activities	Resources
11-12	3.1 Identify the causes of water wastage a. Leakage b. Defective fitting c. Personal negligence d. Rust e. burst pipe 3.2 Effect the appropriate remedies 3.3 Explain the purpose of installing water meters 3.4 Select appropriate type of water meters for a scheme and carry out its installation 3.5 Carry out meter reading and costing. EVALUATION: Group discussion with Teacher's interaction	<ul style="list-style-type: none"> • Ask students to explain appropriate measures to remedy each cause. • Ask students to explains the purpose of water meters and list the different types. • Ask students to explain suitable sitting positions of water meters and to learn how to read and cost water meters. • Demonstrate and explain all the activities. 	<ul style="list-style-type: none"> • Charts and brochures. • Sample of water meter • Installation tools • Testing Bay
General Objective 4.0: Demonstrate And Understand The Causes And Prevention Of Water Pollution			
Week	Specific Learning Outcome	Teachers Activities	Resources
13-17	4.1 Identify sources of pollution e.g (1) Burst pipe (2) Defective valves, etc. 4.2 State the effects and remedy of such pollution Dis-infect polluted cold water installation system.	<ul style="list-style-type: none"> • Ask students to carry out the dis-infection of a polluted cold water installation. (laboratory practical) • Explain to the students and provide notes. 	<ul style="list-style-type: none"> • Chalkboard and charts • Disinfecting chemicals • Water • Pollutant • Nose Mask • Hand gloves • Test Lab

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: HOT AND COLD WATER SERVICES, HEATING & VENTILATION		Course Code: CWS 20	Contact Hours 7hrs.week
Course Specification: Theoretical/Practical Contents			
General Objective 5.0: Understand The Uses And Know The Types Of Heating Installations			
Week	Specific Learning Outcome	Teachers Activities	Resources
18-21	5.1 State the importance of hot water heating system. 5.2 Define the various terms used in heating system e.g latent heat, circulating head, index radiator, friction head, etc. 5.3 State the basic information needed when designing a hot water heating installation 5.4 Design various types of heating systems, e.g single pipe up feed, etc 5.5 Explain the difference between, the advantages and disadvantages of single and two pipe systems of heating 5.6 State the use and the correct positioning of pumps in a heating installation EVALUATION: Group discussion with teachers interaction Marking of individual design.	<ul style="list-style-type: none"> • Ask students to explain the basic requirements needed when designing hot water heating installation • Ask students to design various types of heating systems • Ask students to explain the advantages and disadvantages of single and two pipe systems of heating • Explain and prepare notes. • Group discussion with teacher interaction 	<ul style="list-style-type: none"> • Drawing equipment • Sample of suitable pump for a heating installation system

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: HOT AND COLD WATER SERVICES, HEATING & VENTILATION		Course Code: CWS 20	Contact Hours 7hrs.week
Course Specification: Theoretical/Practical Contents			
General Objective 6.0: Understand The Uses Of Steam Calorifiers For Heating Water			
Week	Specific Learning Outcome	Teachers Activities	Resources
22-25	6.1 State the uses of calorifiers for heating water 6.2 Know the position of use and source of energy for successful operation of calorifiers 6.3 Explain the principles of operation of steam calorifiers 6.4 Sketch and label various types of calorifiers 6.5 Select the appropriate valves used with calorifiers and their operational principles e.g a. Pressure reducing valve b. Steam trap c. Thermometer d. Altitude gauge, etc e. Thermostat	<ul style="list-style-type: none"> • Ask students to determine the position for correct sitting of calorifier and explain the source of energy for its successful operation • Ask students to sketch various types of calorifier and explain the principles of operation of each. • Ask students to determine appropriate valves used with the calorifier and explain their operational principles e.g <ul style="list-style-type: none"> i. Pressure reducing valve ii. Steam trap iii. Thermostat valve iv. Attitude gauge • Explain and prepare notes. 	<ul style="list-style-type: none"> • Sample of calorifier with valves on display • Charts and brochures • Sketching book • Pencite

