PLUMBING THEORY

INTRODUCTION

plumbing trade theory is expected to provide theoritical knowledge to the trainee to supplement the practice. This will take 20% of the trade's time.

GENERAL OBJECTIVES

At the end of this subject the trainee should have

a) Acquired knowledge for proper use, care and maintenance of plumbing tools and equipment

b) Acquired knowledge of the common plumbing materials

c) Developed safety awareness that is required in a working environment

d) Developed ability to produce and to interprete working drawings

e) Acquired knowledge of Building By-laws related to plumbing work

f) Developed mathematical competencies to perform a given task

g) Acquired knowledge in the basic principles of estimating and costing of plumbing tasks.

15.03 SUBJECT SUMMARY AND TIME ALLOCATION

PLUMBING THEORY

STAGE ONE (110 HOURS)

CODE	TOPIC	SUB-TOPIC	TIME HOURS
15.1.1.T	Introduction	- History of plumbing - Relationship of plumbing to other trades	2
15.1.2.T	Safety	- General - Workshop and on site - Personal - First Aid - Fire-fighting	4
15.1.3.T	Tools and equipment	- Measuring - Marking - Cutting - Forming - Holding - Fastening	8
15.1.4.T	Metals used in plumbing	- Properties - Classification - Heat treatment	8
15.1.5.T	Alloys	- Types - Properties - Application	6
15.1.6.T	Water	- Properties - Sources - Hardness in water	6
15.1.7.T	Pipework	- Materials - Classification - Jointing for domestic pipe work - Bending - Protection - Supporting	12

	TOPIC	SUB-TOPIC	TIME HOURS
8.T	Cold water supply	- Storage - Distribution in domestic buildings	16
9.T	Hot water supply	- Water heaters - Domestic hotwater systems - Heat insulation - Storage vessels	16
10.T	Taps and valves	- Types of taps and their applications - Types of valves and their applications - Maintenance of taps and valves	10
11.T	Sanitary Appliances	- Materials - Types	10
12.T	Roof Weathering	- Materials - Jointing Techniques - Gutter and down pipes	12
		Total	110

PLUMBING CRAFT THEORY STAGE 1

15.1.1T INTRODUCTION (2 HOURS)

15.1.1.T1 Specific Objectives

At the end of this topic, the trainee should be able to:-

a) Narrate the history of plumbing trade
b) State relationship existing between plumbing and other building trades.

15.1.1.T11 History of plumbing

- Materials used
- Origin

15.1.1.T12 Relationship of plumbing and other building trades

- Masonry
- Carpentry

15.1.2T SAFETY (4 HOURS)

15.1.2.T1 Specific Objectives

At the end of this topic, the trainee should be able to:-

a) State safety precautions to be observed in the workshop and on the site
b) List classifications of fire
c) Select suitable fire fighting equipment for a given class of fire

15.1.2.T11 Safety precautions

(i) Workshop - workshop layout
- workshop cleanliness
- workshop behaviour
- clothing
- First aid

(ii) The site - Site layout and regulations
- Handling and storage of tools and equipments
- Clothing
- Behaviour on the site
- First Aid

15.1.2.T12 Classification of fire
- Class A
- Class B
- Class C
- Class D

15.1.2.T13 Types of extinguishers and equipment
- CO_2 extinguishers
- Dry powder extinguishers
- Water extinguishers
- Sand buckets
- Blankets
- Tree branches

TOOLS AND EQUIPMENT (8 HOURS)

15.1.3.T1 Specific Objectives

At the end of this topic, the trainee should be able to:-
a) State types of tools and equipment used in a given plumbing task
b) Sketch various tools and equipment used in a given plumbing exercise
c) State methods of caring and maintaining given plumbing tools and equipment

15.1.3.T11 Types of tools and equipment used in plumbing
(i) Measuring
(ii) Marking
(iii) Cutting
(iv) Forming

(v) Fastening
(vi) Holding

15.1.3.T12 Sketching of tools and equipments used in plumbing
(i) Measuring
(ii) Marking out
(iii) Cutting
(iv) Forming
(v) Fastening
(vi) Holding

