NATIONAL BOARD FOR TECHNICAL EDUCATION

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

THE WORLD BANK

NATIONAL TECHNICAL CERTIFICATE (NTC)

AND

ADVANCED NATIONAL TECHNICALCERTIFICATE (ANTC)

PROGRAMMES

IN

PLUMBING AND PIPE FITTING

NOVEMBER 2022

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 & Guide 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.

Behavioural Objectives
These are educational objectives which identify precisely the type of behaviour a student should exhibit at the end of a course/module or programme. Two types of behavioural objectives have been used in the curriculum. This 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	**Certificate**
Technical Programme	
1. Craft Level	National Technical Certificate (NTC)
2. Advanced Craft	Advanced National Technical Certificate (ANTC)

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 is 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 are 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 ofmathematics, 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 able to solve technical problems were taken as pre-requisite to the trade module.

National Technical Certificate (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.

Advanced National Technical Certificate (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 contents 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 plumbing layout, drainage, sanitation, heating & ventilation systems.

TABLE OF CONTENTS

PROGRAMME: NTC PLUMBING AND PIPE FITTING

S/N	Module Code	Module Title	YEAR ONE						YEAR TWO						**YEAR THREE**						Contact Hours
			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	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
9	CME 11	GENERAL METAL WORK I	2	5	2	5															168
10	CME 12	GENERAL METAL WORK II					2	3													80
11	CPF 11	INTRODUCTIION TO PLUMBING IN BUILDING CONSTRUCTION	2	1	2	1	2	1	0	2	0	0	0	0							132
12.	CPF 12	COLD AND HOTWATER SUPPLY													1	3	2	2	2	2	144
13.	CPF 13	GAS AND BRONZE WELDING													1	2	1	2			72
14.	CPF 14	GAS AND STEAM WORK							1	3	1	3	1	3	2	2	2	2	2	2	288
15	CPF 15	SANITATION AND DRAINAGE I							3		3	3									108
16.	CBM 11	ENTREPRENUERSHIP							2		2		2	-	-		-				72
		TOTAL		**12**		**12**	**14**	**7**	**17**	**2**	**16**	**10**	**16**	**8**	**19**	**10**	**18**	**9**	**7**	**7**	**3,008**

CURRICULUM TABLE
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**	**1212**

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN ENGINEERING CRAFT PRACTICE		
Course: General Metal Work I	**Course Code : MEC 11**	**Contact Hours 7hrs/wk**

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

1. Understand workshop safety rules and their application in machine shop.
2. Know ferrous and non-ferrous metals in common use
3. Understand the use of common measuring, marking out, cutting and striking tools.
4. Understand the working principles of drilling machine.
5. Understand the application of various types of screw threads and rivets.
6. Understand the ISO system of tolerances, fits and their application in engineering production.
7. Produce simple engineering components on the bench
8. Know lathe machine operations and its uses.

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

1. Use all tools correctly ensuring the machinery guards and protective eye shields are used at all times.
2. Comply with the general rules for safe practice in the work environment at all time
3. Use and select hand tools for carrying out various bench fitting and assembly tasks
4. Use tools: such as hacksaws, taps, reamers, drills, dividers, surface gauge
5. Produce threads using taps and dies
6. Correctly grind drill point angles: Drills: Twist and flat drills
7. Select and set drilling machine speeds to carry out a range of operations.
8. Perform metal joining by a range of processes.
9. Mark out on metals and other materials.

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN MECHANICAL ENGINEERING CRAFT PRACTICE						
MODULE: GENERAL METAL WORK I			**COURSE CODE: MEC 11**		**CONTACT HOURS: 7hrs/wk**	
COURSE SPECIFICATION: KNOWLEDGE REQUIREMENT						
GENERAL OBJECTIVES: 1.0: UNDERSTAND WORKSHOP SAFETY RULES AND APPLICATIONS IN MACHINE SHOP						
THEORETICAL CONTENT				**PRACTICAL**		
WEEK	**SPECIFIC OBJECTIVES**	**TEACHER ACTIVITY**	**RESOURCES**	**SPECIFIC LEARNING OUTCOME**	**TEACHERS ACTIVITIES**	**Evaluation**
1	1.1 State sources of hazards in the workshop and how to prevent them. e.g 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	- Discuss sources of hazards in the workshop.	- Safety posters, - Common hand tools like files hacksaw. - Television, Video machine. - Overall, - Goggles, - Gloves, - Hardshoes, - Head shield, - fire	Practice hazard preventive methods involving: 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	- Guide the students on how to prevent hazard involving: 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	- Through questions and physical exercises, determine whether the students grasped the topic

	liquids and gases; e. inhaling vapours or fumes; 1.2 Explain the application of factory safety regulations in the machine shop. 1.3 Explain Personal Protective Equipment(PPE) essential in the workshop and their application in working situations e.g Overall, eye goggle of safety wears and equipment should include overall, eye goggles,	- Discuss the application of factory safety regulations in the machine shop. - Discuss safety equipment and their application in	extinguishers. - Ferrous metals - Nonferrous metals	jobs; d. using inflammable or corrosive liquids and gases; e. inhaling vapours or fumes; - Select safety equipment and wears essential in a machine shop. - select appropriate safety equipment and wares in the workshop.	corrosive liquids and gases; e. inhaling vapours or fumes; -Guide student to select safety equipment and wears in the workshop. - guide students on use of safety equipment and wears essential in the machine shop	

	gloves, safety boots, helmet, fire extinguishers, etc	working situations. e.g Overalll, eye goggle of safety wears and equipment should include overall, eye goggles, gloves, safety boots, helmet, fire extinguishers, etc - Demonstrate how to treat emergency cases like artificial respiration, cold compress etc. - List the safety equipment and wears that are essential in the workshop.				
	1.4 Outline safety rules and regulations relating to:-	- Discuss safety rules and regulations relating				

	a. clothing and health hazards; b. workshop hygiene; c. movement and other behavior of workers in the workshops; d. materials handling; e. tool handling, storage and usage; f. f. machine operation;	to:- 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				
	1.5 Explain appropriate procedures in the events of a workshop accident Examples of procedures may include: a. application of first aid to the victim; b. removal or rectification of the accident; c. reporting the	- Discuss appropriate procedures in the events of a workshop accident Examples of procedures may include: a. application of first aid to the		Practice how to treat emergency cases like artificial respiration, coat press etc	- Demonstrate how to treat emergency cases like artificial respiration, coat press etc	

	accident to the appropriate authority; d. Keeping a record of accidents for management use.	victim; b. removal or rectification of the accident; c. reporting the accident to the appropriate authority; d. keeping a record of accidents for management use.				
	General Objective 2.0: Know Ferrous and Non-Ferrous Metals In common use.					
2	2.1 Explain the following physical properties of metals:- - ductility - malleability - strength	- Discuss the physical properties of metals such as - ductility - malleability - strength - toughness	Sample of mild steel, brass, low carbon steel, high carbon steel, aluminum, copper etc	Identify the physical properties of metals as listed 2.1	Show physical behavior of metal as listed in 2.1	Give students assignment on other methods of testing physical properties of metals

	- toughness - brittleness - elasticity - plasticity	- brittleness - elasticity - plasticity	Hand held photo spectrometer Multimedia Charts Textbooks			
	2.2 Describe the basic composition and properties of ferrous metals such as plain carbon steel, cast iron and alloy steel. 2.3 Explain with examples of tools and equipment made from steels and cast iron	- Discuss the basic composition and properties of ferrous metals such as, plain carbon steel, cast iron and alloy steel - Describe with examples of tools and equipment made from steels and cast iron		Identify composition and physical properties of ferrous and nonferrous carbon steels or alloys Identify the characteristics of tools or equipment made from steels and cast iron	Demonstrate using appropriate resources to determine composition and physical properties Demonstrate to the students the characteristics of tools or equipment made from steel or cast iron Demonstrate the	Give students assignment on other methods of testing composition and physical properties of carbon or alloy Sketch and label tools equipment made from steel or cast iron Show the application

	2.4 Explain the application of plain carbon steel cast iron and alloy steel in the engineering industry. 2.5 Explain the following: a. the cupola process of manufacture of cast iron; b. the blast furnace process of manufacture of pig iron; c. the direct reduction process of	- Discuss the application of plain carbon steel cast iron and alloy steel in the engineering industry. - Discuss the following manufacturing process: d. the cupola process of manufacture of cast iron; e. the blast furnace process of manufacture of pig iron; f. the direct reduction process of manufacture of	Handheld spectrometer Cupola Furnace Blast furnace	Identify the application of plain carbon steel, cast iron and alloy steel Identify different manufacturing process involved in Cupola, Furnace, Blast furnace	application stated in Demonstrate the different manufacturing process involved	of plain carbon steel cast iron and alloy steel by given example of their usage in the industry Sketch and label the features of the different types of furnace

	manufacture of steel.	steel.	Hand held spectrometer Multimedia Textbooks			
	2.6 Explain 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 tunmetal, bell metal, aluminium bronze, phosphor bronze and	- Discuss 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 tunmetal, bell metal, aluminium bronze, phosphor bronze and	Sample of aluminum Zinc Catridge brass Gilded metal	Identify the physical properties and application of the non-ferrous metals listed in 2.6	Demonstrate to the students the physical properties and application of ferrous and non-ferrous metals listed in 2.6	Give students assignment to collect the correct samples of the nonferrous metal in 2.6 for a laboratory test/experiment

	lead.	lead.	Bronze Multimedia Textbooks Charts			
	General Objective 3.0: Understand the use of common measuring, marking out, cutting and striking tools.					
3	3.1 Explain units of measurement 3.2 Explain with examples the difference between "line" and "end" measurement.	- Discuss the units of measurement. - Differentiate between ”line” and “end” measurement	Steel rule, dividers calipers, trammel, scribe, and angle plate vee block, Centre Square. Micrometer screw gauge, vernier caliper, vernier height gauge, combination set, pressure	Identify and carry out the conversion in both Imperial and SI unit for length, mass, area, volume and temperature. Carry out line and end measurement on any material	Demonstrate the conversion of Imperial to SI unit Demonstrate “line” and “end” measurement to the students	Give student exercise to perform unit conversion Give assignment to student to state the differences between line and end measuremet

	3.3 Explain the use of the measuring tools such as steel rule, measuring tape, vernier caliper and micrometer screw-gauge.	- Discuss the use of measuring tools listed in 3.3	gauge Digital micrometer and digital vernier caliper Steel rule, dividers, trammel, scriber angle plate, vee-block, Centre punch, Tri-square.	Select the following measuring tools to measure diameter, length and thickness: - Steel rule -measuring Tape - venier caliper -micrometer Screw gauge -Digital micrometer -Digital vernier caliper Practice accuracy in	Guide student to use measuring tools as listed in 3.3:	Perform test in the use of measuring instrument correctly Give

	3.4 Explain the importance of accuracy in measurement. 3.5 Explain the use of datum points, datum lines and datum faces in marking out. 3.6 Describe, the functions and application of the following instruments used in marking out; steel rule, dividers, trammel, scriber angle plate, vee-block, Centre punch, Tri-square.	- Discuss the term accuracy in measurement. - Discuss the use of datum point, datum lines and datum faces in marking out. - Discuss the functions and application of the following instruments used in marking out; steel rule, dividers, trammel, scriber angle plate, vee-block, Centre punch, Try-square.	straight snips, side cutting pliers, hacksaw, chisel and guillotine	the use of measuring instruments Practice marking out activities using datum points, datum lines Practice the use of all marking out instruments listed in 3.6	Guide students in making accurate measurement Guide students in marking out activities using datum points and datum lines Guide students in carrying out marking activities correctly	students different work piece to measure and assess their accuracy of measuremen t Give students marking out activities

	3.7 Explain the uses of template in marking-out operation	- Discuss the uses of template in marking-out operation		Practice the uses of template in marking out operation	Demonstrate the uses of template in marking out operation.	Sketch with the aid of diagram the uses of template correctly in marking out operation
	3.8 Explain the use of cutting tools such as speed cutter, role cutter, hole saw kit, hose cutter, tubing cutter, straight snips, side cutting pliers, pipe saw, hacksaw, chisel and guillotine.	- Discuss the use of cutting tools such as speed cutter, role cutter, hole saw kit, hose cutter,tubing cutter, straight snips, side cutting pliers, pipe saw,hacksaw, chisel and guillotine.		Practice the use of cutting tools listed in 3.8	Demonstrate to students the use of various cutting tools listed in 3.8	Give students practical involving use of cutting tools listed in 3.8 and assess the students
	3.9 Explain the importance of correct cutting technique and	- Discuss correct cutting technique and posture.	Flat file, hard file, round file square, half round, triangular file,	Practice correct cutting technique and posture	Show students correct cutting techniques and posture	Give students practical exercise involving cutting technique and posture

	posture 3.10 Describe the various types of files, their grades and applications. 3.11 Describe the functions of the various types of vicee.g bench vice, handing vice etc and their holding power while performing various operations on them, such as filing, tapping, drilling etc.	 Discuss the various types of files, their grades and applications. Discuss the various parts of a vice and its holding power while performing different operations in the workshop	warding file, rasp file Diagrams Charts Multimedia	 Practice filing operation using different types of files as listed in 3.10 Sketch the bench vice and explain its clamping power Practice the technique of holding work in the vise for filing, drilling and	 Guide students in the use of appropriate files as listed in 3.10 Show diagram, charts or multimedia of a bench vice and its features Demonstrate the technique of holding work in the vice for filing, drilling and tapping operations.	 Give students project having various shapes to students to file Sketch a well label bench vice for Give students various work piece to hold, file, drill and tap for assessment

				tapping operations.		
4	3.12 Explain the uses of the following striking tools such as chisel, hammer, mallet, wedges,etc	Discuss the uses of the following striking tools such as chisel, hammer, mallet, wedges etc		Use the striking tools as correctly listed in 3.12	Demonstrate the use of common striking tools in the workshop	Give students project involving the use of striking tools
	General Objective 4.0: Understand the working principles of a Drilling machine.					
5-6	4.1 Explain the various types of drilling machines such as: Bench drill, Breast drill, Pillar drill, and drill bits, portable drill, radial	Discuss the various types of drilling machines and bits	Textbooks Charts Multimedia	Sketch types of drilling machine and label them	- Show student types of drilling machines.	Give students assignment on the working principles of

	drill, gang drill, multi-spindle drill, deep hole drill, coddles drill 4.2 Explain the main features of a bench or pillar drilling machine. 4.3 Explain 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.	Describe, with sketches, the main features of a bench or pillar drilling machine. Discuss the use of the following types of drills: - twist drill - flat drill - countersink drill - counter bore drill - combination centre drill	Textbooks Charts Multimedia Drilling machines and its accessories.	Identify the features of a bench or a pillar drilling machine. Carry out drilling operation that will require the use of twist drill Carry out drill operation that will require the use of jobbers drill Carry out drill operation that will require the use of flat drill Carry out the drill operation that will	Show the main features of a bench or pillar drilling machine Demonstrate the use of the following drills: - twist drill - flat drill - countersink drill - counter bore drill - combination centre drill	a drilling machine

				require countersink drill Carry out drill operation that will require the use of counter bore drill Carry out drill operation that will require the use of combination center drill. Identify faults in a ground twist drill bit Calculate spindle revolution or cutting speed for specified size of drill using the formulae:- N = 1000S/πd S = πdN/1000 Where S = cutting speed (m/min) N = revolution/minute D		
	4.4 Explain the effects of the following faults in a ground twist drill bit: a. point angle tool acute; b. point angle	Discuss the effects of faults in a ground twist drill	Textbooks Charts Multimedia		Guide students to identify faults in a ground twist drill bit Show student how to Calculate spindle revolution or cutting speed for specified size of drill using the	Give students exercises to calculate spindle

	tool obtuse; c. cutting edges at unusual angles; d. insufficient lip clearance; e. excessive lip clearance. 4.5 Describe the cause and remedy of drilling faults such as:- a. drill breaking; b. drill coloured blue; c. walls of drilled hole left rough; d. chipped cutting lips.	Discuss the cause and remedy of drilling faults such as:- a. drill breaking; b. drill colored blue;	Textbooks Charts Multimedia	= diameter of drill (mm) π = 3.142 Carry out remedy of drilling faults for: a. drill breaking; b. drill coloured blue; c. walls of drilled hole left rough; d. chipped cutting lips. Carry out a project that involves the use of drilling machine while observing	formulae:- N = 1000S/πd S = πdN/1000 Where S = cutting speed (m/min) N = revolution/minute D = diameter of drill (mm) π = 3.142 Demonstrate how to remedy drill faults such as drill breaking, drill coloured blue, walls of drilled hole left rough, chipped cutting lips etc Give students to produce a project that involve the use of drilling machine	revolution or cutting speed for specified size of drill using the formula

	4.6 State the safety precautions to be observed when using a drilling machine. 4.7 Explain the purpose of reaming operation. 4.8 Describe different types of hand and machine reamers.	c. walls of drilled hole left rough; d. chipped cutting lip Discuss the safety precautions to be observed when using a drilling machine. Describe reaming operation. Discuss different types of hand and machine reamers.	Textbooks Charts Multimedia	safety precautions Ream to given specification by hand and machine method Sketch the different types of hand and machine reamers	Check for students compliance to relevant safety precaution Show students how to ream to a given specification using hand and machine method	Perform safety precautions when using drilling machine Sketch with the aid of diagram types of hand and reaming machine

	General Objective 5.0: Understand the application of various types of screw threads and rivets.					
7	5.1 Explain the various thread forms and their uses	- Discuss the various forms of threads and their uses	Diagrams/charts of thread forms Parallel reamers taper reamers twist drills. Rivet set	Sketch the thread forms below 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	Show the various thread forms	
	5.2 State the functions of:- a. taps (taper tap, second tap, plug) b. tap wrench	Discuss the functions of taps, tap wrench, die and die stock	Diagrams/charts of taps	Sketch the following:- a. taps (taper tap, second tap, plug) b. tap wrench c. die and die stock.		

	c. die and die stock. 5.3 Explain the meaning of tapping size and tapping drill.	Discuss the meaning of tapping size and tapping drill and estimate its value in given situations using formulae such as:- T = D - P Where T = tapping diameter D = thread top diameter P = pitch.	Diagrams/charts of tap	Estimate the value of tapping size and tapping drill in given situations using formulae such as:- T = D - P Where T = tapping diameter D = thread top diameter P = pitch Practice the use of taps, tap wrench and die and die	Guide students to estimate tapping size and tapping drill	

	5.4 State precautions to be taken when taping on the bench.	Discuss precautions to be taken when taping on the bench.		Carry out taping on the bench while observing relevant safety precautions	Demonstrate the use of taps, tap wrench and die and die stock	
	5.5 Describe the types of rivets. e.g. Snap and pan head, mushroom and countersunk head, flat head, hollow head rivet, etc.	Explain the types of rivets. e.g. Snap and pan head, mushroom and countersunk head, flat head, hollow rivet, conical head rivet etc.	Diagrams/charts of rivet set	Identify the types of rivets Sketch rivet set Calculate diameter of rivet and riveting allowance	Observe students compliance of safety precaution when taping on the bench	
	5.6 Explain rivet set and its use.	Discuss rivet set and its use.	Diagrams/charts of rivet set		Show students types of rivet	
	5.7 Explain how to calculate diameter of	Discuss how to calculate diameter of	Diagrams/cha		Guide students to calculate diameter of	

	rivet and riveting allowance	rivet and riveting allowance	rts of rivet		rivet and riveting allowance	
	General Objective 6.0: Understand The ISO Tolerances, Fits and its Application in Engineering Production.					
8	6.1 Differentiate between the following:- a. nominal size b. limits (upper and lower) c. tolerance (unilateral and bilateral) d. fit (clearance, transition interference).	Discuss nominal size, limits, tolerance and fit in engineering production	- Charts on tolerances, limits and fits.	Identify the differences between the following:- a. nominal size b. limits (upper and lower) c. tolerance (unilateral and bilateral) d. fit (clearance, transition interference).	Guide the students on differences between the following:- a. nominal size b. limits (upper and lower) c. tolerance (unilateral and bilateral) d. fit (clearance, transition interference).	Give assignment to student on the differences of the following: a. nominal size b. limits c. tolerance d. fit

	6.2 Explain the importance of tolerance and fit in engineering production and describe briefly the ISO system of limits and fits. 6.3 Determine by calculation the amount of tolerance and types of fit	Discuss the important of tolerance and fits in engineering production as well as describing the ISO systems of limits and fits. Explain how to calculating the amount of tolerance and types of fits	Charts on tolerances, limits and fits. Charts on tolerances, limits and fits	Identify the importance of tolerance and fit in engineering production and describe briefly the ISO system of limits and fits. Calculate the amount of tolerance and types of fit in given situations.	Guide the students on how to Explain the importance of tolerance and fit in engineering production and describe briefly the ISO system of limits and fits. Guide students in the calculation of the amount of tolerance and types of fit in as given situations.	Identify the importance of tolerance and fit in engineering production and describe briefly the ISO system of limits and fits. Give students on how to do calculation of the amount of tolerance and fit in a given situation.