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: HOT AND COLD WATER SERVICES, HEATING & VENTILATION		Course Code: CWS 20	Contact Hours 7hrs.week
Course Specification: Theoretical/Practical Contents			
General Objective 7.0: Understand The Uses And Types Of Space Heaters And Install Space Heaters Where Necessary			
Week	Specific Learning Outcome	Teachers Activities	Resources
26-28	7.1 Explain the principles of space heaters 7.2 State the different types of and advantages of space heaters 7.3 Carry out the installation of space heaters taking into consideration all necessary safety precautions associated with the installation and use of space heaters.	<ul style="list-style-type: none"> • Ask students to explain the principles of operation of space heaters and explain the difference between its use and convectional heating installation • Ask students to state different types of space heaters and state the advantages and disadvantages of each • Ask students to carry out installation of space heater. • Explain and prepare notes. • EVALUATION: Group discussion, Assessment as per assignment given. 	<ul style="list-style-type: none"> • Sample of space heater on display • Chart and brochures • Installation tools • Safety Posters
General Objective 8.0: Understand the Principles of solar heating systems and carry out installation of solar heating system			
Week	Specific Learning Outcome	Teachers Activities	Resources
29-32	8.1 Explain the source of solar heating energy 8.2 State the importance and usage of specific material for solar heating installation 8.3 Explain the principles of solar heating energy and carry out a model installation of solar heating system	<ul style="list-style-type: none"> • Ask students to enumerate the need for and the use of solar heating. • Ask students to install a model solar heating system and explain principles of operations (practical) • Explain and prepare notes. • EVALUATION: Group Assessment 	<ul style="list-style-type: none"> • Charts • Solar heating conductors and tools

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: HOT AND COLD WATER SERVICES, HEATING & VENTILATION		Course Code: CWS 20	Contact Hours 7hrs.week
Course Specification: Theoretical/Practical Contents			
General Objective 9.0: Know the operational principles of air conditioners and install an air cool engine			
Week	Specific Learning Outcome	Teachers Activities	Resources
	9.1 Explain the need and the importance for the provision of air-conditioning system in buildings 9.2 Understand the principles of operation of air-conditioning systems. 9.3 Explain the different types of air-conditioning systems 9.4 Select equipment, materials and fitting for air-conditioning installation. 9.5 Design a simple scheme for air-conditioning installation. EVALUATION: Group assessment and assessment of individual design	<ul style="list-style-type: none"> • Ask students to list different types of air-conditioning systems and explain principles of operation of each. • Ask students to determine the essentials materials and fitting that may be needed in an air-conditioning installation. • Ask students to design a simple scheme for air-conditioning installation. • Explain and prepare notes. 	<ul style="list-style-type: none"> • Charts and brochure Installation tools. • Sample of Airconditioner

Sanitation and Drainage II (ANTC)

PROGRAMME:	ADVANCED NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING
COURSE:	SANITATION AND DRAINAGE II CORUSE CODE: CSD 22
CONTACT HOURS:	7HRS/WEEK
GOAL:	The module is designed to provide the trainee with the knowledge and ability to design and execute both public, commercial, domestic and drainage and sanitary systems.

GENERAL OBJECTIVES: On completion of this course, the trainee should be able to:

1. Understand the arrangement and fixing of sanitary appliances in public building and factories.
2. Know the general layout and design of drainage system for town and country houses.
3. Carry out drainage layout using appropriate instruments.

PRACTICAL COMPETENCE: On completion of this course, the trainee should be able to:-

1. Install any type of sanitary appliance in public buildings and industries.
2. Determine the rate of discharge from drainage channels using appropriate instruments.
3. Carry out simple setting out of drainage layout using appropriate
4. Install timbering to sides of drainage trenches.

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING

Course: SANITATION AND DRAINAGE II	Module: CSD 22	Contact Hours: 7hrs/week
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Course Specification: Theoretical/Practical Contents

General Objective 1.0: Understand the arrangement and fixing of sanitary appliances in public building and factories

Week	Specific Learning Outcome	Teachers Activities	Resources
1-9	<p>Arrangement & Fixing Sanitary Appliances</p> <p>1.1 Enumerate the various arrangement and fixings of sanitary appliances to hotels, schools, public building and factories using separate and combined systems (one pipe, two pipes and single stack systems).</p> <p>1.2 Select various types of appliances to be used in different types of buildings.</p> <p>1.3 Design one-pipe, two-pipes and single stack systems for dwellings and flats including multi-storey buildings.</p> <p>1.4 Carry out proper ventilation of sanitary apartment e.g natural, measurement.</p> <p>1.5 Explain the use and the importance of polyvinyl, chloride (P.V.C.) for soil and waste pipe in present day installation.</p> <p>1.6 Install any type of sanitary appliance in public buildings or industries.</p>	<ul style="list-style-type: none"> • Ask students to identify specific sanitary appliances suitable in Hotels, Schools, Public Buildings and Factories • Ask students to assist Students to carryout simple layout sketches of mentioned appliances in various mentioned buildings • Ask students to design one pipe, two pipe and single pipe system for dwellings and flats including multi-storey buildings. 	<ul style="list-style-type: none"> • Sample of Specific types of Appliances on display • Visit and excursion to Construction sites, • Installation materials and tools • Industrial attachment
	<p>EVALUATION: Group work assessment, Individual excursion report</p>	<ul style="list-style-type: none"> • Ask students to explain the need for proper ventilation of sanitary apartment and enumerate different methods that can be adopted • Ask students to explain the use of plastic materials in present day plumbing and emphasise the importance of P.V.C. for soil and waste pipe installation. • Ask students to carryout a sanitary installation in public building or industries. • Explain and prepare notes. 	<ul style="list-style-type: none"> •