15.1.3.T13 Methods of caring and maintaining tools and equipments
(i) Cleaning
(ii) Oiling
(iii) Sharpening
(iv) Storing

15.1.4T METALS USED IN PLUMBING TRADE (8 HOURS)

15.1.4.T1 Specific Objectives

At the end of this topic, the trainee should be able to:-
a) Describe mechanical properties of metals
b) Classify types of metals
c) Describe the manufacture of ferrous metal
d) Describe methods of heat treatment of steel

15.1.4.T11 Mechanical properties of metal
- Ductility
- Malleability
- Brittleness
- Hardness

15.1.4.T12 Classification of metals
- Ferrous metals
- Non-ferrous metals

15.1.4.T13 Manufacture of ferrous metals
- Pig-iron
- Wrought iron
- Cast-iron
- Steel

15.1.4.T14 Heat treatment of steel
- Annealing
- Tempering
- Hardening
- Normalizing
- Case hardening

ALLOYS (6 HOURS)

15.1.5.T1 Specific Objectives

At the end of this topic, the trainee should be able to:-
a) Identify given alloys
b) List common tynes of alloys;

15.1.5.T11 Common alloys
- Bronze
- Brass
- Gunmetal
- Solder

15.1.5.T12 Physical properties of alloys of:
- Copper alloys
- Lead alloys

WATER (8 HOURS)

15.1.6.T1
~~15.1.6.T1~~ Specific Objectives

At the end of this topic, the trainee should be able to:-
a) State the sources of water
b) State the general properties of water

c) State characteristics of water from different sources
) Describe the process that comprise the hydrological cycle
e) Explain the effects of water hardness in domestic and industrial water supply

15.1.6.T11 General properties of water
- Physical
- Chemical

15.1.6.T12 Characteristics of water from different sources
- Surface water
- Ground water
- Rainwater

15.1.6.T13 Process of hydrological cycle
- Precipitation
- Evaporation
- Transpiration
- Percolation and infiltration
- Surface run-off

15.1.6.T14 Effects of hardness in domestic and industrial water supply
- Scaling
- Furring

15.1.7T PIPEWORK (12 HOURS)

15.1.7.T1 Specific Objectives

At the end of this topic, the trainee should be able to:-
a) List materials used in pipework
b) State classification of pipes with KBS/BS Standards
c) Describe methods of jointing pipes
d) Explain methods of bending pipes

e) Describe methods of protecting pipes
f) Describe methods of supporting pipes

15.1.7.T11 Materials used in pipework
- Mild steel
- Cooper
- Plastic
- Fibre Glass pipes

15.1.7.T12 K.B.S./B.S. classification of copper, steel and plastic

15.1.7.T13 Pipe jointing methods for
- Copper pipes
- Mild steel
- Plastic pipes

15.1.7.T14 Pipe bending methods
- Cold bending
- Hot bending

15.1.7.T15 Methods of pipe protection
- Chemical protection
- Physical protection

15.1.7.T16 Methods of pipe supports
- Hangers
- Brackets
- Clips

8T COLD WATER SUPPLY (10 HOURS)

15.1.8.T1 Specific Objectives

At the end of this topic, the trainee should be able to:-
a) Describe methods of storing water for domestic buildings
b) State bye-laws governing cold water distribution
c) Illustrate systems of cold water in domestic buildings

15.1.8.T11 Water storage methods in domestic buildings
- Cisterns
- Tanks

15.1.8.T12 Bye-laws covering cold water distribution
- Pipework
- Sizes
- Storage
- Inspection and testing
- Rates of flow

15.1.8.T13 Systems of cold water supply in domestic buildings
- Direct system
- Indirect system

15.1.9T HOT WATER SYSTEMS (15 HOURS)

15.1.9.T1 Specific Objectives

At the end of this topic, the trainee should be able to:
a) Describe types of water heating appliances
b) Describe domestic hot water supply systems
c) Select suitable heat insulating material for a given fitment

15.1.9.T11 Types of water heating appliances
- Boilers
- Electric heaters
- Gas heaters