	General Objective 7.0: Produce Simple Engineering Components on the Bench.					
9	7.1 Explain layout procedures from working drawing of simple engineering components or tools such as:- a. open ended spanner b. engineer's try square c. tool maker's clamp d. plate bracket or gusset (involving rounds, angles,sholes) e. centre square.	Discuss layout procedures from working drawing of simple engineering components or tools such as:- a. open ended spanner b. engineer's try square c. tool maker's clamp d. plate bracket or gusset (involving rounds, angles, holes) e. centre square.	- Lesson notes - Diagrams and charts	Interpret layout procedure from working drawing of simple engineering components or tools	Show students how to interpret layout procedures from working drawing	Give students assignment to draw sketches of engineering components or tools
	7.2 Explain how to produce any simple engineering component	Describe how to produce a simple engineering component	- Lesson notes - Diagrams and charts	Produce any simple engineering component to given specifications including dimensions, tolerance and finish.	Supervise students following the sequence to produce the engineering components likeopen ended spanner, engineer's try square,	Demonstrate how to produce simple engineering components.

					tool maker's clamp, plate bracket or gusset (involving rounds, angles, holes), centre square etc.	
	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.	Discuss how to carry out simple precision fitting project. e.g. hexagonal mild steel bar making push fit through a mild steel plate.	- Lesson notes - Diagrams and charts	Carry out simple precision fitting project. e.g. hexagonal mild steel bar making push fit through a mild steel plate.	Show students how to carry out precision fitting.	Carryout simple precision fitting
	General Objective: 8.0: Know lathe machine operations and its uses					
10	8.1 Explain the term lathe machine and its types	Discuss the term lathe machine and its types	- Centre lathe and accessories like catch plates, face	Sketch three types of common lathe machine	Show students types of lathe machines	Give students assignment on type of lathe

			plates, centers, fixed and traveling steadies.			machine.
	8.2 Explain the essential features and function of a center lathe machine such as lathe bed, headstock, tailstock, saddle or carriage, etc.	Discuss the essential features and function of a center lathe machine such as lathe bed, headstock, tailstock, saddle or carriage, etc.	- Charts of center lathe and capstan lathe.	Operate the features of center lathe under supervision	Show students how the features of a center lathe operate	Group discussion on features and lathe machine
	8.3 Explain the working principles of the center lathe.	Discuss the working principles of the center lathe.	- Round nose turning tool, finishing tool, site finishing, knife tool, form tool, parting off tool, and boring tool.	Identify the working principle of the centre lathe	Guide student on how to carryout principle of the centre lathe.	Carryout Individual project principle of the centre lathe.
	8.4 Explain the function of the accessories of a center lathe machine such as chuck, drive plate, face plate, angle plate, carrier, lathe centers, mandrel etc	Discuss the function of the accessories of a center lathe machine such as chuck, drive plate, face plate, angle plate, carrier, lathe centers, mandrel etc	Charts on tool height - Charts and diagrams of different machining operations	Practice the adjustment/use accessories of a center lathe machine chuck, drive plate, face plate, angle plate, carrier, lathe centers, mandrel etc	Show students how to use the accessories of center lathe such as chuck, drive plate, face plate, angle plate, carrier, lathe centers, mandrel etc	Demonstrate used of some of accessories of center lathe machine.

	8.5 Explain the difference between center lathe and capstan lathe, in terms of their main features and functions. 8.6 Explain types and functions of cutting fluids used for lathe turning operations. 8.7 Describe common tools used in lathe machine: e.g butt-brazed tool, tipped tool bit etc	Differentiate between center lathe and capstan lathe, in terms of their main features and functions. List types of cutting fluids used for lathe turning operations. Discuss common tools used in lathe machine: e.g butt-brazed tool, tipped tool bit etc	Charts and diagrams of different centre lathe and capstan lathe. Charts and diagrams of different of cutting fluids used for lathe turning operations. Charts and diagrams of different common tools used in lathe machine.	s Identify the difference between center lathe and capstan lathe, in terms of their main features and functions. Demonstrate the use of cutting fluids for different lathe operations Select common tools used in lathe machine Practice how to fix	s Show the different operational features of center lathe and capstan lathe Show students different types cutting fluids used for lathe turning operations Demonstrate how to fix common tools used in lathe	Carryout quiz on different between centre lathe and capstan lathe in terms of their feature and function Assignment on listing type of cutting fluids used for lathe Carryout project demonstration on how to fix common tools used in lathe.

				lathe tools		
	8.8 Explain the functions of tool angles (rake, clearance), and the values for different metals to be machined.	Discuss with sketches the functions of tool angles (rake, clearance), and the values for different metals to be machined.	Charts and diagrams of different function of tools	Practice varying tool angles for different metals	Show students how to vary tool angles for different metals	Carryout project varying tool angles for different metals
	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.	Discuss various tool shapes and state their uses such as Round nose rougher, fine finishing, side finishing, knife tool, form tool, parting off tool, boring tool, etc.	Charts and diagrams of different various tool shapes and state their uses such as Round nose rougher, fine finishing, side finishing, knife tool, form tool, parting off tool, boring tool, etc.	Select tools according to shape and use Identify the effects of wrong setting cutting tool	Show students how to select tools in line job requirements	Assignment on the difference between various tool shapes and state their uses.
	8.10 Explain the effects	Discuss with sketches	Training manual,		Show students the	

	of wrong setting cutting tool: e.g vibration and chatter, tool rubbing against or digging into the job. 8.11 Define cutting speed and feed with respect to lathe Operation. 8.12 Explain safety precautions to be observed when working on the lathe.	the effects of wrong setting cutting tool: e.g vibration and chatter, tool rubbing against or digging into the job. Define cutting speed and feed with respect to lathe Operation. State the procedure to set up the lathe for use for turning operation while observing safety precautions	pictures, flip chart. Training manual, pictures, flip chart. Training manual, pictures, flip chart. Training	Identify the effects of wrong setting cutting tool: e.g vibration and chatter, tool rubbing against or digging into the job Identify cutting speed and feed with respect to lathe Operation. Operate lathe machine while observing the relevant safety precautions Calculate the cutting speed and feed for given turning operation	use of wrong setting cutting tool Guide student on how to define cutting speed and feed with respect to lathe Operation. Guide students to operate a center lathe machine while observing safety precautions in the workshop Guide students to calculate the cutting	Carryout quiz on the effects of wrong setting cuting tool. Assignment on how to define cutting speed and feed with respect to lathe Operation. Carryout practical demonstration of Operating lathe machine while observing the relevant safety precautions Assignment

	8.13 define cutting speed and feed with respect to lathe operation 8.14 Explain how to set up the lathe for carry out turning between centre while observing safety precautions	Discuss cutting speed and feed with respect to lathe operation Discus how to set up the lathe for carrying out turning between centre while observing safety	manual, pictures, flip chart. Training manual, pictures, flip chart.	Estimate the rate of metal removal and time required for carrying out specified turning operations. Compute required taper dimensions from given data using taper ratio angle formulae i.e. Taper Ratio = d2 – d1/L OR Tan 0/2 = d2 d1/2 where 0 = taper angle di - small and diameter d2 = large end diameter L = length of taper Set up the lathe for use in line with standard.carry out basic turning operations between centres with the	speed and feed for given turning operation Demonstrate how to Estimate the rate of metal removal and time required for carrying out specified turning operations Guide students to compute taper dimensions Show students how to set up the lathe for use Demonstrate turning operations between centres for a given metal	on how to calculate the cutting speed and feed for given turning operation. Carryout practical Demonstrati on how to Estimate the rate of metal removal and time required for carrying out specified turning operations Practical Demonstrati on on turning operations between centres for a given metal

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN MECHANICAL ENGINEERING CRAFT PRACTICE		
MODULE: GENERAL METAL WORK II	**MODULE CODE: MEC 12**	**CONTACT HOURS: 5hrs/wk**

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.

PRACTICAL COMPETENCE: On completion of this module students will be able to:

1. Carry out heat treatment of metal in the workshop
2. Produce simple engineering components by forging
3. Carryout gas/arc welding and apply them in fabricating simple engineering components

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN MECHANICAL ENGINEERING CRAFT PRACTICE						
MODULE: GENERAL METAL WORK II		**MODULE CODE: MEC 12**			**CONTACT HOURS: 5hrs/wk**	
MODULE SPECIFICATION: KNOWLEDGE REQUIREMENTS						
GENERAL OBJECTIVES:General Objective 1.0: Understand the Basic Principles and Processes of Heat Treatment of Metal in the Workshop.						
THEORETICAL CONTENT			**PRACTICAL CONTENT**			
WEEK	**Specific Learning Outcome:**	**Teacher Activities**	**Resources**	**Specific learning outcome**	**Teacher activity**	**Evaluation**
1-4	1.1 list types of metals used in workshop 1.2 Explain briefly the structural behaviour of plain carbon steel as it is heated from room temperature to about 1000^0C for the purposes of: a. hardening b. tempering c. annealing d. normalising	- State the types of metals used in workshop 2 Discuss the structural behaviour of plain carbon steel as it is heated from room temperature to about 1000^0C for the purposes of: a. hardening b. tempering	Recommended Text books - Lesson notes,sample of metal etc Recommended Text books - Lesson notes,sample of metal etc	Selecttypes of metals used in workshop. Identify briefly the structural behaviour of plain carbon steel as it is heated from room temperature.	Guide studentsto Selecttypes of metals used in workshop Explain to student on the structural behaviour of plain carbon steel as it is heated from room temperature.	Selecttypes of metals used in workshop Mention structural behaviour of plain carbon steel as it is heated from room temperature.

	e. case-hardening. 1.3 Explain the meaning of hardening metal work. 1.4 State safety precautions relating to heat treatment processes apply them in given situations. 1.5 state the importance of heat treatment of metal.	c. annealing d. normalising e. case-hardening Discuss hardening metal work. Discuss safety precautions relating to heat treatment processes apply them in given situations. Discuss the importance of heat treatment of metal.	Recommended Text books, projector, flip chart - Lesson notes,sample of metal etc	State the meaning of hardening metal work.	Explain to studentthe meaning of hardening metal work.	
General Objective 2.0: Understand the Techniques of Producing simple Engineering Components by Forging.						

5-6	2.1 Describe the main feature of the black smith's forge.	Discuss the main feature of the black smith's forge.	- Charts - poster	Sketch the main features and working principles of the black smith's forge.	Show students the main features of the black smith's forge	
	2.2 Explain the working principles of the black smith's forge.	Discuss the working principles of the black smith's forge.		Sketch common forging tools select forging tools available in the workshop	Show students forging tools in the workshop	
	2.3 State the functions of common forging tools such as anvil, swage block, leg vice, forging hammers, hot and cold sets, set hammer, punches and drifts, press, fullers, top and bottom swages flatter, tongs (open mouth, closed mouth, hollow bit, etc.).	State the functions of common forging tools such as anvil, swage block, leg vice, forging hammers, hot and cold sets, set hammer, punches and drifts, press, fullers, top and bottom swages flatter, tongs (open mouth, closed mouth, hollow bit, etc.).				
7-8	2.4 Describe the following	Discuss the following				

	forging operations: a. upsetting b. drawing down c. setting down d. twisting e. forge welding (scarf and splice welds) f. bending g. forming closed ring h. forming an eye.	forging operations: a. upsetting b. drawing down c. setting down d. twisting e. forge welding (scarf and splice welds) f. bending g. forming closed ring h. forming an eye.		Carry out following forging operations: a. upsetting b. drawing down c. setting down d. twisting e. forge welding (scarf and splice welds) f. bending g. forming closed ring h. forming an eye.	Demonstrate forging operations such as upsetting, drawing down, setting down, twisting, forge, welding (scarf and splice welds), bending, forming closed ring, forming an eye etc	
General Objective 3.0: Understand the Basic Principles and Techniques of Gas and Metal Arc Welding						
	3.1 Define welding 3.2 Explain the principles and application of gas welding.	Discuss welding Discuss the principles and application of gas welding.	- Oxygen cylinder acetylene cylinder regulat			Give student project and supervise them

	3.3 Explain the equipment used for gas welding. 3.4 State the safety precautions to be observed in carrying out gas welding 3.5 Explain the principle and application with metal arc welding. 3.6 Describe the equipment used for metal arc welding.	Discuss the equipment used for gas welding. Discuss safety precautions to be observed in carrying out gas welding Discuss the principle and application with metal arc welding. Discuss the equipment used for metal arc welding. Discuss the safety precautions to be observed in carrying out gas welding	ions arc welding set goggles, shield electrode. - Diagrams and charts of various welding joints, and techniques.	Select equipment used for gas welding Prepare metal joint for gas welding Join metals together by gas welding while observing the relevant safety precautions Select equipment used for metal arc welding	Show students equipment used for gas welding Demonstrate how to prepare joint for welding Demonstrate gas welding operation Check for students' compliance to relevant safety precautions Show students	

				Select consumables used for metal arc welding Join metals together by arc welding operation while observing relevant safety precautions Produce a project that will involve the gas and metal arc welding processes	equipment and consumables used for metal arc welding Demonstrate the use of metal arc welding machine	

COURSE: BUILDING CONSTRUCTION
MODULE: CPF 11 – INTRODUCTION TO PLUMBING AND PIPE FITTING IN 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 and understand his basic roles as a plumber.

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

1. Understand health and safety in construction
2. Understand the basic tools and equipment in plumbing installation
3. Understand the properties of materials and their application in plumbing
4. Understand the basic principles of site preparation.
5. Understand simple sketches and mechanical drawings.
6. Understand basic communication and team work in building construction
7. 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. Applyhealth and safety in construction
2. Carryout good housekeeping in the workplace
3. Identify, Use and maintain basic hand/machine tools and equipment used in building construction.
4. Understand the use of different plumbing materials
5. Carryout storage and handling of different plumbing materials
6. Application of different plumbing materials and its properties
7. Understand and carryout the Cutting and Threading Pipes.
8. Understand and carryout the Bending of plumbing pipes
9. Interpret construction drawings, symbols and signs.
10. Understand and carryout teamwork and its important in construction
11. Understand and apply various types of communication and its important in construction
12. Interpret electrical circuit, plumbing symbols and/drawing.

PROGRAMME: NTC IN PLUMBING AND PIPE FITTING						
Module: - INTRODUCTION TO BUILDING CONSTRUCTION			**Module Code : CPF II**		**Contact Hours:3 hrs/week**	
Course Specification: Theoretical				**Practical Contents**		
	General Objective: 1.0 Understand health and safety in construction. Year 1, Term 1					
1-3	**Specific Learning Outcome**	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Evaluation**

	1.1 Define hazards in the workshop environment relating same to a construction site situation, 1.2 State causes of hazard and method of prevention.	▪ Teacher should arrange to use slide, video films, Computer simulation etc. to show and explain various hazard in workshop and method of prevention. ▪ Explain proper handling of construction tools and equipment and how to prevent accidents both in the workshop and on site.	▪ Slides, video player Safety signs, chart Protective Equipment, Handout and Safety Equipment	▪ Demonstrate the use of appropriate personal protective equipment (PPE) in hazards. ▪ Illustrate the Proper way to put on and remove personal protective equipment in terms of accident. ▪ Demonstrate proper handling of construction tools and equipment and how to prevent accidents both in the workshop and on site.	▪ Guide students to demonstrate the use and care of appropriate personal protective equipment (PPE) ▪ Guide students to put on and remove personal protective equipment ▪ Demonstrate proper handling of construction tools and equipment and how to prevent accidents both in the workshop and on site.	Define hazards. List types of hazards. Explain the precaution to take to avoid hazards. List and explain the types of PPE and there uses. List some safety tools and equipmentand their application.