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: SANITATION AND DRAINAGE II		Module: CSD 22	Contact Hours: 7hrs/week
Course Specification: Theoretical/Practical Contents			
General Objective 2.0: Know the general layout and design of drainage system for town & country houses			
Week	Specific Learning Outcome	Teachers Activities	Resources
10-22	2.1 Describe the different systems of drainage installations 2.2 State the requirements and the regulations governing the design of drainage schemes for town and country houses. 2.3 Plan and design simple drainage layout scheme for town and country houses. 2.4 Calculate the rate of discharge from drainage channels using appropriate instruments/formulae/chart	<ul style="list-style-type: none"> • Ask students to determine Specific requirements and regulations governing the design of drainage schemes for town and country houses. • Ask students to carryout model design of drainage layout schemes for town and country houses. • Ask students to calculate the rate of discharges through drainage pipes and channels using appropriate instruments/formulae/chart • Explain and prepare notes. • Assess the students. 	<ul style="list-style-type: none"> • Drawing Instruments • Calculator, site visit • Relevant design Regulations and byelaws • Installation Materials and tools
General Objective 3.0: CARRY OUT DRAINAGE LAYOUT USING APPROPRIATE INSTRUMENTS			
Week	Specific Learning Outcome	Teachers Activities	Resources
	3.1 Use of various setting out instruments, e.g. dumpy level, sight level, sight rail, boning rods, etc 3.2 Carry out simple setting out of drainage layout using appropriate instrument. 3.3 Install timbering to sides of drainage trenches and state reason for the choice of the timbering used. 3.4 Test drains and soil pipes by means of smoke, water, chemical and air pressure. EVALUATION: Group site work and Assessment.	<ul style="list-style-type: none"> • Ask students to identify various setting out instruments e.g. Dumpy level, Sight level, sight vail, and boning Rod, etc. and explain the uses of each. • Ask students to carryout a simple drainage layout using the above listed instruments • Ask students to explain the need for use of timbering and to carryout testing of soil pipes and drains by means of smoke, water, chemical or air-pressure. • Explain and prepare notes. • Assess the students. 	<ul style="list-style-type: none"> • Gas equipment • Blow pipe, Necessary metal support, various sizes of metals • Chart, Apron and Gloves.

Fabrication, Welding and Brazing (ANTC)

PROGRAMME:	ADVANCED NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING
COURSE:	FABRICATION, WELDING AND BRAZING, COURSE CODE: CFW 23
CONTACT HOURS:	7HRS/WEEK
GOAL:	This course is designed to provide the trainee with further knowledge and skills which will enable him to carry out fabrication, welding and brazing of both ferrous and non-ferrous metals using arc and gas welding equipment.

GENERAL OBJECTIVES: On completion of this course, the trainee should be able to:-

1. Understand the principles of manufacture of acetylene gas, the storage and installation of gas welding equipment, fabricate and weld plumbing models, thick mild steel plates and steel pipes.
2. Carry out bronze welding on non-ferrous metals.
3. Understand the principles of gas cutting of metals and carry out metal cutting using oxy-acetylene equipment.
4. Understand the principles and functions of electric arc welding transformer and carry out electric arc welding operation with facility.

PRACTICAL COMPETENCE On completion of this course, the trainee should be able to:-

1. Carry out different techniques in gas welding.
2. Carry out fabrication and welding of plumbing models.
3. Fabricate and carry out bronze welding of waste pipe models on copper pipes e.,g stack and branches, loop venting, etc.
4. Select equipment, prepare template for and apply these in intricate cuttings.
5. Carry out electric arc welding and observing necessary safety precautions while welding.