15.1.9.T12 Domestic hot water systems
- Direct system
- Indirect system

15.1.9.T13 Selection of heat insulating materials for
- Boilers
- Pipes
- Cylinders

).T TAPS.AND VALVES (10 HOURS)

15.1.10.T1 Specific Objectives

At the end of this topic, the trainee should be able to:-
- Describe components which control the flow of water in pipework

15.1.10.T11 Controls used in pipework
(i) Taps - screw down
- push
- swivel
- "sura"
(ii) Valves and cocks
- Stop - valves
- Ball - valves
- Non-return valves
- Safety valves

.11T SANITARY APPLIANCES (10 HOURS)

15.1.11.T1 Specific Objectives

At the end of this topic, the trainee should be able to:-
a) Describe types of materials used in the manufacture of sanitary appliances
b) Classify sanitary appliances

15.1.11.T11 Types of materials used in manufacture of sanitary appliances
- Vitreous china
- Fibre glass
- Stainless steel
- Cast iron
- Mild steel
- Plastics

15.1.11.T12 Classifying sanitary appliances

(i) Waste appliances
- wash basins
- baths
- sinks
- showers

(ii) Soil appliances
- W.c. pans
- W.c. cisterns

15.1.12T ROOF WEATHERING (12 HOURS)

15.12.T1 Specific Objectives

At the end of this topic, the trainee should be able to:-

a) Describe types of materials used in roof weathering
b) Describe joints used in roof weathering
c) Describe various types of rain water goods

15.1.12.T11 Materials used in roof weathering
- Sheet metals
- Non-metalic materials
- Bituménous felt
- Neurolites

15.1.12.T12 Joints used in roof weathering
- Welts
- Seams

15.1.12.T13 Rain water goods
- Gutters
- Down pipes

12

SCT SUMMARY AND TIME ALLOCATION
S TWO PLUMBING THEORY (88 HOURS)

	TOPIC	SUB-TOPIC	TIME (HOURS)
.1T	WATER	- Water treatment	6
.2T	PIPEWORK	- Jointing for mains and drainage	8
.3T	COLDWATER SUPPLY	- Pumps - Distribution to high rise buildings	12
.4T	HOTWATER SUPPLY	- Water heaters - Heat energy - Hot water systems (large buildings) - Heat loss calculations	12
2.5T	SANITARY APPLIANCES	- Fixing - Types	8
2.6T	DRAINAGE (ABOVE GROUND)	- Systems - Testing - Traps - Regulations	16
2.7T	ROOF WEATHERING	- Flashing - Gutters and down pipes	8
2.8T	GAS WELDING	- Safety precautions - Flames - Welding techniques - Gas cutting - Welding defects - Brazing - Bronze welding - Silver soldering	8
2.9T	DRAINAGE (BELOW GROUND)	- Principles - Systems - Testing - Regulations	10
		TOTAL	88

SECOND STAGE SYLLABUS CONTENT

PLUMBING THEORY

15.2.1T WATER (6 HOURS)

15.2.1.T1 Specific Objectives

At the end of this topic, the trainee should be able to:-

a) Explain the three classifications related to the quality of water;
b) State the main impurities in water from a given source
c) Explain the processes of water treatment
d) Explain the process of removal of hardness in water

15.2.1.T11 Classification of water

- Dangerous
- Suspicious
- Wholesome

15.2.1.T12 Water impurities

- Suspended matter
- Colloidal matter
- Solids
- Colour
- Gases
- Compounds
- Pathogenic organisms

15.2.1.T13 Water treatment

- Screening
- Sedimentation
- Aeration
- Coagulation/Flocculation
- Disinfection/Chlorination
- Filtration
- Conditioning/Softening

15.2.1.T14 Hardness removal processes
- Boiling
- Base exchange

PIPEWORK (3 HOURS)

15.2.2.T1 Specific Objectives

At the end of this topic the trainee should be able to:-

a) Sketch common joints used in water mains
b) Sketch common joints used in drainage pipes
c) Describe common materials used in drainage pipes