	1.3 Enumerate the types of hazards in the workshop environment relating same to a construction site situation, and stating their causes and method of prevention.	▪ Explain various hazards that occurs in the use of hand tools and machines should be displayed and show to students and the methods of safe handling explained. ▪ Explain hazards that can be caused by poisonous and dangerous gases e.g. paint fumes, carbon mono oxide etc.	▪ Slides, video player Safety signs and chart Protective Equipment Handout Safety Equipment	▪ Demonstrate Various hazards that occurs in the use of hand tools and machines should be displayed and show to students and the methods of safe ▪ 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.	▪ Guide students to demonstrate Hazards that can be caused by poisonous and dangerous gases e.g. paint fumes, carbon mono oxide etc. ▪ Carryout Various hazards that occur in the use of hand tools and machines should be displayed and show to students and the methods of safe	
	1.4 Explain danger in the use construction tools and equipment e.g. drilling machines, grinding, machine and circular saw etc. 1.5 Name dangerous gases and liquids commonly used in the workshop or construction site e.g. paint frames, flammable liquids, acetylene etc.	Show films and photo clips of the hazards that can be caused by construction tools and equipment e.g. drilling machines, grinding, machine and circular saw etc. Explain and Show films and photo clips of dangerous gases and liquids in common	▪ Slides, video player Safety signs and chart Protective Equipment Handout Safety Equipment ▪ Slides, video player Safety signs and chart Protective Equipment Handout Safety Equipment	▪ Show films and photo clips of the hazards that can be caused by construction tools and equipment e.g. drilling machines, grinding, machine and circular saw etc. ▪ Show film and video in dangerous gases and liquids in common use in the workshop or construction site	▪ Guide the student in handling the hazards that can be caused by construction tools and equipment e.g. drilling machines, grinding, machine and circular saw Etc. ▪ Guide learners in dangerous gases and liquids in common use in the workshop or construction site e.g. Frames, flammable liquids	

	1.6 Define relevant clauses in the factory act on Health, Safety and Welfare Regulations for workers on a construction site . 1.7 Explain appropriate First Aid Treatment on a victim in need of First Aid. e.g., burns, shocks, accident victims etc.	Explain relevant clauses in the factory act on Health, Safety and Welfare Regulations for workers on a construction site. Describe the application of 1st Aid on victims, this could be done in the classroom to reinforce the knowledge being imparted to students	▪ 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.	▪ Demonstrate Relevant clauses in the factory act on Health, Safety and Welfare Regulations for workers on a construction site. ▪ Demonstrate the application of 1st Aid on victims, this could be done in the classroom to reinforce the knowledge being imparted to students	▪ Guide the student In relevant clauses in the factory act on Health, Safety and Welfare Regulations for workers on a construction site. ▪ Guide the learnersin demonstrate the application of 1st Aid on victims, this could be done in the classroom to reinforce the knowledge being imparted to students	What is health and safety regulation act. What is first Aids List things found in a first aids box
	1.8 Explain habitual maintenance of health, safety and general welfare of the individual. .	▪ Describe habitual maintenance of health, safety and general welfare of the individual. ▪ Identify what safety is and how to prevent accidents, generally.	▪ First aid box, different drugs, bandage other first aid materials.	▪ Demonstrate habitual maintenance of health, safety and general welfare of the individual.	▪ Guide the learners in demonstrate habitual maintenance of health, safety and general welfare of the individual.	Mention some activities involve in habitual maintenance.

	1.9 Explain what safety is and how to prevent accidents, generally	▪ Describe what safety is and how to prevent accidents, generally	▪ Safety sign and symbols PPE First aid box, different drugs, bandage other first aid materials.	▪ Demonstrate and explain what safety is and how to prevent accidents, generally	▪ Guide the learners in demonstrate explain what safety is and how to prevent accidents, generally	Explain what safety is and how to prevent accidents, generally
	General Objective: 2.0 Basic Tools and Equipment in plumbing installation. Year 1, Term 1					

4-12	2.1 Describe the basic hand tools in plumbing work and state their functions.	▪ Teacher should show students basic hand tools related to a plumber's work and its application e.g., alignment tools levelling tools cutting threading tools, bending tools, measurement tools and marking tools etc.	▪ Basic hand tools for Plumbing work and application eg measurement tools, and marking hand tools etc	▪ Demonstrate the Use of basic hand tools and required plumbing, work ▪ Demonstrate the selecting of basic hand tools and required plumbing, work	▪ Guide students to Demonstrate the Use of basic tools and equipment required for plumbing work, ▪ Guide the student in the selection of the right basic hand tools and required plumbing, work	State some basic hand tools and explain their function
	2.2 State the types of powers tools and equipment in plumbing work.	▪ Teacher should practically show the handling and application of power tools and equipment with students, naming each power tool and asking the students to identify same.	Power tools for plumbing work eg angle grinder, ppe welding machine etc	▪ Demonstrate the use of power tools and equipment required for plumbing, work ▪ Demonstrate the selecting of power tools and equipment required for plumbing, work	▪ Guide students to demonstrate the use of power tools and equipment required for plumbing. ▪ Guild the learners in the selection of power tools and equipment required for plumbing, work	▪ Demonstrate the use of some power tools and equipment for plumbing, workshop.
	2.3 Explain the safety in application of basic tools and equipment	▪ Teacher should show and demonstrate the safety in basic tools and equipment	Handout on Safety in tools and equipment, PPE Video and pictures	▪ Demonstrate the use of safety in tools and equipment tools required for plumbing, work	▪ Guide students to Demonstrate the Use of safety in power tools and hand tools required for simple plumbing,	Explain the safety in application of basic tools and equipment

	2.4 state the repair, routine care and maintenance of tools and equipment in use in plumbing	▪ Explain the repair, routine care and maintenance of tools and equipment in use in plumbing.	manufacturer manual, handout, video and pictures	▪ Demonstration the repair, routine care and maintenance of tools and equipment in use in the workshop.	▪ Guide the student IN repair, routine care and maintenance of tools and equipment in use in the workshop.	Mention some repair, routine care and maintenance of tools and equipment in use in plumbing
	2.5 state cutting, threading and bending tools and equipment in plumbing	▪ Explain cutting, threading and bending tools and equipment in plumbing	Sample of cutting, threading and bending tools and equipment in plumbing such as tube cutters threading machine angle grinder and bending machine either electrical or manual etc Pictures and video, flip chart, PPE, handout manuals etc	▪ Demonstrate cutting of different types of pipes with the right tools eg plastic tube cutter metal tube cutter hacksaw angle grinder etc ▪ Carryout threading and bending of pipes using the right tools and equipment eg threading machine.	▪ Guide the student in the following activities: cutting, threading and bending using tools and equipment. ▪ support the learners in carryout threading and bending of pipes using the right tools and equipment eg threading machine.	Mention some cutting, threading and bending tools and equipment in plumbing Demonstrate cutting of different types of pipes with the right tools
	2.6 state tools and equipment for plumbing installation	Explain tools and equipment for plumbing installation	Plumbing tools eg Cutting, measurement, levelling, cutting, threading PPE, videos, pictures, manuals etc.	▪ apply tools and equipment for plumbing installation	▪ guide learners in applying tools and equipment for plumbing installation	Mention some tools and equipment for plumbing installation. ▪ apply tools and equipment for plumbing installation

	General Objective: 3.0 UNDERSTAND THE PROPERTIES OF MATERIALS AND THEIR APPLICATION IN PLUMBING INSTALLATION. Year 1, Term 2					
1-6	3.1 State the types of plumbing materials characteristics and uses.	▪ Teacher should bring various types of plumbing materials to class and identify same to students by name and characteristics.	▪ Samples Plumbing component, pipes fitting, fixture etc	▪ Demonstration the Identifying of various types of plumbing materials characteristics and uses. ▪ Illustrate Identifying of fittings that match various types of pipes. ▪ Carryout Selecting fittings that match various types of pipes identified.	▪ Teacher should Guide the student in identifying materials by bring various types of plumbing materials eg Plumbing component, pipes fitting, fixture to class and identify characteristics and uses. ▪ Illustrate Identify fittings that match various types of pipes ▪ Carryout Selecting fittings that match various types of pipes identified	Mention some types of plumbing materials, characteristics and uses.

	3.2 Explain the application of different types of plumbing materials 3.3 Describe materials handling and storage in plumbing	▪ Teacher should bring various types of plumbing materials to class and identify same to students by name and characteristics. And show the application Explain handling and storage of plumbing materials	▪ Samples of Plumbing component, pipes fitting, fixture etc Samples of Plumbing component, pipes fitting, fixture etc Video and pictures PPE manufacturer manual of the material etc	▪ Demonstration the application of various types of plumbing materials ▪ Perform connection of 2 pipes and fittings identified. ▪ Demonstrate the handling and storage of plumbing materials	▪ Teacher should Guide the student in application of plumbing materials eg Plumbing component, pipes fitting, fixture etc ▪ Perform connection of 2 pipes and fittings identified. ▪ Teacher should Guide the student in handling and storage of plumbing materials eg Plumbing component, pipes fitting, fixture etc	Demonstrate the application of different types of plumbing materials Demonstrate materials handling and storage in plumbing
	General Objective: 4.0 UNDERSTAND THE BASIC PRINCIPLES OF SITE PREPARATION. Year 1, Term 2					
7-12	4.1 Define vegetable soil 4.2 Explain hand tools and mechanical plants used for excavation.	▪ Use question and answer technique to describe vegetable soil and reasons for removal before setting out. ▪ Show student various hand tools used for	▪ Sample of Vegetable soil. ▪ Digger, trowel, shovel ▪ Pictures, videos and chart of excavator, etc.	▪ Identify same State the reasons for removing vegetable soil or top –soil before setting out. ▪ Identify the hand tools	▪ Guide student to identify same State the reasons for removing vegetable soil or top –soil before setting out. ▪ Guide student in site preparation and procedures prior to setting	Define vegetable soil List and Explain hand tools and mechanical plants used for

	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. 4.5 Describe site layout and it important in construction	earth excavation e.g auger, excavator, shovel, digger]' etc. ▪ Take a visit to new construction site with the students. ▪ Take a visit to new construction site with the students. ▪ Explain site layout and it important in construction		and mechanical plants used for excavation. ▪ Demonstrate site layout and it important in construction using sketches	out. ▪ Guide the student on how to identify the hand tools and mechanical plants used for excavation. ▪ Guide the student to Demonstrate site layout and it important in construction using sketches	excavation. Explain the Importance of site investigation and preparation prior to setting out. Explain site preparation and procedures prior to setting out. Define site layout and it important in construction
	General Objective 5.0: Understand simple sketches and mechanical drawings. Year 1, Term 3					
1-6	**5.1** Interpret and read simple mechanical drawings **5.2** state sign and symbols in a mechanical drawing	Explain and read simple mechanical drawings Explain sign and symbols in a mechanical drawing	Plumbing drawing Sketch pad Unit of measurement Sign and symbols Colour codes Plumbing drawing Sketch pad Unit of measurement Sign and symbols Colour codes	▪ Demonstrate interpretation and read of simple mechanical drawings ▪ Demonstrate the use of sign and symbols in a mechanical drawing	▪ Guide the student in interpretation and read of simple mechanical drawings ▪ Guide the student in the use of sign and symbols in a mechanical drawing	Interpret and read simple mechanical drawings state sign and symbols in a mechanical drawing

	5.3 state the SI unit of measurement used in plumbing drawing **5.4** make simple sketches relating to plumbing work	explain the SI unit of measurement used in plumbing drawing eg meter (m, mm,cm)	Plumbing drawing Sketch pad Unit of measurement Sign and symbols Colour codes	▪ Demonstrate measurement used in plumbing drawing	▪ Guide student in carryout measurement used in plumbing drawing. ▪ Guide student in make simple sketches relating to plumbing work	state the SI unit of measurement used in plumbing drawing make simple sketches relating to plumbing work
	General Objective 6.0: UNDERSTAND BASIC COMMUNICATION AND TEAM WORK IN BUILDING CONSTRUCTION					
6-8	6.1 state communication the various types used in construction	Explain communication the various types used in construction eg verbal, non -verbal written visual etc	▪ Communicate signs and symbols, video garget used in communication (phones letters) and hand out on communication	▪ Carryout communication using various types and their garget	▪ Guide learners in Carryout communication using various types and their garget.	state communication the various types used in construction
	6.2 Describe teamwork and it import in construction.	Explain teamwork and its important in construction Explain individual roles and it import in construction	▪ Roles, works schedule templet videos and plumbing regulations.	▪ Carryout teamwork and it important in construction. ▪ Demonstrate individual roles and it import in construction.	▪ Guide the student in Carryout teamwork and it import in construction. ▪ And support the learners to Demonstrate individual roles and it import in construction	Define teamwork and it import in construction.

	6.3 Explain Estimating of materials in plumbing	Describe Estimating of materials in plumbing	▪ Simple addition multiplications	Estimate materials in plumbing	Guide the student carryout Estimating of materials in plumbing	Carryout simple Estimating of materials in plumbing
TERM 3	**General Objective 7.0: UNDERSTAND THE BASIC PRINCIPLES OF INSTALLATION OF VARIOUS TYPES OF SERVICES IN DWELLING. Year 2, Term 1**					
9-12	7.1 State the basic principles of a good drainage system.	explain the basic principles of a good drainage system	▪ PPE, video flip charts plumbing regulations and handout etc.	▪ Work with the basic principles of a good drainage system.	▪ Guide the student in Work with the basic principles of a good drainage system	State the basic principles of a good drainage system.
	7.2 Describe with sketches the installation standards relating to cold and; hot water supply.	Explain with sketches the installation standards relating to cold and; hot water supply.	Sketches Plumbing tools, plumbing materials such as fittings, fixtures, pipes etc	Demonstrate With sketches the installation standards relating to cold and; hot water supply.	▪ Guide student to explain and make sketches relating to the installation standards of cold and; hot water supply.	Describe with sketches the installation standards relating to cold and; hot water supply.
	7.3 Describe the installation of Sanitary wares; fittings e.g. sinks, bath, W.C. shower, wash hand basin,	Explain the installation of Sanitary wares; fittings e.g. sinks, bath, W.C. shower, wash hand	Sanitary wares; fittings e.g. sinks, bath, W.C. shower, wash hand basin, Urinals, etc	▪ Demonstrate e the installation of Sanitary wares; fittings e.g. sinks, bath, W.C. shower,	▪ Guide the Learner in the installation of Sanitary wares; fittings e.g. sinks, bath, W.C. shower, wash hand basin, Urinals, etc.	Carryout the installation of Sanitary wares; fittings e.g. sinks, bath, W.C. shower, wash

	Urinals, etc.	basin, Urinals, etc.		wash hand basin, Urinals, etc.		hand basin, Urinals, etc.
	7.4 Analyse sketches relating to the construction of domestic drainage system, e.g. Inspection chamber/cesspool, septic tank, soakaway.	Explain with sketches construction standards relating to the construction of domestic drainage system, e.g. Inspection chamber/cesspool, septic tank, soakaway.	Sketches Pictures, video, flip chart PPE	▪ Demonstrate with sketches construction standards relating to the construction of domestic drainage system, e.g. Inspection chamber/cesspool, septic tank, soakaway.	▪ Guide the Learners in Explaining with sketches construction standards relating to the construction of domestic drainage system, e.g. Inspection chamber/cesspool, septic tank, soakaway.	Interpret sketches relating to the construction of domestic drainage system, e.g. Inspection chamber/cesspool, septic tank, soakaway.
	7.5 State the functions of a good insulation and lighting in plumbing.	Explain the functions of good or insulation and lighting in dwellings	▪ Pictures, video, flip chart PPE	▪ Demonstrate he functions of good or insulation and lighting in dwellings	▪ Guide the learners in explaining the functions of good or insulation and lighting in dwellings	Mention some functions of a good insulation and lighting in plumbing.
	7.6 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)	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)	▪ Pictures, video, flip chart PPE, sketches of electrical drawings	▪ Demonstrate the different modes of supply and installation systems of electricity in dwellings e.g. simple phase, 3-phase supply (conduit or surface	▪ Guide the learners to 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)	Mention the different modes of supply and installation systems of electricity in dwellings e.g. simple phase, 3-phase supply (conduit or surface wiring

				wiring system)		system)
	7.7 Describe electrical fixtures stating their functions and explain their installation principles.	▪ Use a detailed Electrical drawing to teach the student the key. ▪ Explain and describe various electrical fixtures stating their functions and explain their installation principles.	▪ Electrical drawing of a typical building. Signs and symbols, fixtures eg water heater, and AC	▪ Demonstrate the use of detailed Electrical drawing to teach the student the key. ▪ Show various electrical fixtures stating their functions and explain their installation principles.	▪ Guide the learners to use of detailed Electrical drawing to teach the student the key. ▪ Support learners Explain and describe various electrical fixtures stating their functions and explain their installation principles.	List electrical fixtures stating their functions and explain their installation principles.
	7.8 List the precautions to be taken to ensure safe electrical installation in dwellings.	Explain the precautions to be taken to ensure safe electrical installation in dwellings.	▪ PPE Video, pictures regulations, flip chart	▪ Demonstrate e and list the precautions to be taken to ensure safe electrical installation in dwellings	▪ Guide the learners in carryout and listing the precautions to be taken to ensure safe electrical installation in dwellings	List some precautions to be taken to ensure safe electrical installation in dwellings.
	7.9 Interpret electrical circuit symbols and drawings.	Explain and read electrical circuit symbols and drawings.	PPE Video, pictures regulations, flip chart electrical drawings signs	▪ Demonstrate e how to read electrical circuit symbols and	▪ Guide student on how to read and interpret electrical circuit symbols and drawings.	Interpret and read electrical circuit symbols and drawings.

			and symbols and specifications	drawings.		