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING

Course: FABRICATION, WELDING & BRAZING	Course Code: CFW 23	Contact Hours 7hrs/week
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Course Specification: Theoretical/Practical Contents

General Objective 1.0: Understand the principles of manufacture of acetylene gas, the storage and installation of gas welding equipment, fabricate and weld plumbing models, thick m.s. plates and steel, pipes.

Week	Specific Learning Outcome	Teachers Activities	Resources
1-9	1.1 State the principles of manufacture of acetylene gas and the storage and installation of gas welding equipment. 1.2 Carry out different techniques in gas welding 1.3 Weld bigger sizes of steel pipe and thicker sizes of m.s. plates. 1.4 Carry out fabrication and welding of plumbing models. EVALUATION: Group work Assessment and Marking of individual assignments.	<ul style="list-style-type: none"> • Ask students to review the principles of manufacture of acetylene gas, storage, assembly and Testing of gas welding equipment. • Ask students prepare bigger sizes of steel pipes and thicker sizes of M.s plates for welding. • Explain and prepare notes. 	<ul style="list-style-type: none"> • Welding equipment • M.S. pipe of various sizes • M.S. plates of various thickness • Marking tools.

General Objective 2.0: Carry out bronze welding on non ferrous metals

Week	Specific Learning Outcome	Teachers Activities	Resources
9-18	2.1 Adjust flame for bronze welding of different metals 2.2 Fabricate and carry out bronze welding of waste pipe models on copper pipes e.g. stack and branches, loop venting, etc. 2.3 Explain the need for and carry out bronze welding of castings, brasses and galvanised metals.	<ul style="list-style-type: none"> • Ask students to review the proper methods of setting welding flame for bronze of different metals. • Ask students to carryout fabrication and bronze welding of waste pipe models on copper pipes. • Ask students to carry out successful bronze welding of brass castings and galvanise metals. • Explain and prepare notes. • Assess the students. 	<ul style="list-style-type: none"> • Gas Welding equipment • Suitable fluxes for brazing • Rods, copper pipes and Galvanise pipes

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: FABRICATION, WELDING & BRAZING		Course Code: CFW 23	Contact Hours 7hrs/week
Course Specification: Theoretical/Practical Contents			
General Objective: 3.0 Understand the principles of gas cutting of metals and carry out metal cutting using oxy-acetylene equipment			
Week	Specific Learning Outcome	Teachers Activities	Resources
19-27	3.1 State the principles of gas cutting. 3.2 Select suitable equipment used for gas cutting 3.3 Mark and prepare m.s. plate ready for gas cutting 3.4 Light and adjust flame correctly 3.5 Carry out straight cutting observing necessary precautions 3.6 Prepare template for and apply these to carry out intricate cuttings.	<ul style="list-style-type: none"> • Ask students to explain the principles of gas cutting and analyse the function of the equipment used for gas cutting. • Ask students prepare and mark m.s. steel plate ready for gas cutting operations. • Ask students to mark out and cut specific template for intricate cuttings. • Explain and prepare notes. • Assess the students. • EVALUATION: Project assignment. (Group) • Assessment of individual work. 	<ul style="list-style-type: none"> • Cutting blow • Pipe • Metals • Metal support • Charts • Aprons • Gloves

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING			
Course: FABRICATION, WELDING & BRAZING		Course Code: CFW 23	Contact Hours 7hrs/week
Course Specification: Theoretical/Practical Contents			
General Objective 4.0: Understand the principles and functions of electric arc welding transformer and carry out electric arc welding operations with facility			
Week	Specific Learning Outcome	Teachers Activities	Resources
28-36	<p>4.1 Differentiate between electric arc welding machine and gas welding equipment.</p> <p>4.2 Identify parts of the transformer and their functions</p> <p>4.3 Relate arc welding to gas welding process</p> <p>4.4 Select the current rating suitable for the thickness of metals.</p> <p>4.5 Apply necessary safety precautions while using the equipment to carry out electric arc welding.</p> <p>4.6 State the reason for a complete circuit with regards to the electrode holder and the job.</p>	<ul style="list-style-type: none"> • Ask students to explain the difference between electric arc welding and gas welding. • Ask students to enumerate the equipment needed for each class of welding and explain their differences. • Ask students to identify parts of electric welding transformer and explain their functions. • Ask students to set or obtain current rating suitable for thickness of metals. • Ask students to demonstrate in the striking of Arc • Ask students to carry out arc welding on m.s. plates. • Ask students to emphasise the necessary safety precautions to be observed while carryout arc welding. • Ask students to explain the reasons for a complete circuit with regards to electrode holder and the job. • Explain and prepare notes. • Asses the students. • EVALUATION: assessment of the assigned project. 	<ul style="list-style-type: none"> • Complete Arc striking equipment • Electrodes (different gauges) • Rubber boot • Gloves • Protecting clothing • Welding shield