15.2.2.T11 Types of joints for water mains
- Viking Johnson
- Flange joints
- Screwed gland joints
- Caulked joints
- Rubber-ring joints
- Solvent cement

15.2.2.T12 Types of joints for drainage pipes
- Rubber 'O' ring joints
- Solvent cement
- Caulked joint

15.2.2.T13 Materials used in drainage pipe work
- Cast iron
- pitch fibre
- Concrete
- plastics
- Asbestos cement

15.2.3T COLD WATER SUPPLY (12 HOURS)

15.2.3.T1 Specific Objectives

At the end of this topic, the trainee should be able to:-

a) Describe the working principles of common pumps used in water supply
b) State factors to be considered when selecting pumps
c) Describe various components associated with pumping
d) Illustrate the layout of types of systems used in cold water supply for high rise building
e) Describe the principles of operation of a pneumatic vessel
f) Describe the operation of various control devices
g) Define types of pressures
h) Calculate pressures in a given pipe installation
j) State effects of water hammer in pipework

15.2.3.T11 Common water supply pumps

- Centrifugal
- Rotary
- Reciprocating/displacement
- Hand pumps
- Hydraulic ram

15.2.3.T12 Pump selection factors

- Delivery head
- Quantity
- Methods ofdriving the pump
- Power ratiy of the pump
- Nature of water
- Suction head

15.2.3.T13 Pump components
- Suction valves
- Foot valves/strainers
- Non-return valves
- Priming devices
- Float and pressure switches

15.2.3.T14 High rise cold water supply systems
(i) Unboosted system
- Direct pumping
- Indirect pumping
- Zoned system
(ii) boosted system

15.2.3.T15 Principles of operation of a pneumatic vessel -
- Air compressor
- Pressure switch
- Float switch
- Pressure gauge
- Safety valve
- Sight glass

15.2.3.T16 Controls devices
- Delayed action ball valve
- Electrode and float switches
- Pipeline switch

15.2.3.T17 Types of pressures
- Intensity of pressure
- Atmospheric pressure
- Gauge pressure
- Absolute pressure

15.2.3.T18 Calculation of pressures
- Intensity of pressure
- Atmospheric pressure
- Gauge pressure
- Absolute pressure

15.2.3.T19 Water hammer
- Definition
- Effects
- Remedy

15.2.4T HOT-WATER SUPPLY (12 HOURS)

15.2.4.T1 Specific Objectives

At the end of this topic, the trainee should be able to:-

a) Describe the operation of instantaneous water heaters
b) Describe storage water heaters for a given fuel
c) Explain the bye-law requirements regarding storage vessels
d) Calculate specific heat capacity
e) Calculate the relative costs of using various fuels
f) calculate heat loss from a given surface
g) State regulations regarding hot water systems

15.2.4.T11 Instantaneous water heaters
- Gas
- Electrical

15.2.4.T12 Storage water heaters for
(i) Gas
(ii) Electricity
(iii) Solid fuel

15.2.4.T13 Storage Vessels
- Size
- Shape
- Positioning
- Supports
- Materials
- Lagging
- Primatic cylinder

15.3.4.T14 Heat capacity
- Specific heat
- Latent heat
- Sensible heat

15.2.4.T15 Costs of fuels
- Oil
- Electricity
- Gas
- Solid fuels
- Solar

15.2.4.T16 Heat loss calculations from pipes
- Cylinders

15.2.4.T17 Hot water systems regulations
- Indirect
- Direct
- Secondary circulation

SANITARY APPLIANCES

15.2.5.T1 Specific Objectives

At the end of this topic the trainee should be able to:-

a) Describe the methods of fixing and supporting when installing sanitary appliances
b) Describe food waste disposer
c) Describe the use and operations of a given sanitary appliances

15.25.T11 Methods of fixing and supporting of appliances
- Soil
- Waste

15.2.5.T12 Food waste disposers
- Operation
- Application
- Installation

15.2.5.T13 Use and operations of sanitary appliances
- Automatic flushing cisterns
- Urinals
- Slop sinks
- Bidets
- Flushing trough
- Flushing valve
- Drinking fountain
- Bed pan washer