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING
COURSE: PLUMBING AND PIPE FITTING
MODULE: CPF 12 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 corks 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. Understand 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 : CPF 12	Contact Hours 4hrs/week	
Course Specification: Theoretical				Practical Content		
WEEK	General Objective 1.0: Understand the Sources and Properties of Water. Year 3, Term 1					
	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources

1-	1.1 State the source of water, i.e. rainfall, rivers, lakes, wells, bore hole etc.	▪ Explain the source of water in nature, i.e. rainfall, rivers, lakes, wells, etc.	▪ Samples of soil component ▪ vehicles ▪ Simple test of properties of water. ▪ Pictures and video of source of water and flip chart	▪ Visitation to nearby rivers, wells etc ▪ Analyse sources of water	▪ Guide the student toexplain the source of water in nature, i.e. rainfall, rivers, lakes, wells, etc.	List some of the source of water
	1.2 State the properties of water from wells, rivers, lakes and rain.	Explain the properties of water from wells, rivers, lakes and rain.	▪ Samples of soil component ▪ vehicles ▪ Simple test of properties of water. ▪ Pictures and video of source of water and flip chart	▪ Visitation to nearby rivers, wells etc ▪ Analyse and make a sketch of the sources of water .	▪ Guide the student to explain the properties of water from wells, rivers, lakes and rain.	State the properties of water
	General Objective 2.0: Identify Sources of impurities and contamination of water and precautions to be taken					

2-5	2.1 State the sources of impurities in water from wells, rivers and rain.	▪ Explain processes of hardness and softness of water. (Temporary and permanent)	▪ Samples of water, videos ▪ Handout flip ▪ chart	▪ Show processes of hardness and softness of water. (Temporary and permanent	▪ Guide the student on processes of hardness and softness of water. (Temporary and permanent	List some source of water List some impurities found in water List types of water Carryout water purification
	2.2 State the precautions to be taken to prevent contaminati on of water supplies.	▪ Visit to water treatment station	▪ Samples of water, videos Handout flip chart	▪ Demonstrate simple experiment (filtration and sedimentatio n and boiling	▪ show simple experiment (filtration and sedimentatio n and boiling	Mention some of the precautions to be taken to prevent contamination of water supplies
	2.3 Enumerate types of water eghardness and softness of water, e.g. temporary and permanent hardness.	Explain types of water eg hardness and softness of water, e.g. temporary and permanent hardness	▪ Samples of water, videos Handout flip chart samples of different filters and boilers for water treatment PPE etc	identify the types of water ▪ Demonstrate how to carry out simple treatment of water such as filtration, sedimentatio n, boiling.	▪ Carry out simple treatment of water such as filtration, sedimentatio n, boiling.	List types of water and explain them
	2.4 Explain how to carry out simple treatment of water such as	Explain how to Carry out simple treatment of water such as filtration, sedimentation, boiling.	▪ Samples of water, videos Hand-out flip chart samples of different filters and boilers for water treatment	Demonstrate how to carry out simple treatment of water such as filtration, sedimentation, boiling	▪ Carry out simple treatment of water such as filtration, sedimentatio n, boiling	

	General Objective 3.0: Understand the general Principles of the Layout of Public and Domestic Water Supply system.					
	3.1 Explain the general principles of layout of public and domestic water supply system using sketches. 3.2 Select a suitable type of storage tank and reservoir 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.	▪ Explain the general layout systems, identify the materials and explain their importance. ▪ Prepare detailed notes for the students. ▪ Explain the installation of tank and service mains, and select suitable materials for the construction of cistern for cold water supply.	▪ Brochure of appliance and soil structures ▪ Samples of valves ▪ Fittings on display ▪ Simple installation involving using of GRP/PVC pipes and storage tank ▪ Blue print Tools – Diecing machine Stilson wrench, ¾ Hammer foot print, screwdriver, standing vice, hacksaw, etc	▪ Apply the general principles layout of public and domestic water supply system ▪ Carry out simple cold water installation using a storage tank. ▪ fix the appropriate fittings i.e. bends, tees flanges, etc. and valves, i.e sluice, air valve, gate valve, non-return valves, etc ▪ Select the types of supports and protections required at various positions of the	▪ Guide the student on general principles of layout of public and domestic water supply system ▪ Guide the student to fix the appropriate fittings i.e. elbows, tees flanges, etc. and valves, i.e sluice, air valve, gate valve, non-return valves, etc ▪ Guide the student in Select the types of supports and protections required at various positions of the installation of trunk and	explain the general principles of layout of public and domestic water supply system using sketches. List some type of storage tank and reservoir List some types of materials used for pipe work in public water supply i.e. cast iron, asbestos, steel, concrete and plastics. Carryout the installation of tank and service mains, and select suitable materials for the construction of cistern for cold water supply. List types of fittings i.e. bends, tees flanges, etc. and valves, i.e sluice, air valve, gate valve, non-return valves, etc.

	3.4 Explain the installation of tank and service mains, and select suitable materials for the constructio n of cistern for cold water supply. 3.5 Select the types of supports and protections required at various positions of the installation of trunk and service mains. 3.6 Select the appropriate fittings i.e.	Describe the installation of tank and service mains, and select suitable materials for the construction of cistern for cold water supply. Select the types of supports and protections required at various positions of the installation of trunk and service mains. Select the appropriate fittings i.e.	Cistern flexible valves fittings and pipes	installatio n of trunk and service mains. ▪ Select and fix the appropria te fittings i.e. bends, tees flanges, etc. and valves, i.e sluice, air valve, gate valve, non-return valves, etc. ▪ Demonstrate Pipe Cutting process. ▪ Demonstrate Pipes Threadin ▪ Demonstrate Coupling Mild Steel, Light gauge copper and PVC Pipes.	service mains. • Guide the student • Fix the appropriate fittings i.e. bends, tees flanges, etc. and valves, i.e sluice, air valve, gate valve, non-return valves, etc. ▪ Guide the student in the following: ▪ Demonstrate Pipe Cutting process. ▪ Demonstrate Pipes Threadin ▪ Demonstrate Coupling Mild Steel, Light gauge copper and PsVC Pipes. ▪ Demonstrate method of Bending mild steel	Carryout installation of of tank and service mains, and select suitable materials for the construction of cistern for cold water supply. Select the of tank and service mains, and select suitable materials for the construction of cistern for cold water supply. Select the appropriate fittings i.e. bends, tees flanges, etc. and valves, i.e sluice, air valve, gate valve, non-return valves, etc.

	bends, tees flanges, etc. and valves, i.e sluice, air valve, gate valve, non-return valves, etc.	bends, tees flanges, etc. and valves, i.e sluice, air valve, gate valve, non-return valves, etc.		▪ Demonstrate method of Bending mild steel pipe in plumbing work ▪ Demonstrate method of bending light gauge copper pipe in plumbing work ▪ Understand Heat bending to mild steel, light gauge copper and plastic pipes in plumbing	pipe in plumbing work ▪ Demonstrate method of bending light gauge copper pipe in plumbing work ▪ Understand Heat bending to mild steel, light gauge copper and plastic pipes in plumbing	
	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					
10-12	4.1 Explain the principle of constant and intermittent system of public cold-water supply. 4.2 State classes of pipe and	▪ Define the intermittent and constant system ▪ Analyse colours for pipe classes ▪ Explain types of jointing	▪ Brochures of water fittings to assist in the identification ▪ Sample of jointing compounds ▪ Common tools for cold water pipe jointing,	▪ Carry out checks on the installed pipe network to ascertain any loose joint (not water tight) on the network) ▪ Recognize different	▪ Guide the student to Carry out checks on the installed pipe network ▪ Guide the student to Recognize different types of	Mention some of the principle of constant and intermittent system of public cold-water supply. State classes of pipe and their uses e.g. Classes A, B, C. Mention various methods of jointing cast iron, asbestos, cement, steel and concrete pipes used for public water supply.

	their uses e.g. Classes A, B, C.	compounds for different types of public water pipes.	such as yarn, thread tape, jointing paste – caulking	types of pipes, differentiate between domestic	pipes, differentiate between domestic	Project on installing cold water supply systems.
	4.3 Select the various jointing compound suitable for cast iron, asbestos cement, steel and concrete pipes used for public water supply.	Select the various jointing compound	tools, hammer, chisel, ladle, cracking knives, lead-wool, cement, flanges, etc.	Select the various jointing compound	Guide the student to Select the various jointing compound	Select the various jointing compound
	4.4 Explain the various methods of jointing cast iron, asbestos, cement, steel and concrete pipes used for public water supply.	▪ Demonstrate simple joints on various public water pipes ▪ Make a simple diagram of public cold water supply system.		Carry out various methods of jointing cast iron, asbestos, cement, steel and concrete pipes used for public water supply.	Guide the student to Carry out various methods of jointing cast iron, asbestos, cement, steel and concrete pipes used for public water supply.	▪ Demonstrate simple joints on various public water pipes
	4.5 Explain the	▪ Prepare		Install a public, cold water supply	Guide the student to Install a	Demonstrate the process of installing a public, cold water supply systems

	process of installing cold water supply systems. 4.6 Interpret blue print of public and domestic cold water supply system layout. 4.7 Read blue print of public and domestic cold water supply system layout.	notes for students. ▪ Demonstrate the process of installing a public, cold water supply systems. Make drawing of domestic cold water supply system. Explain how to Read blue print of public and domestic cold water supply system layout.		systems Interpret blue print of public and domestic cold water supply system layout. Read blue print of public and domestic cold water supply system layout	public, cold water supply systems Guide the student to read and interpret and Make drawing of domestic cold water supply system Guide the student to Read blue print of public and domestic cold water supply system layout.	Interpret blue print of public and domestic cold water supply system layout. Read blue print of public and domestic cold water supply system layout.
	General Objective 5.0: Understand the Principles of Domestic hot and cold water and install various systems of domestic cold and hot water supply					
13-16	5.1 Explain the principles of direct and indirect	▪ State the students the principles of direct and	▪ Brochures of water fittings to assist in the	▪ Identify the principles of direct and indirect	▪ Guide the student to Identify the principles of	Explain the principles of direct and indirect domestic cold and hot water supply system

	domestic cold and hot water supply system 5.2 Select fittings and valves required for carrying out service connections to water mains. 5.3 Select appropriate pipes and fittings for cold and hot service pipes 5.4 Explain the need for valves in a water supply system and install them	indirect cold and hot water supply ▪ Explain principles behind water circulation Select fittings and valves required for carrying out service connections to water mains. Select appropriate pipes and fittings for cold and hot service pipes ▪ Explain the Lay water main and attempt service connection ▪ Explain 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	domestic cold and hot water supply system ▪ Carry out connections of service pipe to water mains. Demonstrate the Selection of fittings and valves required for carrying out service connections to water mains. ▪ Lay water main and attempt service connection ▪ Identify the need for valves in a water supply system and install them on the	direct and indirect domestic cold and hot water supply system Guild the student to Select fittings and valves required for carrying out service connections to water mains. Guide student to Select appropriate pipes and fittings for cold and hot service pipes ▪ Guide the student to Carry out connections of service pipe to water mains	Explain the need for valves in a water supply system and install them on the service pipes. Explain the need for support and protection of pipe layout within buildings Project Carryout Installing a direct or indirect domestic hot and cold-water supply. Select fittings and valves required for carrying out service connections to water mains. Mention some valves in a water supply system and install them on the service pipes.

	on the service pipes.	Test the system for leakage ▪ Prepare notes.		service pipes ▪ Test the system for leakage		
	5.5 Explain various types of joints in domestic cold and hot water supply pipes such as mild steel, (galvanised) copper, plastics.	▪ explain pipe connections with flanged joints and gaskets		▪ Practical: Students to practise pipe connections with flanged joints and gaskets ▪ Install a direct or indirect domestic hot and cold water supply system.		Mention some types of joints in domestic cold and hot water supply pipes such as mild steel, (galvanised) copper, plastics.
	5.6 Explain the need for support and protection of pipe layout within buildings.	Demonstrate the need for support and protection of pipe layout within buildings Enumerate the needs and emphasise the importance of		Identify the need for support and protection of pipe layout within buildings.	▪ Guide the student to identify the need for valves in a water supply system and install them on the service pipes.	Demonstrate the need for support and protection of pipe layout within buildings.

	5.7 Explain Install a direct or indirect domestic hot and cold-water supply system.	adequate pipe supports. Demonstrate the Installation of direct or indirect domestic hot and cold-water supply system.		Install a direct or indirect domestic hot and cold-water supply system.	Carryout Install a direct or indirect domestic hot and cold-water supply system.	Carryout the Installing of direct or indirect domestic hot and cold-water supply system.

	General Objective 6.0: Understand the Principle of Operation and uses of taps, valves, and corks in public and domestic supply					
17-21	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. 6.2 Sketch and label including sectional sketches, the	▪ 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.	▪ Sectional samples of valves on display. ▪ Brochures to assist ▪ Appropriate layout drawing to assist.	Identify the principles of operation of bib, pillar, globe taps, stop valve, high- and low-pressure ball valves, gate valves, drain cocks and plug cocks Sketch and label including sectional sketches, the following valves,	Show principles of operation of bib, pillar, globe taps, stop valve, high and low pressure ball valves Guide them to Sketch and label including sectional	State the principles of operation of the following bib, pillar, globe taps, stop valve, high- and low-pressure ball valves, gate valves, drain cocks and plug cocks.

	following valves, taps and cocks enumerated above in (6.1) 6.3 Selectthe appropriate valves and taps required in any water supply cistern	▪ Select appropriate valves for various positions. ▪ Prepare notes for students. ▪ Assess students.		taps and cocks enumerated above in (6.1) install the appropriate valves and taps required in any water supply cistern	sketches, the following valves, taps and cocks enumerated above in (6.1) Guide them to install the appropriate valves and taps required in any water supply cistern	Sketch and label including sectional sketches, the following valves, taps and cocks Select the appropriate valves and taps required in any water supply cistern
	General Objective 7.0: Identify and remedy faults and defects in water supply system.					

22	7.1 Identify causes of faults in cold and hot water systems and rectify them 7.2 Identify and remedy other types of faults such as air-locks, worn-out valves, leakages, etc. – in cold water supply system. 7.3 Explain method of remedying fault 7.4 Explain soundness test	Explain causes of faults in cold and hot water systems and rectify them ▪ prescribe remedies ▪ Prepares notes for students. Explain the remedy other types of faults such as air-locks, worn-out valves, leakages, etc. – in cold water supply system. Describe the method of remedying fault Explain soundness test	▪ Samples of affected valves and pipes on display. ▪ Possible diagram indicating the position of noises.	▪ Carryout the remedy other types of faults such as air-locks, worn-out valves, leakages, etc. – in cold water supply system. ▪ Carryout the method of remedying fault ▪ Carryout soundness test	▪ Guide the learners to carry out the remedy other types of faults such as air-locks, worn-out valves, leakages, etc. – in cold water supply system. ▪ Support the learners to Carry out the method of remedying fault ▪ Guide the learners to Carryout soundness test	List 5 causes of faults in cold and hot water systems and rectify them Mention some remedy to the types of faults such as air-locks, worn-out valves, leakages, etc. – in cold water supply system. Project on method of remedying fault Project on soundness test

	General Objective 8.0: Understand and carry out water supply system to rural areas.					
23-24	8.1 Explain the sources of water supply in rural area, wells, streams, etc. 8.2 Explain the principles of operations of pumps, e.g. centrifugal pump summative pump, semi-rotary pumps and hydraulic pump etc. 8.3 Explain the importance of setting essential valves used for efficient performanc e of pumps, e.g. foot valves, air-vessels, buttery, stop valve non return valve, etc.	▪ Review the sources of water supply and identify one for rural areas. Describe the principles of operations of pumps, e.g. centrifugal pump summative pump, semi-rotary pumps and hydraulic pump etc. Identify the importance and use of essential supporting valves Describe the installing pumps using valves and tools. State common faults in pumps installation and prescribes solution to the faults.	▪ 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.	▪ Identify various types of pumps suitable for a specific job ▪ Sketch and label the following, jack, lift, lift and force, semi-rotary pumps and hydraulic ram. ▪ Install the pumps and valves and maintain them when necessary.	▪ Guide the student to Identify various types of pumps suitable for a specific job ▪ Guide the student to Sketch and label the following , jack, lift, lift and force, semi-rotary pumps and hydraulic ram ▪ Guide the student to Install the pumps and valves and maintain them when	Mention the sources of water supply in rural area, wells, streams, etc. State the principles of operations of pumps, e.g. centrifugal pump summative pump, semi-rotary pumps and hydraulic pump etc. List the importance of setting essential valves used for efficient performance of pumps, e.g. foot valves, air-vessels, buttery, stop valve non return valve, etc.

					necessary	
	General Objective 9.0: Understand the Safety Precautions to be observed in the Installation and use of Domestic Hot Water Supply.					

25-30	9.1 Explain the main provisions of the model and relevant local bye-laws on hot water installation. 9.2 State reasons for installing safety valves, control valves, air release valves and gauges etc 9.3 State the danger associated with the storage and use of fuels, e.g. electricity, gas, oil, etc. 9.4 State reasons for installing thermostats and thermometer in the water heating system. 9.5 Describe the danger associated with boiler and cylinder explosions.	▪ State the disadvantages and advantages of using various fuels mentioned in 9.3 ▪ explain reasons for installing safety valves, control valves, air release valves and gauges etc ▪ Analyse, select and install thermostat and thermometer in water heating system. ▪ Explain possible causes of boiler and cylinder explosion and prescribe precautions. ▪ Prepare notes.	▪ Copies of various bylaws to be studied ▪ Specimen of various valves ▪ Samples of thermometer and thermostat.	▪ Installing safety valves, control valves, air release valves and gauges etc and install these items in a hot water supply system. ▪ Identify the danger associated with the storage and use of fuels, e.g. electricity, gas, oil, etc. ▪ Identify the causes of boiler and cylinder explosion and prescribe precautions. ▪ Identify the causes of boiler and cylinder explosion and prescribe precautions. ▪ Demonstrate Water Storage Tank Installation.	▪ Guide the student to Installing safety valves, control valves, air release valves and gauges etc and install these items in a hot water supply system. ▪ Guide the student to Identify the danger associated with the storage and use of fuels, e.g. electricity, gas, oil, etc ▪ Guide the student to. Identify the causes of boiler and cylinder explosion and	Explain the main provisions of the model and relevant local bye-laws on hot water installation. State reasons for installing safety valves, control valves, air release valves and gauges etc State the danger associated with the storage and use of fuels, e.g. electricity, gas, oil, etc. State reasons for installing thermostats and thermometer in the water heating system. Describe the danger associated with boiler and cylinder explosions. Carryout installation of hot water component

General Objective 10.0: Plan and carry out Public and Domestic Hot Water Installation						
31-36	10.1 Interpret blue print of public and domestic hot water system layout. 10.2 Read blue print of public and domestic hot water system layout. 10.3 explain the components of the hot water installation e.g boiler, feed tank and hot water storage cylinder 10.4 Explain needs for carry out complete insulation to all components of the hot water installation 10.5 list the different types of electric and gas water heaters for any given job	▪ 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. ▪ Explain positing and support the components of the hot water installation e.g. boiler, feed tank and hot water storage cylinder ▪ Explain needs for carry out complete insulation to all components of the hot water installation ▪ explain the different types of electric and gas water heaters for any given job ▪ ▪ Explain installation of the two types of heaters (practical)	▪ Enough copies of blueprints to go round the students ▪ Boiler, Cylinder, Feed tank, Gas water, heater, electric water heater ▪ Solid fuel ▪ Insulation materials.	▪ Carry out necessary pipe work to the components. ▪ Cite and install appropriate hot water heaters ▪ Test the completed hot water installation for safety and efficient working of the system. ▪ Demonstrate Position and support the components of the hot water installation e.g. boiler, feed tank and hot water storage cylinder ▪ carry out complete insulation to all components of the hot water installation	▪ Assist students to carry out necessary pipe work to the components. ▪ Assist students to perform the installations ▪ Assist students to. Completed hot water installation for safety and efficient working of the system. ▪ Guide the student in Positioning and supportin	List symbols used blue print of public and domestic hot water system layout. Explain blue print of public a domestic hot water system layout. explain the components of the hot water installation e.g boiler, feed tank and hot water storage cylinder Explain needs for carry out complete insulation to all components of the hot water installation list the different

					g the compone nts of the hot water installatio n e.g. boiler, feed tank and hot water storage cylinder	types of electric and gas water heaters for any given job

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING
COURSE: GAS AND STEAM WORK
CODE: CPF14
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 Bunsen 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. Understand 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 : CPF 14			Contact Hours 4hrs/week		
Course Specification: Theoretical				Practical		
WEEK	General Objective: 1.0 Understand the method of Production and Storage of Liquefied Petroleum Gas and the safety Precautions associated with this Operation. Year 2, Term 1					
	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Evaluation

1-2	1.1 Explain Liquefied Petroleum Gas 1.2 Explain the method of production and storage of liquid petroleum gases. 1.3 State the types of liquid petroleum gases and their properties 1.4 State necessary safety precautions to be observed when storing and using L.P.G.	▪ Explain the origin of L.P.G. and their production principles ▪ Emphasise the need for safety. ▪ Enumerate the safety precautions to be observed when storing and using L.P.G. ▪ Prepare notes.	▪ Charts and brochures depicting L.P.G. on display ▪ L.P.G. Cylinder and their colour code. ▪	• Identify L.P.G. and explain their production principles • Identify the method of production and storage of liquid petroleum gases • Show the various types of liquid petroleum gases and their properties • Identify all necessary safety precautions to be observed when storing and using L.P.G.	• Guide the student to Identify L.P.G. and explain their production principles • Guide the student to Identify the method of production and storage of liquid petroleum gases • Guide the student to identify the various types of liquid petroleum gases and their properties • Guide the student to identify all necessary safety precautions to be observed when storing and using L.P.G.	List Liquefied Petroleum Gas Explain the method of production and storage of liquid petroleum gases. State the types of liquid petroleum gases and their properties State necessary safety precautions to be observed when storing and using L.P.G.