List of Equipment for Plumbing and Pipe Fitting Work

S/NO	TOOLS AND EQUIPMENT	MINIMUM QUANTITY REQUIRED	QUANTITY AVAILABLE	ADDITIONAL QUANTITY REQUIRED
1.	Pillar Drilling Machine	2		
2.	Circular pipe cutting machine	2		
3.	Power saw	1		
4.	Grinding machine	2		
5.	Drilling (portable type)	2		
6	Power threading machine	2		
7	Guillotine shearing machine	1		
8	Bench shears	2		
9	Set of acetylene welding equipment	2		
10	Low pressure generator	2		
11	Standing vice	4		
12	Bench Vice	5		
13	Pipe vice	5		
14	Electric Arc welding machine	2		
15	Pipe stock and dice*	5		
16	Hydraulic bending machine	2		
17	Copper bending machine	2		
18	Sheet metal folding machine	2		
19	Seaming machine	2		
20	Rolling Machine	2		
21	Stock and dies (BSW and BSF)	5		
22	Electrically operated coal furnace	1		
	Spot welding machine	2		
23	U gauge manometer	5		
24	Chain pipe cutter	5		
25	Pipe wrench (various sizes)	10		
26	Paraffin blow lamp	5		
27	Try Square	10		
28	Cane rod	10		
29	Shilling rod	10		

S/NO	TOOLS AND EQUIPMENT	MINIMUM QUANTITY REQUIRED	QUANTITY AVAILABLE	ADDITIONAL QUANTITY REQUIRED
30	Workshop benches	10		
31	Bench vices	10		
32.	Oil can	10		
33	Tape rule 3.5 metres	10		
34	Oxygen and acetylene cylinder	2 set		
35	Tin man's square	10		
36	Spirit level	10		
37	Plunger	10		
38	Reamer	10		
39	Trowels	10		
40	Panel saws	10		
41	Set of G. clamp	10		
42	Ladder	5		
43	Hand drilling machine (manual)	2		
44	Sandal hand grinder	2		
45	Wheel cutter (power)	2		
46	Hacksaw frame and blades	10		
47	Wooden mallet	10		
48	Toothless pipe wrench	10		
49	Wire brush	10		
50	Steel rule (foldable)	10		
51	Snips	10		
52	Gas pliers	10		
53	Marking knife	10		
54	Dividers	10		
55	Centre punch	10		
56	Scriber	10		
57	Pliers (engineering & glass)	10		
58	Cold chisel	10		
59	Rasp file	10		
60	Files, flat rough half round	10 each		
61	Pipe opener	10		

S/NO	TOOLS AND EQUIPMENT	MINIMUM QUANTITY REQUIRED	QUANTITY AVAILABLE	ADDITIONAL QUANTITY REQUIRED
62	Heat treatment furnace	2		
63	Blacksmith forge (gas)	2		
64	Blacksmith tools (i) Anvil (ii) Hammers (iii) Chisels (iv) Fuller (v) Shape block (vi) Pinches (vii) Drifts (viii) Tongues differential type	5 each		
65	Carbine extractor	2		
66	Gas Welding Platform	2		
67	Blacksmith Electric	5		
68	Soldering Iron	5		
69	Rawl plug	10		
70	Caulking tool	10		
71	Wall drill	10		
72	Diamond glass cutter	10		
73	Surface table 1200 x 12000mm (4"x4")	2		
74	Surface plate 500 x 500 mm	2		
75	Vernier Caliper	10		
76	Vee Blocks 100 x 100mm	2		
77	Chisels (i) Flat (ii) Round nose (iii) Cross cut	5 each		