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.						
	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 types of fittings used with L.P.G. and their functions.	Describe the principles of luminous and Bunsen flames, combustion and oxidation. List out the product of combustion and how best to get rid of them. Select the types of fittings used with L.P.G. and their functions. Enumerate various types of fittings used with L.P.G. and their functions	▪ Charts and brochures ▪ Bunsen Bonus, and laboratory experiment ▪ Gas cooker ▪ Sample of element ▪ Spark lighter	Identify the principles of luminous and Bunsen flames, combustion and oxidation. ▪ Identify the materials, tools and equipment required for the installation process fit for the intended purpose. ▪ Select appropriate materials, tools and equipment required for the particular installation purpose. ▪ Code of practice for plumbing industry ▪ Explain the need and objective of the code of practice. ▪ Introduction of the	Guide the student Explain the principles of luminous and Bunsen flames, combustion and oxidation. ▪ Guide the student to Identify the different methods of gas installations and know their advantages and disadvantages ▪ Guide the student to Construct and position platforms for receiving gas cylinders ▪ Guide the student to Install gas pipe work to feed suitable appliances ▪ Guide the student to Demonstrate the construction of platforms for receiving gas	Explain the principles of luminous and Bunsen flames, combustion and oxidation. State the common products of combustion and how to get rid of them. Select the types of fittings used with L.P.G. and their functions. Mention the different methods of gas installations and know their advantages and disadvantages. Practical Installation of gas pipe work to feed suitable appliances Practical Testing using soapy water to detect leakages and defective fittings.

				plumbing code of practice. ▪ Measure and record site details for installation ▪ Identify the different methods of gas installations and know their advantages and disadvantages. ▪ Construct and position platforms for receiving gas cylinders ▪ Install gas pipe work to feed suitable appliances ▪ Demonstrate the construction of platforms for receiving gas cylinders and enumerate different methods of gas installations, stating the advantages and	cylinders and enumerate different methods of gas installations, stating the advantages and disadvantages ▪ Guide the student to Test using soapy water to detect leakages and defective fittings.	

				disadvantages Test using soapy water to detect leakages and defective fittings.		
	General Objective 3.0: Understand the Principles, functions and the Constructional details of Steam Generator					
	3.1 List types of steam generators 3.2 Explain the working principles of a steam generator 3.3 Explain the functions and constructional details of a steam generator	▪ Discuss types of steam generators ▪ Discuss the working principles of a steam generator ▪ Define the functions and construction al details of a steam generator ▪ assess the students	▪ Brochures ▪ Charts. ▪ PPE ▪ Pictures ▪ Manual	▪ Enumerate different types of steam generators and explain their functions ▪ Give or produce pictorial and sectional sketches of steam generators ▪ Describe the functions and constructional details of a steam generator	▪ Guide the student to identify 3.1,3.2 and 3.3	Examination Discussion Practical project ▪
	General Objective 4.0: understand 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					
8-12	4.1 Explain the importance and usage of steam in manufacturing industry. 4.2 Explain the purpose of insulation	▪ Usage of steam in manufacturi ng industry. ▪ Explain the purpose of insulation ▪ State the	▪ Charts and brochures ▪ Sample of insulating materials, different valves on	▪ Enumerate the process of steam generation and identify various types, stressing the importance of	▪ Guide the student to identify the process of steam generation and identify various types, stressing the importance	Explain the importance and usage of steam in manufacturing industry. Explain the purpose of insulation List types of insulation of steam pipes and

	4.3 State the purpose and types of insulation of steam pipes and fittings 4.4 Explain the reasons for insulating a steam pipe	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	display ▪ Vehicles ▪ Brackets, fittings, ▪ Pipes, ▪ Insulator, ▪ General Tools	each Carry out insulation of steam pipes ▪ Differentiate the various types of steam e.g. wet, dry and superheated with facility ▪ Enumerate different types of insulating materials used for steam/heating work and their applications ▪ Select various types of pipes used for gas, water and steam installations ▪ Select and describe the various types of valves used in steam installations. ▪ Demonstrate simple steam methods of steam pipeline insulation emphasising	of each Carry out insulation of steam pipes ▪ Guide the student to differentiate the various types of steam e.g. wet, dry and superheated with facility ▪ Guide the student to identify different types of insulating materials used for steam/heating work and their applications ▪ Guide the student to identify Select various types of pipes used for gas, water and steam installations ▪ Guide the student to identify Select the various types of valves used in steam installations.	fittings. Explain the reasons for insulating a steam pipe Carry out insulation of steam pipes

				the needs for brackets and fittings depicting the methods of positioning and securing,	▪ Guide the student to simple steam methods of steam pipeline insulation emphasising the needs for brackets and fittings depicting the methods of positioning and securing,	
	General Objective 5.0: Install a Steam pipe system, providing adequate support and insulation of the System.					
13-15 16-18 19-20	5.1 Explain position platforms for receiving gas cylinders 5.2 Explain gas pipe work to feed suitable appliances. 5.3 Explain use of soapy water to detect leakages and defective fittings. 5.4 Explain the full insulation of steam pipes 5.5 Explain Set out pipe-line from the source to the point of use. 5.6Explain the Fixing on correct bracket or clips along the pipe-lines to support steam	▪ Teacher to discuss all the activities to students to practise till they become competent.	▪ Angle Iron ▪ Metal sheets ▪ Valves, pipes ▪ Set of Welding and Cutting tools ▪ Diecing machine ▪ Oxy-acetylene ▪ Screws. Hacksaw completes with blade ▪ Set of	▪ Construct and position platforms for receiving gas cylinders ▪ Install gas pipe work to feed suitable appliances ▪ Test using soapy water to detect leakages and defective fittings. ▪ Carry out insulation of steam pipes ▪ Set out pipe-line from the source to the point of use.	▪ Guide the student to perform all practical activities to students to practise till they become competent.	Explain position platforms for receiving gas cylinders. Explain gas pipe work to feed suitable appliances. Explain use of soapy water to detect leakages and defective fittings. Discuss laying of pipes on to bracket and secure firmly. Explain the construction of an apron to shield the cylinders from the rain and direct ray of sun

	pipes 5.8 Discuss laying of pipes on to bracket and secure firmly. 5.9 Explain the construction of an apron to shield the cylinders from the rain and direct ray of sun		machination tods ▪ Pipe cutters ▪ Gas cylinders ▪ Pressure hoses ▪ Control valves, D-clips ▪ Soap, form, water	▪ Fix on correct bracket or clips along the pipe-lines to support steam pipes ▪ Lay pipes on to bracket and secure firmly ▪ Join steam pipe ▪ Select and apply suitable materials to insulate a steam pipe system ▪ Carry out essential tests on completed installation. ▪ Construct an apron to shield the cylinders from the rain and direct ray of sun		project carryout installation of steam pipe and insulate and support pipe

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING
COURSE: GAS AND BRONZE WELDING COURSE CODE: CPF 13
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. Understand 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. Understand Assembling 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. Understand 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. Understand the various welding defects 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 :CPF 13**	**Contact Hours 3hrs//week**			
Course Specification: Theoretical				**Practical Contents**		
	General Objective: 1.0 Understand and apply the general safety precautions related to Gas and Bronze Welding. Year 3, Term 1					
weeks	**Specific Learning Outcome**	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Evaluation**
1-2	1.1 Explain the essence and emphasis on safety precautions 1.2 Explain Carry, transport and store full and empty gas cylinders safely using appropriate equipment 1.3 Explain the 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	▪ Explain the importance of separation of empty and full cylinders and safety – in carrying and transporting of cylinder bottles. ▪ Explain insulative shield for welding; welding goggles, gloves, etc. e.g. when welding near inflammable materials	▪ Insulating shield ▪ Fans ▪ Extractors ▪ Safety signsand symbol – prohibition, mandatory, warning and information signs. Information sheet and postal ▪ Welding goggles, ▪ Shield overall ▪ Arching tables, ▪ Trolling, etc. ▪ White board marker	▪ Wear clean, smart and appropriate personal Protective Equipment. ▪ Prepare explosive containers ready for welding operation ▪ Select, use and care for protective wears for carrying out the following gas welding operations, e.g. Welding goggles, Welding shields Gloves Boots, etc. ▪ Explain the appropriate safety precautions while carrying out the following: 1.Gas welding operations on containers which have been emptied of chemicals, inflammable or explosive liquids 2.Gas welding near containers with inflammable	▪ Guide the student to wear clean, smart and appropriate personal Protective Equipment. ▪ Guide the student to Prepare explosive containers ready for welding operation ▪ Guide the student to Select, use and care for protective wears for carrying out the following gas welding operations, e.g. Welding goggles, Welding	Explain the essence and emphasis on safety precautions on gas welding. Explain the appropriate safety precautions while carrying out the following: d. Gas welding operations on containers which have been emptied of chemicals, inflammable or explosive liquids e. Gas welding near containers with inflammable materials, e.g petrol

	confined spaces			materials, e.g petrol tank 3.Gas welding in confined spaces		tank f. Gas welding in confined spaces
3	1.4 Explain safety signs – prohibition, mandatory, warning and information signs. 1.5 Explain the importance of fans and cathode extractors when welding in a confined area	▪ Explain the importance and use of protective wears, e.g. welding goggles, gloves, booths, nose covers, etc. ▪ Discuss the importance of fans and cathode extractors when welding in a confined area		▪ Identify the safety signs – i.e. prohibition signs, mandatory signs, warning signs and information signs. ▪ Identify the importance and use of protective wears, e.g. welding goggles, gloves, booths, nose covers, etc.	▪ Guide the student to identify the safety signs – i.e. prohibition signs, mandatory signs, warning signs and information signs. ▪ Guide the student to identify the importance and use of protective wears, e.g. welding goggles, gloves, booths, nose covers, etc.	List the safety signs – prohibition, mandatory, and warning and information signs. Explain the importance of fans and cathode extractors when welding in a confined area
	General Objective 2.0: understand and apply successfully various gas welding processes/operations including the acetylene and oxy-fuel gas cutting processes. Year 3, Term 1					
4-6	2.1 Explain the following gas welding equipment, describing their features, functions, applications and care: a. generators b. regulators c. blow pipes d. nozzles e. hoses f. gas cylinders and their colours	Explain the following gas welding equipment, describing their features, functions, applications and care: j. generators k. regulators l. blow pipes m. nozzles n. hoses o. gas cylinders and their colours	▪ Gas generator ▪ Gas regulator ▪ Blow pipes, Nozzles ▪ Pressure hoses ▪ Gas cylinders ▪ Economizers ▪ Check valves	▪ Identify the following gas welding equipment, describing their features, functions, applications and care: ▪ generators ▪ regulators ▪ blow pipes ▪ nozzles ▪ hoses ▪ gas cylinders and their colours ▪ economizers	▪ Guide the student to Identify the following gas welding equipment, describing their features, functions, applications and care: ▪ generators ▪ regulators ▪ blow pipes ▪ nozzles ▪ hoses	Explain the following gas welding equipment, describing their features, functions, applications and care: generators regulators blow pipes nozzles hoses gas

	g. economizers h. Check valves. i. Propane welding 2.2 Explain low and high-pressure gas generating equipment. 2.3 State the advantages and the disadvantages of the two low pressure generating equipment 2.4 State the properties of calcium carbide	p. economizers q. Check valves. Explain low- and high-pressure gas generating equipment. Explain the advantages and the disadvantages of the two low pressure generating equipment. Explain the properties of calcium carbide	▪ Carbide trays ▪ Calcium carbide ▪ Pressure valve ▪ Purifiers ▪ Propane torch	check valves ▪ Identify the welding component and explain the differences ▪ Differentiate between the following types of generators, stating their merits and demerits. ▪ Distinguish between high- and low-pressure systems of welding. ▪ Carbide to water generator ▪ Calcium carbide to-water generator ▪ Identify the main parts of the generator e.g. ▪ hydraulic back pressure valve ▪ Purifier ▪ carbidetrays etc. ▪ Analyse the properties of calcium carbide and process of generating acetylene from carbide	▪ gas cylinders and their colours ▪ economizers check valves ▪ Guide the student to Identify the welding component and explain the differences ▪ Guide the student to Differentiate between the following types of generators, stating their merits and demerits. ▪ Carbide to water generator ▪ Calcium carbide to-water generator ▪ Guide the student to Identify the main parts of the generator e.g. ▪ hydraulic back pressure valve ▪ purifier ▪ carbidetrays etc. ▪ Guide the student to Distinguish between high- and low-pressure systems of welding ▪ Guide the student to Analyse the properties of calcium	cylinders and their colours economizers Check valves. List some of the types of low-pressure gas generating equipment. State the advantages and the disadvantages of the two low pressure generating equipment Mention some of the properties of calcium carbide

					carbide and process of generating acetylene from carbide	
Year 3, Term 1 7-9	2.5 Explain acetylene using calcium carbide guiding against danger or over-charge 2.6 Explain simple processes of gas welding with or without filler 2.7 List types of welding rods stating their properties, compositions, and uses Differentiate between welding and cutting torches 2.8 Explain how to derived oxy-acetylene welding process: oxidizing flame, carbonising flame, and neutral flame 2.9 State the functions of backing bars and strips	▪ Discuss the activities in 2.5 to 2.9. ▪ List different welding methods, and emphasise the functions of backing bars and strips. ▪ Prepare detailed notes.	▪ Calcium carbide ▪ Carbide trays ▪ Posters and brochures ▪ Listing and identifying part of welding equipment ▪ Set of welding wedge ▪ Cutting tools ▪ Materials ▪ Welding rods, spark lighter ▪ Posters indicating different welding joints.	▪ Sketches indicating the conventional symbols for the welded joints, e.g. butt joint, fillet joint and lap joint. ▪ Prepare plate surfaces for the following welding joints and tack weld i. Butt joints, ii. Filet joint iii. Lap joint ▪ Weld metals together in down-hand or flat position ▪ Demonstrate simple processes of gas welding with or without filler ▪ Identify different welding rods and enumerate their properties composition and uses ▪ Identify convectional welding symbols and preparation of plate surfaces for carrying out various joint e.g. butt and fillet joints ▪ Identify and differentiate between	▪ Guide the student to sketches indicating the conventional symbols for the welded joints, e.g. butt joint, fillet joint and lap joint. ▪ Guide the student to Prepare plate surfaces for the following welding joints and tack weld i. Butt joints, ii. filet joint iii. Lap joint ▪ Guide the student to Weld metals together in down-hand or flat position ▪ Guide the student to Demonstrate simple processes of gas welding with or without filler ▪ Guide the student to Identify different welding rods and enumerate their properties composition and uses ▪ Guide the student to	Explain acetylene using calcium carbide guiding against danger or over-charge Explain simple processes of gas welding with or without filler. List types of welding rods stating their properties, compositions, and uses Differentiate between welding and cutting torches. Explain how to derived oxy-acetylene welding process: oxidizing flame, carbonising flame, and neutral flame. State the functions of backing bars and strips Project.

				welding and cutting torches Demonstrate student to carry out on how to make propane welding	Identify convectional welding symbols and preparation of plate surfaces for carrying out various joint e.g butt and fillet joints ▪ Guide the student to Identify and differentiate between welding and cutting tourches Guide student to carry out on how to make propane welding	carryout welding of different metals Explain simple processes of propane welding.
	2.10. Explain propane welding	Discuss how carryout propane welding	Propane torch and regulator			
	General Objective 3.0: Understand the Process of Manufacture and Storage of Oxygen and Acetylene and Associated Safety Measures.					
10	3.1 Explain the methods of manufacture and storage of oxygen and acetylene 3.2 Explain the principal components of manufacture of oxygen and acetylene gas (carbide) 3.3 State the safety precautions: a. during handling	3.4 List the methods of manufacture and storage of oxygen and acetylene 3.5 Discuss the principal components of manufacture of oxygen and acetylene gas (carbide) 3.6 Explain the safety precautions: d. during handling	▪ Pictures, video, PPE, handout, flipchart regulations	▪ Identify the difference between the equipment for oxygen and acetylene ▪ 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	▪ Guide the student to Identify the difference between the equipment for oxygen and acetylene ▪ Guide the student to identify the difference between oxygen and acetylene equipment; and emphasise all safety	Explain the methods of manufacture and storage of oxygen and acetylene. Explain the principal components of manufacture of oxygen and acetylene gas (carbide) State the safety precautions:

	b. during storage c. During assembly and use.	e. during storage ▪ During assembly and use		Industrial Gas manufacturing companies	precaution during handling, storage, assembly and use of oxygen and acetylene. ▪ Guide the student in Visitation trip to Industrial Gas manufacturing companies	• during handling • during storage • During assembly and use.
	General Objective 4.0: Assemble oxygen and Acetylene Equipment ready for Welding Operation. Year 3, Term 1					
11-12	4.1 State the functions of the components, viz a. regulators b. blow-pipe c. nozzles d. Hoses, etc. 4.2 explain the Assemble oxy-acetylene welding equipment 4.3 Explain the Positioning and securing of the acetylene welding cylinders. 4.4 Explain oxy-acetylene welding on any materials applying left ward and rightward techniques 4.5 Explain Testing the completely assembled equipment for leakages	▪ Prepare detailed notes for the students to copy after explaining the activities	▪ Silver solder ▪ Brazing welding rods ▪ Bend bolt ▪ Tapping hammer ▪ Brazing spectacle ▪ Flux ▪ Bronze materials ▪ Filler rods ▪ Gas – oxy-acetylene ▪ Safety posters	▪ Identify functions of the various components, viz a. regulators b. blow-pipe c. nozzles d. Hoses, etc. ▪ Assemble oxy-acetylene welding equipment ▪ Position and secure the acetylene welding cylinders ▪ Clean the outlet of cylinder of foreign body and fix on the pressure regulators ▪ Identify the correct hose pipes and fixing them on to pressure regulators ▪ Fix on the welding blow pipe to the hose pipe and attaching correct nozzle ▪ Carry out oxy-acetylene welding on any	▪ Guide the student to Identify functions of the various components, viz e. regulators f. blow-pipe g. nozzles h. Hoses, etc. ▪ Guide the student to Assemble oxy-acetylene welding equipment ▪ Guide the student to Position and secure the acetylene welding cylinders ▪ Guide the student to Clean the outlet of cylinder of foreign body and fix on the pressure regulators ▪ Guide the student to Identify the correct hose pipes and	State the functions of the components, viz regulators blow-pipe nozzles Hoses, etc. explain the Assemble oxy-acetylene welding equipment Explain the Positioning and securing of the acetylene welding cylinders. Project: carryout oxy-acetylene welding on any materials applying left ward and rightward techniques.

				materials applying left ward and rightward techniques ▪ Test the completely assembled equipment for leakages using soapy water	fixing them on to pressure regulators ▪ Guide the student to Fix on the welding blow pipe to the hose pipe and attaching correct nozzle ▪ Guide the student to Carry out oxy-acetylene welding on any materials applying left ward and rightward techniques ▪ Guide the student to Test the completely assembled equipment for leakages using soapy water	Carryout Testing the completely assembled equipment for leakages
	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. Year 3, Term 2					
13-15	5.1 Define soldering and sealing process. 5.2 Explain the relationship and differences between brazing/silver soldering and bronze welding 5.3 State the composition of the types of fluxes and filler rods used for brazing and bronze welding	▪ Explain soldering and sealing materials ▪ 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	▪ Oxy-acetylene equipment ▪ Brazing lamp. ▪ Soldering mate. ▪ Magnifying glasses. ▪ Soldering preheaters ▪ Brazing rod,	▪ Identify soldering material and equipment. ▪ Perform soldering and sealing process appropriately. ▪ Carryout clearing process of soldering and sealing areas. ▪ Light a flame necessary for successful brazing and bronze welding ▪ Prepare metal/edges for brazing	▪ Guide the student to Identify soldering material and equipment. ▪ Guide the student to perform soldering and sealing process appropriately. ▪ Guide the student to Carryout clearing process of soldering and sealing areas. ▪ Guide the student to	Define soldering and explain sealing process. Explain the relationship and differences between brazing/silver soldering and bronze welding State the composition of the types of fluxes

	5.4 Explain the importance of using bronze welding for the welding of dissimilar metals; e.g. Copper and steel, cast iron and copper and galvanized materials	different various types of fluxes and filler rods used for brazing and bronze welding ▪ 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.	fluxes, (paste and powder type). ▪ Pipe expander ▪ Abrasive papers, taping hammer, bend bolt, etc. ▪ Copper plates or rod ▪ Cast iron plates ▪ Galvanised sheet ▪ Steel plates/rod ▪ Safety materials	▪ Braze joints using oxy-acetylene flame/brazing lamp, observing necessary safety precautions ▪ Prepare joints for bronze welding e.g. bell mouth, branch joints, joint etc. ▪ Carry out bronze welding on prepared joints using slightly oxidizing flame as appropriate and observing necessary safety precautions. ▪ Demonstrate the method of preparing metal for brazing and carryout brazing joint using oxy-acetylene flame or brazing lamp ▪ Observe necessary safety precautions ▪ 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.	Light a flame necessary for successful brazing and bronze welding ▪ Guide the student to Prepare metal/edges for brazing ▪ Guide the student to Braze joints using oxy-acetylene flame/brazing lamp, observing necessary safety precautions ▪ Guide the student to Prepare joints for bronze welding e.g. bell mouth, branch joints, joint etc. ▪ Guide the student to carry out bronze welding on prepared joints using slightly oxidizing flame as appropriate and observing necessary safety precautions. ▪ Guide the student to Demonstrate the method of preparing metal for brazing and carryout brazing joint using oxy-acetylene flame or brazing lamp ▪ Guide the student to	and filler rods used for brazing and bronze welding Project: carryout bronze welding and the welding of dissimilar metals; e.g. Copper and steel, cast iron and copper and galvanized materials

					Observe necessary precautions ▪ Guide the student to prepare the following bronze welding joint – bell mouth, branch joint, etc ▪ Guide the student to Set slightly oxidising flame and proceed to carry out bronze welding on prepared welding joint, observing necessary safety precautions.	
	General Objective 6.0: Know and weld together the different types of Non-ferrous and ferrous Metals. Year 3, Term 2					
16-18 19-20	6.1 Explain the different between ferrous and non-ferrous metals 6.2 State the properties and composition of fluxes used for welding non-ferrous metals 6.3 Explain the effect of welding together two different metals. 6.4 Explain the composition and state the mechanical properties of the above-named non-ferrous metals. Mechanical properties	▪ Explain the different between ferrous and non-ferrous metals ▪ Explain the properties and composition of fluxes used for welding non-ferrous metals ▪ Narrate the effect of welding two dissimilar metals together i.e. Electrolytic corrosion. ▪ Prepare detailed notes for the students.	▪ Oxy-acetylene equipment ▪ Brazing lamp ▪ Brazing rod, fluxes, (paste and powder type) ▪ Pipe expander ▪ Abrasive papers ▪ Taping hammer, bend bolt, etc.	▪ 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 ▪ Identify the following non-ferrous metals: a. Copper b. Aluminium	▪ Guide student to Identify and state the compositions/mechanical properties of – Brass, Bronze, and stainless steel ▪ Guide student to Identify Prepare non-ferrous materials for welding – emphasising suitable fluxes, composition and properties. ▪ Guide student to Identify	State the principles and applications of fuel-gas cutting process e.g. a. Manual b. Machine List the fuel and gases used in oxy-fuel cutting: a. acetylene b. propane c. butane d. coal gas, etc State the advantages and disadvantages of using the above mentioned, fuel-

	to include: a. Ductility b. Malleability Hardness; etc		▪ Bronze plate ▪ Bronze plates ▪ Stainless Steel Materials ▪ Coppers Materials ▪ Aluminium Materials ▪ Various types of Welding rods ▪ Safety Posters ▪ Safety materials	c. Brass d. Bronze, etc. ▪ Emphasise the properties of stainless steel and show the technique and material for a successful welding ▪ Describe the composition and state the mechanical properties of the above-named non-ferrous metals. Mechanical properties to include: c. Ductility d. Malleability Hardness; etc ▪ Prepare and weld non-ferrous metals using appropriate fluxes ▪ Prepare bronze components for welding, avoiding sharp edges and weld to specification. ▪ Identify and state the type, composition and properties of stainless steels used in metal work. ▪ Prepare stainless steel components for welding ▪ Weld stainless steel components using appropriate welding rods, techniques and observing safety precautions.	Demonstrate the process of preparation and welding of bronze components ▪ Guide student to Identify the following non-ferrous metals: e. Copper f. Aluminium g. Brass h. Bronze, etc. ▪ Emphasise the properties of stainless steel and show the technique and material for a successful welding ▪ Guide student to Identify Prepare and weld non-ferrous metals using appropriate fluxes ▪ Guide student to Identify Prepare bronze components for welding, avoiding sharp edges and weld to specification. ▪ Guide student to Identify the type, composition and properties of stainless steels used	gases for oxy-fuel cutting operations,

					in metal work. ▪ Guide student to Identify Prepare stainless steel components for welding ▪ Guide student to Identify Weld stainless steel components using appropriate welding rods, techniques and observing safety precautions.	
	General Objective 7.0: Understanding and Apply the Fuel Gas Cutting Metals to a Given Specification. Year 3, Term 2					
21	7.1 State the principles and applications of fuel-gas cutting process e.g. c. Manual d. Machine 7.2 Describe fuel and gases used in oxy-fuel cutting: acetylene propane butane coal gas, etc. 7.3 State the advantages and disadvantages of using the above mentioned, fuel-gases for oxy-fuel cutting	▪ Explain principles behind fuel-gas cutting and state the different methods of cutting ▪ Prepare detailed notes. Explain various fuel gases used in oxy-fuel cutting: acetylene propane butane coal gas, etc. explain the advantages and disadvantages of using the above mentioned, fuel-gases for oxy-fuel cutting	▪ Oxy-fuel cutting equipment ▪ Colour code for different fuel-Gases ▪ PPE. pictures and video	▪ Demonstrate the Identifying the different fuel gases used in oxy-fuel cutting and explain their advantages and disadvantages. ▪ Demonstrate the Identifying manual and machine cutting equipment. Identify the advantages and disadvantages of using the above mentioned, fuel-gases for oxy-fuel cutting operations,	▪ Guide student to Identify the different fuel gases used in oxy-fuel cutting and explain their advantages and disadvantages. ▪ Guide student to Identify manual and machine cutting equipment. Guide student to State the advantages and disadvantages of using the above mentioned, fuel-gases for oxy-fuel	Explain the principles and applications of fuel-gas cutting process e.g. Manual Machine Explain the fuel and gases used in oxy-fuel cutting: acetylene propane butane coal gas, etc. mention some of the advantages and disadvantages of using the above

	operations,	operations,			cutting operations,	mentioned, fuel-gases for oxy-fuel cutting operations,
	General Objective 8.0: Know the various Welding Defects and Rectify Them. Year 3, Term 2					
22-24	8.1 Describe welded joints defects by the known methods e.g. a. non-destructive test b. destructive test 8.2 Describe how to Rectify welded joint defects enumerated above 8.3 State the main causes of defects in welded joints.	▪ 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.	▪ Hacksaw ▪ File ▪ Table Vice ▪ Gamma ray ▪ Or ex-ray machine ▪ Etching fluid ▪ Hammer	Identify welded joints defects by the known methods e.g. c. non-destructive test d. destructive test Rectify the welded joint defects enumerated above. identify and explain the causes of defect in welded joints Demonstrate storage of oxygen and Acetylene gas using Calcium carbide and electrolysis of water. Carryout Positing, assembling and test gas welding equipment ready for welding operation. Carryout Preparation of plate surfaces for the following welding joint and Tack and weld a. Butt joint b. fillet joint c. Lap joint	Identify welded joints defects by the known methods e.g. a. non-destructive test b. destructive test Guide the student to rectify the welded joint defects enumerated above. Guide the student identify and explain the causes of defect in welded joints. Guide the student in storage of oxygen and Acetylene gas using Calcium carbide and electrolysis of water. Guide student to Position, assemble and test gas welding equipment ready for welding operation. Support the learners in the Preparation of plate surfaces for the	Mention some welded joints defects project: Rectify welded joint defects enumerated above State the main causes of defects in welded joints.

				▪ Prepare joints for bronze welding e.g. bell mouth branch joint, V joint.	following welding joint and Tack and weld a. Butt joint b. fillet joint c. Lap joint Prepare joints for bronze welding e.g. bell mouth branch joint, V joint.	

PROGRAMME: NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING
COURSE: SANITATION AND DRAINAGE I COURSE CODE CPF 15
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 setting out 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 Understand 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 in buildings
7 Carry out connections of the drainage system to cesspool.
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: CPF 15**				**Contact Hours 3hrs/week**	
Course Specification: Theoretical				**Practical Contents**		
WEEK	**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 setting out Appliances in the Building. Year 2, Term 1**					
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Evaluation**

1-8	1.1 Explain the Principles of Sanitation in buildings 1.2 List types of sanitary fittings. E.g soil (W.C. Bidet Slop Sink) Waste appliances (Wash Hand Basin, Bath, Sink) 1.3 State the properties of the different materials used for the manufacture of waste and soil appliances 1.4 Explain the sizes of the sanitary appliances and various fixing levels .	▪ Explain the process of manufacturing appliances (practical) ▪ Explain installation principles of sanitary appliances ▪ Prepare detailed notes for the students. .	▪ 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.	▪ Identify various appliances and analyse their materials of manufacture ▪ Sketch, label and dimension, soil and waste appliances, etc. ▪ Select the materials and describe the process used for the manufacture of soil and waste appliances ▪ Select and site sanitary appliances in different types of building ▪ Select the various sizes of pipes suitable for supplies and wastes of sanitary appliances to specification	▪ Guide the student to Identify various appliances and analyse their materials of manufacture ▪ Guide the student to Sketch, label and dimension, soil and waste appliances, etc. ▪ Guide the student to Select the materials and describe the process used for the manufacture of soil and waste appliances ▪ Guide the student to Select and site sanitary appliances in different types of building ▪ Guide the student to Select the various sizes of pipes suitable for	State the Principles of Sanitation in buildings. List types of sanitary fittings. E.g soil (W.C. Bidet Slop Sink) Waste appliances (Wash Hand Basin, Bath, Sink) State the properties of the different materials used for the manufacture of waste and soil appliances. Project carryout setting out of waste appliances

	General Objective: 2.0 Install Sanitary Appliances and Test the system for Leakages, Security, Efficiency, etc. Year 2, Term 1					
	2.1 Explain drawings of sanitary installation in a building plan 2.2 Explain necessary preparation relevant to the fixing of each sanitary appliances e.g. marking out, assembling the units raw plugging of walls and floor. 2.3 Explain the sanitary appliance to a given specification	▪ Explaininterpret scaled drawings for the students ▪ 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.	▪ Essential tools for installation as listed above ▪ Test Media – Air test, Drain plug, Smoke rocket, Air pump to be made available. ▪ U Gauge.	▪ Test finished sanitary installation for leakages, security, efficiency, etc. ▪ 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. ▪ Install appliances using correct sizes of pipes and positioning at correct levels. ▪ Assemble components and proceed to install sanitary appliances	▪ Guide the student to Test finished sanitary installation for leakages, security, efficiency, etc. ▪ Guide the student to 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. ▪ Guide the student to install appliances using correct sizes of pipes and positioning at correct levels.	make drawings of sanitary installation in a building plan Explain necessary preparation relevant to the fixing of each sanitary appliances e.g. marking out, assembling the units raw plugging of walls and floor. Explain the sanitary appliance to a given specification. Project Carryout installation of sanitary appliances and test for leakage

					▪ Guide the student to Assemble components and proceed to install sanitary appliances	
	General Objective 3.0: Understand the Functions of traps used in Sanitary Appliances and fix Traps in sanitary System. Year 2, Term 1					
	3.1 Differentiate the types of traps and their uses – bottle trap, running trap, 'P' and 'S' trap, etc.. 3.2 Explain the functions of the water seals in traps. 3.3 Explain the causes of unsealing of traps and their remedies.	▪ Discuss various traps and understand their differences. ▪ Define water seal and explain the functions of it in traps. ▪ Outline the causes of unseal of traps ▪ Prepare detailed notes for the students.	▪ Various traps e.g. Bottle trap, Running trap, 'S' trap, 'P' trap on display ▪ General Welding Tools	▪ Sketch and describe different types of traps ▪ Demonstrate the positioning and fixing of traps, and carry out their test to ensure efficiency. ▪ Fix traps to the sanitary systems and test for efficiency.	▪ Guide the student to Sketch and describe different types of traps ▪ Guide the student to demonstrate the positioning and fixing of traps, and carry out their test to ensure efficiency. ▪ Guide the student to Fix traps to the sanitary systems and test for efficiency	List the types of traps and their uses – bottle trap, running trap, 'P' and 'S' trap, etc. Mention the functions of the water seals in traps. What the causes of unsealing of traps and their remedies. Project install different traps

	General Objective 4.0: Know the Methods and Techniques of Installing Waste and Soil Pipes above Ground level. Year 2, Term 1					
9-11	4.1 List the 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.	▪ 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.	▪ Sample of various soil and waste pipes ▪ Tools required for waste and soil pipe ▪ Suitable testing media for the installation to be assembled.	▪ Demonstrate Selecting the various types of soil and waste appliances ▪ Identify pipes that are suitable for use in soil and waste installations ▪ Demonstrate Installing and test soil and waste pipes above ground level.	▪ Guide the student to Select the various types of soil and waste appliances ▪ Guide the student to Identify pipes that are suitable for use in soil and waste installations ▪ Guide the student to Install and test soil and waste pipes above ground level.	Enumerate the types of soil and waste appliances. Explain the Principles and arrangement of soil waste pipes above ground e.g. (one pipe, two pipe and single stack systems). State the materials used for and the sizes of waste and soil pipes. Project: Installing waste pipes above ground level. and test soil
	General Objective 5.0: Understand the basic Principles of Good Drainage, the Layout of Simple Drainage System and the Properties of Materials Used. Year 2, Term 2					
11-14	5.1 State the basic principles of good drainage system. 5.2 Explain the main provisions	▪ Explain basic principle, regulation of a good drainage system. ▪ Explain the types of drainage system ▪ Prepare detailed	▪ Suitable (materials) pipes and fittings for above and underground drainage. Tools required – As stated above	▪ Select and determine sizes of drain pipes. ▪ Draw simple drainage layout and sketch drainage pipe	▪ Guide student in Selecting and determine sizes of drain pipes. ▪ Guide student to	State the basic principles of good drainage system. Mention the main regulation with regard to domestic drainage. list the types of drainage systems.