S/NO	TOOLS AND EQUIPMENT	MINIMUM QUANTITY REQUIRED	QUANTITY AVAILABLE	ADDITIONAL QUANTITY REQUIRED
78	Micrometer 0-25 25-50 50-75 75-100 100-125 125-150	2 each		
79	Benches			
80	Files: a. 250mm Flat Rough b. 10 Hand Rough c. 10" Round Rough d. 10" Three sq e. Square Rough f. 10" Half Round 2 nd cut g. 200mm Warding file h. 100" Retail File i. Wallets of Warding File As in a - i 2 nd Cut files As in a - i Smooth files As in a - i Dead Smooth			
81	Steel Rules (12") 300mm			
82	Dividers			
83	Scribers			
84	Pocket Size (200mm) Vernier Calipers			
85	Centre Punches			
86	(½ lb) Hammer ¼ kg			
87	(1lb) Hammer ¾kg			
88	Pair of Pliers 150mm			
89	Tool Box and Lock			
90	Odd-leg Calipers			
91	Engineers Square 100			
92	Screw Drivers 200mm			
93	Pair of tin snip			

S/NO	TOOLS AND EQUIPMENT	MINIMUM QUANTITY REQUIRED	QUANTITY AVAILABLE	ADDITIONAL QUANTITY REQUIRED
94	Nippy vice - 4 FITTING - WORKSHOP EQUIPMENT			
95	Drilling Machines Sensitive			
96	Mandrels, 25mm, 32mm, 32mm, 38mm			
97	Drilling Machine Radial			
98	Surface table 1200 x 1200mm (4' x 4')			
100	Surface Plates 500 x 500mm (18' x 18')			
101	Surface gauge			
102	Vernier Height Gauges			
103	Vee Blocks 100 x 100mm pairs			
104	Vee Blocks 200mm			
105	Parallels strips (pairs) 37 x 25 x 300			
106	Flat Scrappers			
107	Half round scrapers			
108	Triangular scraper			
109	Stock and Dies a. Metric sets 3mm – 12mm b (BA) 150 sets 0-10			
110	Sockets Spanners 3 – 22mm			
111	Open ended 3 – 22mm			
112	Pedestal Grinders			
113	Reamers 3-25mm			
114	Reamers Machine 3-25mm			
115	Dial Gauge			
116	Card wire			

S/NO	TOOLS AND EQUIPMENT	MINIMUM QUANTITY REQUIRED	QUANTITY AVAILABLE	ADDITIONAL QUANTITY REQUIRED
117	Drills a. Straight Shank 1½ - 10mm b. Straight shank 6-15mm c. Taper shank 3-22mm d. Drift			
118	Heat treatment furnace (medium size)			
119	Chase wedge			
120	Copper bit			
121	Gimlet for wood screw			
122	Arboy press			
123	Extractors			
124	Snips (Tin sheer) 200mm			
125	Stud extractors			
126	Circlip Plier (internal and external)			
127	Pipe wrench 250mm			
128	Pipe wrench 350			
129	Rawl plug			
130	Cauking tool			
131	Wall drill			
132	Screw Driver (ratchet and cabinet)			
133	Seft grip wrench			
134	Diamond glass cutter			
135	Hacking knife			
136	Vernier callipers			
137	Brazing lamp			
138	Calipers Internal and external			
139	Hammers (ball pein and flat pein)			
140	Sledge hammer			
141	Bent pin or bolt			
142	Brace and bit up to 10mm			
143	Bobbins all sizes to 50mm			

S/NO	TOOLS AND EQUIPMENT	MINIMUM QUANTITY REQUIRED	QUANTITY AVAILABLE	ADDITIONAL QUANTITY REQUIRED
144	Bradawl			
145	Bossing stick			
146	Boxwood dresser (large and small)			
147	Boxwood setting in stick			
148	Boxwood Mallets (large and small)			
149	Gauge for wood			
150	Hand Dummy			
151	Handsaw			
152	Hand ladle			
153	Lavatory Union Key			
154	Screw drivers (large and small)			
156	Shave – hooks			
157	Small brick drill			
158	Spring for bending 13mm and 19mm			
159	Light gauge copper pipe			
160	Steel drip-plate			
161	Tanpins up to 50mm			
162	Wiping cloths			

List of Participants

UNESCO-NIGERIA PROJECT IN SUPPORT OF REVITALIUSATION OF TECHNICAL AND VOCATIONAL EDUCATION(TVE) IN NIGERIA PROJECT TEAM MEMBERS

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3	Engr. S.C. Odumah	Curriculum Development Coordinator
4	Mr. B.N. Niriyyus	Staff Development Coordinator
5	Engr. Dr. S.N. Mumah	Information & Communication Technology Coordinator
6	Isa Alhaji Sulaimanu	Project Accountant
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