	of the building regulation with regard to domestic drainage. 5.3 State the types of drainage systems i.e above ground and under - ground 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 Explain the metric units of measurement use in below ground drainage. **5.6** Mention factors to be considered for	notes for the students. ▪ Explain factors to be considered for designing, layout and sizing of a drainage system below ground drainage system i.e. excavation, gradients location of the sewer and connection, Access points etc.	suitable for drainage includes; diggers, Shovels, Cement, etc. PPE Handout Video and pictures Regulations /bylaws	joints, man holes, etc. ▪ Put up a simple drainage layout, stating the correct sizes of pipes used. ▪ Apply the main provisions of the building regulation with regard to domestic drainage installation. ▪ Put up simple sketches of drain pipe joints and suitable drainage interceptions. ▪ Enumerate standard metric units used in below ground drainage system i.e. length: millimetres (mm), Area: meters square	draw simple drainage layout and sketch drainage pipe joints, man holes, etc. ▪ Guide student to put up a simple drainage layout, stating the correct sizes of pipes used. ▪ Guide student to make simple sketches of drain pipe joints and suitable drainage interceptions. ▪ Guide student in carrying out measurement using standard metric units	State the properties of and the materials used for drainage system. Explain the metric units Mention factors to be considered for designing, drainage system

	designing, drainage system			(m2), Volume: cubic meter (m3), Flow rate: litres/minutes (L/m). ▪ Identify different diameters of size of pipes use in below ground drainage system. I.e. 40mm, 50mm, 110mm, etc. ▪ Identify plan or specifications for the dwelling of building for designing the layout and sizing of a below ground drainage system. 3.	used in below ground drainage system i.e. length: millimetres (mm), Area: meters square (m2), Volume: cubic meter (m3), Flow rate: litres/minutes (L/m). ▪ Guide the student in identifying the different diameters of size of pipes use in below ground drainage system. I.e. 40mm, 50mm, 110mm, etc. ▪ Guide the student in Identifying the plan or specifications for the dwelling of building for designing	

					the layout and sizing of a below ground drainage system. 3.	
	General Objective 6.0: Understand the Purpose of Septic Tank and soak-away pit and their Construction in buildings. Year 2, Term 2					
14-17	6.1 State the purpose of septic tank and soak-away drainage system. 6.2 State the different types of septic tank and soak-away drainage system. 6.3 Explain the principles of constructing septic tanks and soak-	▪ explain the purpose of septic tank and soak-away drainage ▪ Explain the principles of construction and the operation of septic tank and soak-away drainage system. ▪ Explain the different septic tank and soak-away drainage system. ▪ Draw to scale	▪ Manual and Brochures ▪ All normal tools needed for drainage installation as above ▪ Visitation to mini-private septic-tank system ▪ Sketches ▪ Video and pictures of various type of septic tank and soak-away drainage system ▪ PPE	▪ Identify installation code for below ground drainage pipes and fittings. ▪ Explain the function of manufacturer's pipes and fittings specification for below ground drainage. ▪ Identify the procedures of below ground drainage pipes and fittings installation government	▪ Guide the student to State the purpose of septic tank and soak-away drainage system. ▪ Guide the student to explain the principles of constructing septic tanks and soak-away drainage system. ▪ Guide the student to	Explain the purpose of septic tank and soak-away drainage system. Explain the different types of septic tank and soak-away drainage system. Explain the principles of constructing septic tanks and soak-away drainage system. Draw a standard septic tank of domestic dwelling. Carry out connections of drainage systems to septic tank and soak-away drainage system

	away drainage system. 6.4 Draw a standard septic tank of domestic dwelling. 6.5 Choose the recommended sizes of septic tank and soak-away for building. 6.6 Carry out connections of drainage systems to septic tank and soak-away drainage system 6.7 State the importance of ventilation in septic tanks. 6.8 Select the appropriate types of soak-away pit and its construction	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.	▪ Flip chart	approval ▪ Explain safe and productive manners of excavation trenching and back filling of below ground drainage pipes and fittings relevant to the safety standard. ▪ Discuss reasons that below ground drainage pipes and fittings excavation must be mark-out, trench width and depth (cover), and bedding must be consider. ▪ Carry out levelling and determining of the relevant gradients in below ground pipes and fitting laying. ▪ List factors to consider in below ground pipes and	make standard sketches septic tank of domestic dwelling. ▪ Guide the student to choose various recommended sizes of septic tank and soak-away for building. ▪ Guide the student to Carry out connections of drainage systems to septic tank and soak-away drainage system ▪ Guide the student to State the importance of ventilation in septic tanks. ▪ Guide the student to select the appropriate	list the importance of ventilation in septic tanks. Explain the factors that govern the choice of type and size of soak away pits/septic tanks

	for different soils. 6.9 Explain the factors that govern the choice of type and size of soak away pits/septic tanks			fittings, laying trench according to general rules. ▪ Identify methods of joining below ground drainage pipes. ▪ State the procedures of joining Twin wall pipes in below ground drainage pipe. ▪ Use lubricant, tape rule after chamfered and of the pipe to join twin wall and solid wall pipes with rubber ring joints of below ground drainage installation.	types of soak-away pit construction for various soils. ▪ Guide the student to Explain the factors that govern the choice of type and size of soak away pits/septic tanks	
General Objective 7.0: Carry out Connections of the Drainage System to Cesspool. Year 2, Term 2						
17-20	7.1 State the purpose of a cesspool – drainage system. 7.2 State the requirements for the location of a cesspool. 7.3 Explain the	▪ Explain the purpose of a cesspool – drainage system. Explain the principle involved in construction of a cesspool	▪ All Construction Tools as above. ▪ PPE ▪ Pictures and video of connection of cesspool ▪ Flip chart ▪ Sketches	▪ Draw to scale a standard cesspool drainage system for domestic dwellings. ▪ Construct a standard cesspool drainage system for domestic	▪ Guide the student to state the purpose of a cesspool – drainage system. ▪ Guide the student to	List the purpose of a cesspool – drainage system. List the requirements for the location of a cesspool. mention the principle of constructing a cesspool

	principle of constructing a cesspool drainage system.	drainage system ▪ Explain the proper requirement for the location of a cesspool. ▪ Prepare detailed notes for the students.	▪ Regulation /byelaws	dwellings. ▪ Draw to scale a standard cesspool system ▪ Demonstrate the construction of a standard cesspool drainage system for domestic dwellings.	State the requirements for the location of a cesspool. ▪ Guide the student to explain the principle of constructing a cesspool drainage system. ▪ Guide the student in the construction of a standard cesspool drainage system for domestic dwellings. ▪ Guide the learner to draw to scale a	drainage system

					standard cesspool drainage system for domestic dwellings.	
General Objective 8.0: Understand the Principles of environmental Sanitation and its Application to the Installation and Tests of a Surface Drainage System. Year 2, Term 2						
20-24	8.1 State the importance of environmental sanitation. 8.2 List the materials used in surface drainage and state their properties 8.3 Explain Fabrication of common supports that can be used for pipe and gutter 8.4 Explain installation of simple	▪ Explain the importance of environmental sanitation. ▪ Describe the materials used in surface drainage and state their properties ▪ Demonstrate Fabrication of common supports that can be used for pipe and gutter ▪ Demonstrate installation of simple roof drainage ▪ Explain support for pipes and gutters for collecting rain	▪ Aluminium ▪ P.V.C. ▪ Galvanise iron ▪ Flat bar ▪ Screws and; ▪ All common tools as listed above. ▪ PPE ▪ Flip chart ▪ Handout ▪ Video and pictures ▪ Projectors ▪ White board markers	▪ Fabricate common supports that can be used for pipe and gutter and guide students to do same. ▪ Carryout installation of simple roof drainage ▪ Manufacture support for pipes and gutters for collecting rain water ▪ Carry out roof drainage and weathering. ▪ Make sketches showing half round, box, valley and ogee gutters.	▪ Guide the student to Fabricate common supports that can be used for pipe and gutter and guide students to do same. ▪ Guide the student to Carryout installation of simple roof drainage ▪ Guide the student to Manufacture support for pipes and gutters for collecting	Mention some of the importance of environmental sanitation. List some of the materials used in surface drainage and state their properties Mention common supports that can be used for pipe and gutter Carryout installation of simple roof drainage Describe support for pipes and gutters for collecting rain water Explain roof drainage and weathering.

	roof drainage 8.5 Describe support for pipes and gutters for collecting rain water 8.6 Explain roof drainage and weathering. 8.7 Make sketches showing half round, box, valley and ogee gutters. 8.8 Describe appropriate component for connecting surface drainage to public sewer or soak-away	water ▪ Describe roof drainage and weathering. ▪ Demonstrate sketches showing half round, box, valley and ogee gutters. ▪ Explain appropriate component for connecting surface drainage to public sewer or soak-away ▪ Explain and prepare notes accordingly.		▪ Join appropriate component and connect surface drainage to public sewer or soak-away. (Depending on the locality).	rain water ▪ Guide the student to carry out roof drainage and weathering. ▪ Guide the student to make sketches showing half round, box, valley and ogee gutters. ▪ Guide the student to Join appropriate component and connect surface drainage to public sewer or soak-away. (Depending on the locality).	Make sketches showing half round, box, valley and ogee gutters. List component for connecting surface drainage to public sewer or soak-away

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,
COURSE CODE: CPF 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. Understand and demonstrate the causes and prevention of water pollution.
5. Understand the Types and demonstrate the uses 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. Understand the operational principles of air conditioners and install air cool engine.

PRACTICAL COMPETENCE 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, and fittings and design a simple scheme for air-conditioning installation.

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING						
Course: HOT AND COLD-WATERSERVICES, HEATING & VENTILATION		**Course Code : CPF 20**				**Contact Hours 7hrs.week**
Course Specification: Theoretical				**Practical Contents**		
Week	**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.**					
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Evaluation**
1-5	1.1 State the purpose of service installations to domestic and industrial buildings. 1.2 Explain the average daily water consumption requirements for different buildings. . 1.3 Explain the installation to domestic, commercial and industrial buildings from a working drawing. 1.4 Explain cylinder tank system of hot water supply. 1.5 Explain indirect hot water and heating system. 1.6 State the principles and the uses of mixing valves	▪ Discuss all the activities in 1.1 to 1.6 and prepare detailed notes accordingly.	▪ Chalkboard ▪ Textbooks ▪ Drawing Board and equipment ▪ Computer with appropriate CAD programme (software and hardware ▪ Sample of water heater ▪ Valves ▪ Samples of Hot water component ▪ Ventilation and heating system	▪ Carryout service installations to domestic and industrial buildings. ▪ Estimate the average daily water consumption requirements for different buildings. ▪ Carry out simple calculation of cold-water pipe sizing using appropriate formulae and tables. ▪ Plan and design installation scheme completely. ▪ Prepare schedule of materials and fittings required for particular installations. ▪ Carry out installation to domestic, commercial and	Guide the student to carryout all the activities in 1.1 to 1.6	Explain indirect hot water and heating system. State the principles and the uses of mixing valves Project; Carry out complete installation of a hot and cold water supply system to specification. Project ; Carry out complete installation of ventilation and heating system to specification

				industrial buildings from a working drawing. ▪ Design indirect hot water system ▪ Design cylinder tank system of hot water supply. ▪ Design indirect hot water and heating system. ▪ Identify the principles and the uses of mixing valves ▪ Select the appropriate type of boiler for a particular installation. E.g. material for manufacture rating, etc. ▪ Carry out complete installation of a hot water supply system to specification.		
	General Objective 2.0: Understand the method of selecting pumps for water supply purposes					
6-10	2.1 Review previous knowledge on the operation of pumps 2.2 List the principles of operation of centrifugal pumps 2.3 State the need for and	▪ Explain operation principles of centrifugal pump ▪ Explain calculations on	▪ Charts and brochures ▪ Sample of Centrifugal pump ▪ Submersible pumps	▪ Carry out simple calculations on pumps sizing and discharge using appropriate formulae ▪ Carry out	▪ Guide the student to Carry out simple calculations on pumps sizing and discharge using appropriate formulae ▪ Guide the student to	List the principles of operation of centrifugal pumps Mention some the factors to be considered for

	provision of automatic controls for pumps. 2.4 Explain the factors to be considered for selecting different types of pumps	pump sizing and discharge using appropriate formulae ▪ Discuss elementary design of a scheme of water supply to a multistorey building. ▪ Discuss the factors to be considered for selecting different types of pumps	▪ Booster pump ▪ Plunger pump ▪ Axial flow pumps ▪ diaphragm pump ▪ hand pump ▪ Calculator ▪ Drawing equipment ▪ PPE ▪ Video and pictures	elementary design of a scheme of water supply to multi-storey buildings ▪ Carry out the estimate of water consumption requirement for housing estate. ▪ Carryout selection of pumps	Carry out elementary design of a scheme of water supply to multi-storey buildings ▪ Guide the student to carry out the estimate of water consumption requirement for housing estate. ▪ Guide the student to Carryout selection of pumps	selecting different types of pumps list various type of pump
	General Objective 3.0: Understand the economic use of water and the installation of water meter for domestic and industrial Purposes.					
11-12	**3.1** State the causes of water wastage a. Leakage b. Defective fitting c. Personal negligence d. Rust e. burst pipe **3.2** State the appropriate remedies 3.1 **3.3** Explain the purpose of installing water meters **3.4** Select the appropriate type of water meters for a scheme and	▪ Explain the causes of water wastage Leakage Defective fitting Personal negligence Rust Burst pipe ▪ Explain appropriate measures to remedy each cause. ▪ Explains the purpose of water meters	▪ Charts and brochures. ▪ Sample of water meter ▪ Installation tools ▪ Testing Bay	▪ Check the causes of water wastage Leakage Defective fitting Personal negligence Rust burst pipe ▪ Carryout the appropriate remedies. ▪ Carryout installation of water meters. ▪ Select appropriate type of water meters for a scheme	▪ Guide the student to carry out all the activities in 3.1 to 3.5	Explain the following causes of water wastage Leakage Defective fitting Personal negligence Rust burst pipe State the appropriate remedies 3.1 Explain the purpose of installing water meters List type of water meters for a scheme

	carry out its installation **3.5** Explain meter reading and costing.	and list the different types. ▪ Discuses suitable setting positions of water meters and to learn how to read and cost water meters. ▪ Demonstrate and explain all the activities from 3.1-3.5		and carry out its installation. ▪ Carry out meter reading and costing.		and carry out its installation Project :installation of water meter
	General Objective 4.0: Understand and demonstrate the Causes and Prevention of Water Pollution					
13-17	4.1 State the effects of pollution, Dis-infect polluted on cold water installation system. 4.2 State the effects of such Remedies 4.3 Explain the dis-infection of a polluted cold-water installation.	▪ Explain to the students 4.1, 4.2 and 4.3 and provide notes.	▪ Chalkboard and charts ▪ Disinfecting chemicals ▪ Water ▪ Pollutant ▪ Nose Mask ▪ Hand gloves ▪ PPE ▪ Test Lab etc.	▪ Check the sources of pollution e.g. Burst pipes and Défective valves, etc. ▪ Carry out the dis-infection of a polluted cold-water installation.	▪ Guide student to the students to carry out activities 4.1, 4.2 and 4.3 and provide notes.	State the effects of pollution Dis-infect polluted cold water installation system. State the effects of such Remedies Explain the dis-infection of a polluted cold-water installation.
	General Objective 5.0: Understand the Types and demonstrate the uses Of Heating Installations					
18-21	5.1 State the importance of hot water heating system. 5.2 Define the terms used in heating system e.g.	▪ Explain and prepare notes for 5.1 to 5.6 ▪ Group discussion with	▪ Drawing equipment ▪ Sample of suitable pump for a	▪ Identify the basic requirements needed when designing hot water heating installation	▪ Guide the student to identify the basic requirements needed when designing hot water heating	State the importance of hot water heating system. Define the terms used

	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 Explain the difference between, single and two pipe systems of heating 5.5 List 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.	teacher interaction	heating installation system ▪ Sketches ▪ Mechanical drawings	▪ Design various types of heating systems, e.g., single pipe up feed, etc	installation ▪ Guide student to design various types of heating systems	in heating system e.g. latent heat, circulating head, index radiator, friction head, etc. State the basic information needed when designing a hot water heating installation project install single and two pipe systems of heating List the advantages and disadvantages of single and two pipe systems of heating. State the use and the correct positioning of pumps in a heating installation.
	General Objective 6.0: Understand the Uses of Steam Calorifiers for Heating Water					
22-25	6.1 State the uses of calorifiers for heating water 6.2 explain the position of source of energy for successful operation of calorifiers 6.3 Explain the principles of operation of steam calorifiers	▪ Discuss and prepare notes for 6.1 to 6.5.	▪ Sample of calorifier with valves on display ▪ Charts and brochures ▪ Sketching book. ▪ PPE ▪ Steam trap	▪ 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	▪ Guide the students to determine the position for correct sitting of calorifier and explain the source of energy for its successful operation ▪ Guide the students to sketch various types of calorifier and explain	State the uses of calorifiers for heating water. Explain the principles of operation of steam calorifiers. Lists various types of calorifiers

	6.4 Lists various types of calorifiers 6.5 Explain 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		▪ Thermometer ▪ Altitude gauge, etc ▪ Thermostat	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. i. Pressure reducing valve ii. Steam trap iii. Thermostat valve iv. Attitude gauge	the principles of operation of each ▪ Guide the students to determine appropriate valves used with the calorifier and explain their operational principles e.g. v. Pressure reducing valve vi. Steam trap vii. Thermostat valve viii. Attitude gauge	List and explain valves used with calorifiers and their operational principles.
	General Objective 7.0: Understand the Uses and Types of Space Heaters and Install Space Heaters Where Necessary					
26-28	**7.1** State the principles of space heaters **7.2** Enumerate the different types of space heaters **7.3** State the disadvantages and advantages of the various types. **7.4** Explain the installation procedure of space heaters	▪ Explain and prepare notes for 7.1 to 7.4.	▪ Sample of space heater ▪ on display ▪ Chart and brochures ▪ Installation tools ▪ Safety Posters	▪ Identify the principles of operation of space heaters and explain the difference between its use and convectional heating installation ▪ Identify different the types of space heaters and state the advantages and disadvantages of each ▪ Demonstrate carry out installation of space heater.	▪ Guide the student to Identify the principles of operation of space heaters and explain the difference between its use and convectional heating installation ▪ Guide the student to different the types of space heaters and state the advantages and disadvantages of each ▪ Guide the student to carry out installation of space heater.	State the principles of space heaters Enumerate the different types of space heaters State the disadvantages and advantages of the various types. Project: installation of space heaters

	General Objective 8.0: Understand the Principles of solar heating systems and carry out installation of solar heating system					
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 8.4 Explain installation of solar heating system	▪ Make clear explanations on activities on 8.1-8.4 and prepare notes. ▪	▪ Charts ▪ Solar heating conductors and tools	▪ Identify the need for and the use of solar heating. ▪ Demonstrate installation of a model solar heating system and explain the principlesof operations.	▪ Guide the student to identify the need for and the use of solar heating. ▪ Guide the student to install a model solar heating system and explain principles of operations	Explain the source of solar heating energy State the importance and usage of specific material for solar heating installation. Explain the principles of solar heating energy Project: installation of solar heating system
	General Objective 9.0: Understand the operational principles of air conditioners and installation of an air cool engine					
	9.1 Explain the need and the importance for the provision of air-conditioning system in buildings 9.2 State the principles of operation of air-conditioning systems. 9.3 Explain the different types of air-conditioning systems 9.4 Explain the Design a simple scheme for air-conditioning installation.	▪ Describe and prepare notes for 9.1 to 9.4.	▪ Charts and brochure Installation tools. ▪ Sample of Air conditioner ▪ Mechanical drawings ▪ Flip chart ▪ Video and pictures	▪ List different types of air-conditioning systems and explain principles of operation of each. ▪ Determine the essentials materials and fitting that may be needed in an air-conditioning installation. ▪ Design a simple scheme for air-conditioning installation	Guide the student to: ▪ Identify the different types of air-conditioning systems and explain principles of operation of each. ▪ Determine the essentials materials and fitting that may be needed in an air-conditioning installation. ▪ Design a simple scheme for air-conditioning installation	State the importance for the provision of air-conditioning system in buildings. State the principles of operation of air-conditioning systems. List and explain the different types of air-conditioning systems. Explain the Design a simple scheme for air-conditioning installation.

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE IN PLUMBING AND PIPE FITTING
COURSE: SANITATION AND DRAINAGE II CORUSE CODE: CPF 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. Understand the general layout and design of drainage system for town and country house.
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: CPF 22**		**Contact Hours: 7hrs/week**	
Course Specification: Theoretical			**Practical Contents**			
WEEK	**General Objective 1.0: Understand the arrangement and fixing of sanitary appliances in public building and factories. Year 1, Term 1**					
1-9	**Specific Learning Outcome**	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Evaluation**
	1.1 List the types of arrangement and fixings of sanitary appliances in building using separate and combined systems (one pipe, two pipes and single stack systems). 1.2 Explain one-pipe, two-pipes and single stack systems for buildings. 1.3 Explain the uses and the importance of soil and waste pipe in present day	▪ Discuss the activities in 1.1 to 1.3	▪ Sample of Specific types of Appliances on display ▪ Visit and excursion to Constructi on sites, ▪ Installation materials and tools ▪ Industrial attachment ▪ Projectors ▪ White board makers ▪ PPE etc	▪ Arrangement & Fixing Sanitary Appliances ▪ identify specific sanitary appliances suitable in Hotels, Schools, Public Buildings and Factories ▪ carryout simple layout sketches of mentioned appliances in various mentioned buildings ▪ Design one pipe, two pipe and single pipe system for dwellings and flats including multi-storey buildings. ▪ Install any type of sanitary appliance in public buildings or industries. ▪ Select various types of appliances to be used in different	Guide the student to: ▪ Arrange & Fix Sanitary Appliances ▪ Identify specific sanitary appliances suitable in Hotels, Schools, Public Buildings and Factories ▪ Carryout simple layout sketches of mentioned appliances in various mentioned buildings ▪ Design one pipe, two pipe and single pipe system for dwellings and flats including multi-storey buildings. ▪ Install any type of sanitary appliance in public buildings or industries. ▪ Select various types of appliances to be used in different	▪ List the types of fixings of sanitary appliances in building. ▪ Explain one-pipe, two-pipes and single stack systems for buildings. ▪ Explain the use and the importance of for soil and waste pipe in present day installation. ▪ Project on : one pipe, two pipe and single pipe system install different types of fixtures

	installation eg polyvinyl, chloride (P.V.C.) UPVC, CPVC etc ,			types of buildings. ▪ Carry out proper ventilation of sanitary apartment e.g. natural, measurement.	types of buildings. ▪ Carry out proper ventilation of sanitary apartment e.g. natural, measurement.	

	General Objective 2.0: understand the general layout and design of drainage system for town & country houses. Year 1, Term 2 & 3					
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	▪ Discuss the activities from 2.1 to 2.3.	▪ Drawing Instruments ▪ Calculator, site visit ▪ Relevant design Regulations and byelaws ▪ Installation Materials and tools	▪ 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. ▪ Calculate the rate of discharges through drainage pipes and channels using appropriate ``instruments/formulae/chart ▪ Explain and prepare notes. Assess the students.	Guide the student to: ▪ Determine Specific requirements and regulations governing the design of drainage schemes for town and country houses. ▪ Carryout model design of drainage layout schemes for town and country houses. ▪ Calculate the rate of discharges through drainage pipes and channels using appropriate instruments/formulae/chart ▪ Explain and prepare notes. Assess the students.	▪ Describe the different systems of drainage installations. ▪ State the requirements and the regulations governing the design of drainage. ▪ Plan and design simple drainage layout scheme for town and country houses. ▪ Calculate the rate of discharge from drainage channels using appropriate instruments/formulae/chart
	General Objective 3.0: CARRY OUT DRAINAGE LAYOUT USING APPROPRIATE INSTRUMENTS. Year 1, Term 3					

	3.1 Listtypes of setting out instruments, e.g.,ranging pole spirt level theodolite, dumpy level, sight level, sight rail, boning rods, etc 3.2 Explain simple setting out of drainage layout using appropriate instrument.	▪ Explain and prepare notes 3.1 to 3.2. ▪ Assess the students.	▪ Gas equipment ▪ Blow pipe, Necessary metal support, various sizes of metals ▪ Chart, Apron and Gloves. ▪ Tools and equipment for setting out	▪ Install timbering to sides of drainage trenches and state reason for the choice of the timbering used. ▪ Test drains and soil pipes by means of smoke, water, chemical and air pressure. ▪ Identifyvarious setting out instruments e.g. Dumpy level, Sight level, sight vail, and boning Rod, etc. and explain the uses of each. ▪ Carryouta simple drainage layout using the above listed instruments ▪ Ask students use of timbering and to carryout testing of soil pipes and drains by means of smoke, water, chemical or air-pressure.	Guide the student to: ▪ Install timbering to sides of drainage trenches and state reason for the choice of the timbering used. ▪ Test drains and soil pipes by means of smoke, water, chemical and air pressure. ▪ Identify various setting out instruments e.g. ranging pole Dumpy level, Sight level, sight vail, and boning Rod, etc. and explain the uses of each. ▪ Carryout a simple drainage layout using the above listed instruments ▪ Ask students use of timbering and to carryout testing of soil pipes and drains by means of smoke, water, chemical or air-pressure.	▪ List types of setting out instruments, ▪ Project on setting out of drainage layout using appropriate instrument.

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**
Course Specification: Theoretical				**Practical Contents**		
WEEK	**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.**					
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Evaluation**

1-9	1.1 State the principles of manufacturing of acetylene gas. 1.2 Explain storage of acetylene gas 1.3 Explain the installation of fitting using gas welding equipment. 1.4 Explain the storage and handling of gas welding equipment. 1.5 List different techniques in gas welding	▪ Explain and prepare notes for 1.1 to 1.5.	▪ Welding equipment ▪ M.S. pipe of various sizes ▪ M.S. plates of various thickness ▪ Marking tools. ▪ PPE ▪ Samples Metals fittings ▪ Pictures and video	▪ Review the principles of manufacture of acetylene gas, storage, assembly and Testing of gas welding equipment. ▪ Prepare bigger sizes of steel pipes and thicker sizes of M.s plates for welding. ▪ Identify Weld bigger sizes of steel pipe and thicker sizes of m.s. plates. ▪ Carry out fabrication and welding of plumbing models.	Guide the student to: ▪ Assembly and Testing of gas welding equipment. ▪ Prepare bigger sizes of steel pipes and thicker sizes of M.s plates for welding. ▪ Weld bigger sizes of steel pipe and thicker sizes of m.s. plates. ▪ Carry out fabrication and welding of plumbing models.	• State the principles of manufacturing of acetylene gas. • Explain storage of acetylene gas the installation of fitting using gas welding equipment. • Define the storage and handling of gas welding equipment. • List different techniques in gas welding. • Project on fabrication and welding

	General Objective 2.0: Carryout bronze welding on non-ferrous metals					
9-18	2.1 Explain Adjustment of flame for bronze welding of different metals 2.2 Explain the Fabrication of bronze welding of waste pipe models on copper pipes e.g., stack and branches, loop venting, etc. 2.3 Explain the need for bronze welding of castings, brasses and galvanised metals.	▪ Explain and prepare notes for 2.1 to 2.3.	▪ Gas Welding equipment ▪ Suitable fluxes for brazing ▪ Rods, copper pipes and Galvanise pipes ▪ PPE ▪ Video and pictures	▪ Review the proper methods of setting welding flame for bronze of different metals. ▪ Carryout fabrication and bronze welding of waste pipe models on copper pipes. ▪ Carry out successful bronze welding of brass castings and galvanise metals.	▪ Guide the student to: ▪ Adjustment of flame for bronze welding of different metals. Fabricateand carry out bronze welding of waste pipe models on copper pipes e.g. stack and branches, loop venting, etc. Carry out bronze welding of castings, brasses and galvanised metals.	Explain Adjustment of flame for bronze welding of different metals what is Fabrication in bronze welding State the important for bronze welding of castings, brasses and galvanised metals.
	General Objective: 3.0 Understand the principles of gas cutting of metals and carry out metal cutting using oxy-acetylene equipment					
19-27	3.1 State the principles of gas cutting. 3.2 Explain	▪ Explain and prepare notes on 3.1-3.2	▪ Cutting blow ▪ Pipe ▪ Metals ▪ Metal	▪ Select suitable equipment used for gas cutting ▪ Mark and prepare m.s. plate ready for gas	Guide the student to: ▪ Select suitable equipment used for gas cutting ▪ Mark and prepare m.s.	• State the principles of gas cutting. • Explain the function of

	the function of the equipment used for gas cutting.		support ▪ Charts ▪ Aprons ▪ Glove ▪ PPE ▪ Sample of metals ▪ Projectors ▪ White board markers ▪ Video and pictures	cutting ▪ Light and adjust flame correctly ▪ Carry out straight cutting observing necessary precautions ▪ Prepare template for and apply these to carry out intricate cuttings.	plate ready for gas cutting ▪ Light and adjust flame correctly ▪ Carry out straight cutting observing necessary precautions ▪ Prepare template for and apply these to carry out intricate cuttings	the equipment used for gas cutting.
General Objective 4.0: Understand the principles and functions of electric arc welding transformer and carry out electric arc welding operations with facility						
28-36	4.1 Explain Difference between electric arc welding machine and gas welding equipment. 4.2 Explain parts of the transformer and their functions	Explain and prepare note on 4.1-4.5	▪ Complete Arc striking equipment ▪ Electrodes (different gauges) ▪ Rubber boot ▪ Gloves ▪ Protecting clothing ▪ Welding shield ▪ PPE ▪ Video and pictures ▪ Projectors ▪ White	▪ Explain the difference between electric arc welding and gas welding. ▪ Enumerate the equipment needed for each class of welding and explain their differences. ▪ Identify parts of electric welding transformer and explain their functions. ▪ Set or obtain current rating suitable for thickness of metals. ▪ Demonstrate the striking of Arc ▪ Demonstrate arc welding on m.s. plates.	Guide the student to: ▪ Carryout electric arc welding and gas welding. ▪ use the equipment needed for each class of welding ▪ Identify parts of electric welding transformer and explain their functions. ▪ Set or obtain current rating suitable for thickness of metals. ▪ Demonstrate the striking of Arc ▪ Carry out arc welding on m.s. plates. ▪ Apply necessary safety precautions to be	State the difference between electric arc welding machine and gas welding equipment. State parts of the transformer and their functions State Relationship between arc welding and gas welding process List safety precautions while

	4.3 Explain Relationship between arc welding and gas welding process 4.4 Explain safety precautions while using the equipment to carry out electric arc welding. 4.5 State the reason for a complete circuit with regards to the electrode holder and the job.		board white marker	▪ Demonstrate necessary safety precautions to be observed while carryout arc welding.	observed while carryout arc welding.	using the equipment to carry out electric arc welding. State the reason for a complete circuit with regards to the electrode holder and the job

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	Pipe bending machine	5		
13	Pipe vice	5		
14	Electric Arc welding machine	2		
15	Water Leakage detector {PQWT L2000 }	5		
16	Hydraulic bending machine	2		
17	Copper bending machine	2		
18	Sheet metal folding machine	2		
19	Pipe Seaming machine	2		
20	Rolling Machine	2		
21	Stock and dies (BSW and BSF)	5		
22	Electrically operated coal furnace Spot welding machine	1 2		
23	U gauge manometer	5		
24	Chain pipe cutter	5		
25	Pipe wrench (various sizes) and types	10		

26	Paraffin blow lamp	5		
27	Try Square	10		
28	Cane rod/rod plumbing set	10		
29	Shilling rod/sewer rod	10		
30	Moveable Workshop benches	10		
31	Bench vices	10		
32.	Oil can	10		
33	Tape rule 3.5 metres	10		
34	Oxygen and acetylene cylinders	2 set		
35	Tin man's square	10		
36	Spirit level set	10		
37	Plunger	10		
38	Reamer	10		
39	Trowels	10		
40	Panel saws	10		
41	Set of G. clamp	10		
42	Ladder/ moveable scaffolds	5		
43	Hand drilling machine (manual/ mechanical)	2		
44	Sandal hand grinder	2		
45	Wheel cutter (power)	2		
46	Set of Hacksaw frame and blades	10		
47	Wooden mallet /plastic 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 set	10		
56	Tube cutter (plastic and metals)	10		
57	Set of Pliers (engineering & glass)	10		
58	set of screw drivers	10		

59	Basin wrench	10		
60	Laser measuring level	10 each		
61	Set of spanners flat and ring	10		
62	Heat treatment furnace	2		
63	Blacksmith forge (gas)	2		
64	Blacksmith tools (i) Anvil (ii) Hammers different types (Congo hammer) (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 machine, Iron/ flux	5		
69	Rawl plug	10		
70	Caulking gun tool	10		
71	Wall drill machine /set of bitseg metals and masonry	10		
72	Diamond glass cutter	10		
73	Surface table 1200 x 12000mm (4”x4”)	5		
74	Surface plate 500 x 500 mm	2		
75	Vernier Calliper	10		
76	Vee Blocks 100 x 100mm	2		
77	Chisels set (i) Flat (ii) Round nose (iii) Cross cut	5 each		
78	Micrometer 0-25 25-50			

	50-75 75-100 100-125 125-150	2 each		
79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97	Benches Files: a. 250mm Flat Rough b. 10 Hand Rough c. 10” Round Rough d. 10” Three sq e. Square Rough f. 10” Half Round 2nd cut g. 200mm Warding file h. 100” Retail File i. Wallets of Warding File As in a – i 2nd Cut files As in a – i Smooth files As in a - i Dead Smooth Steel Rules (12”) 300mm Internal wire brush Scribers Pocket Size (200mm) Vernier Callipers Centre Punches (½ lb) Hammer ¼ kg (1lb) Hammer ¾kg Pair of Pliers 150mm Tool Box and Lock Odd-leg Callipers Engineers Square 100 Set of Screw Drivers 200mm Pair of tin snip Nippy vice – 4 FITTING – WORKSHOP EQUIPMENT Drilling Machines Sensitive Mandrels, 25mm, 32mm, 32mm, 38mm Drilling Machine Radial	10 each		

98	Surface gauge			
100	Vernier Height Gauges			
101	Vee Blocks 100 x 100mm pairs			
102	Vee Blocks 200mm			
103	Parallels strips (pairs) 37 x 25 x 300			
104	Flat Scrappers			
105	Half round scrapers			
106	Triangular scraper			
107	Stock and Dies			
108	a. tape sets 3mm – 12mm			
109	b (BA) 150 sets 0-10			
	Sockets Spanners 3 – 22mm			
	Open ended 3 – 22mm			
110	Pedestal Grinders			
111	Reamers 3-25mm			
112	Reamers Machine 3-25mm			
113	Dial Gauge			
114	Card wire			
115	Drills			
116	a. Straight Shank 1½ - 10mm			
117	b. Straight shank 6-15mm			
	c. Taper shank 3-22mm			
	d. Drift			
	Heat treatment furnace (medium size)			
	Chase wedge			
118	Copper bit			
119	Gimlet for wood screw			
120	Arboy press			
121	Extractors			
122	Snips (Tin sheer) 200mm			
123	Stud extractors			
124	Circlip Plier (internal and external)			
125	Rawl plug			
126	Hacking/utility knife			
127	Brazing lamp			
128	Callipers Internal and external			

129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 156 157 158 159	Hammers (ball pein and flat pein) Sledge hammer Bent pin or bolt Brace and bit up to 10mm Bobbins all sizes to 50mm Bradawl Bossing stick Boxwood dresser (large and small) Boxwood setting in stick Gauge for wood Hand Dummy Hand ladle Lavatory Union Key Shave – hooks Spring for bending 13mm and 19mm Light gauge copper pipe Steel drip-plate Wiping cloths /towels PPE (personal protective equipment) First aids box Pick axe Shovels Hydraulic testing bucket Pressure gauge Snake machine Drain inspection camera Hydro jetting machine Heat shield or pads Mole grips Plumbing torch			
160	Hole saw kit	10		
161	CNC bending machine	1		
162	CNC tube cutting machine and forming	1		
163	Fitting press plier	10		
164	Propane gas cylinder and torch	10		

	Propane gas torch			
165	Plumbing software	1		
166	Ppr welding machine	10		
167	Snake machine	10		
168	Plumbing snake auger(35/ft)	10		
169	Calking gun	10		
170	Gas burner	10		
171	Drain cleaner vacuum pump	10		
172	Swaging tools for copper pipe	10		
173	Swaging tools for plastic pipe			
174	Flaring tools for cooper pipes	10		

LIST OF PARTICIPANTS

S/NO	NAME	ADDRESS
1.	Sarah Fatu Agada	FOCI SKILLS ACADEMY KATAMPE ABUJA.
2.	Bldr. Mahmud Salihu	NIOB
3.	Salisu Attahir Ibrahim	GTC Kano
4.	Engr. Mahmud Hussaini	NATE
5.	Balogun Bola Tairu	BATVE
6.	Mrs. Edna Agbuke	NABTEB
7.	Engr Bashir Datti	NBTE
8.	Baros Salihu Umar	NBTE