15.2.6T DRAINAGE ABOVE GROUND (16 HOURS)

15.2.6.T1 Specific Objectives

At the end of this topic, the trainee should be able to:-

a) Describe a given system of above ground drainage
b) State bye-law requirement regarding the design of a given system
c) Describe the types of traps in sanitary appliances
d) Describe performance and soundness tests on above ground drainage

15.2.6.T11 Drainage systems above ground for:
- One-pipe system
- Two-pipe system
- Single stack system

15.2.6.T12 Bye-law requirements for:
- One-pipe system
- Two-pipe system
- Single stack system

15.2.6.T13 Traps
- Common traps
- Resealing traps/anti-siphon traps

15.2.6.T14 Above ground drainage testing
- Performance test
- Soundness test

7T ROOF WEATHERING (8 HOURS)

15.2.7.T1 Specific Objectives

At the end of this topic, the trainee should be able to:-

a) Describe suitable flashing for a given situation
b) Determine sizes of rainwater goods.

15.2.7.T11 Flashings at about:-
- Abutments
- Chimneys
- Ridge

15.2.7.T12 Rainwater goods sizing
- Downpipes
- Gutters

8T GAS-WELDING (8 HOURS)

15.2.8.8.T1 Specific Objectives

At the end of this topic, the trainee should be able to:-

a) State safety precautions to be observed while using oxy-acetylene welding equipment
b) Explain the characteristics of different welding flames
c) Illustrate a suitable welding technique for a given task
d) Illustrate common defects in gas welding
e) Describe various methods of hard-soldering

15.2.8.T11 Safety precautions
- Use of equipment
- Storage of equipment
- Protective clothing

15.2.8.T12 Welding flames

- Oxidising
- Carburising
- Neutral
- Cutting flare

15.2.8.T13 Welding technique

- Right-ward
- Left-ward

15.2.8.T14 Common welding defects

- Undercuts
- Poor penetration
- Porosity

15.2.8.T15 Hard-soldering

- Bronze welding
- Silver soldering
- Brazing
- Filler rods

15.2.9T DRAINAGE BELOW GROUND

15.2.9.T1 Specific Objectives

At the end of this topic, the trainee should be able to:-

a) Describe the various systems of below ground drainage
b) Describe methods of testing drains
c) State regulations governing under-ground drainage
d) Explain the functions of a given tran

15.2.9.T11 Systems of below ground drainage

- Separate system
- Partial system
- Combined system

15.2.9.T12 Testing of drains
- Smoke test
- Hydraulic test
- Air test
- Obstruction test
- Alignment test

15.2.9.T13 Regulations for underground drainage
- Access
- Support & protection
- Ventilation
- Gradients
- Discharges

15.2.9.T14 Functions of the following traps
- Grease
- Petrol interceptor
- Silt traps

SUBJECT SUMMARY AND TIME ALLOCATION

PLUMBING THEORY STAGE THREE (88 HOURS)

CODE	TOPIC	SUB-TOPIC	TIME
15.3.1T	COLD WATER SUPPLY	- Fire-fighting systems - Pipe sizing - Water mains + Reservoirs - Pumps	13
15.3.2T	HOT WATER SUPPLY	- Hot water systems (large buildings) - Steam systems - Solar heaters	14
15.3.3T	DRAINAGE BELOW GROUND	- Methods of disposal - Sizing of drains - Setting out and levelling drains	14
15.3.4T	DRAINAGE ABOVE GROUND	- Sizing - Problems in high rise buildings	14
15.3.5T	WELDING(ARC)	- Safety - Equipment - Types of joints - Welding deffects	19
15.3.6T	GAS SUPPLY	- Safety - Meters and regulators - Pressure testing - Pipe sizing - Gas installation and regulations	19
15.3.7T	DESIGN ESTIMATING AND COSTING	- Design - Estimating - Costing	19
		TOTAL	88

NG THEORY STAGE THREE

T COLD WATER SUPPLY - 16 HOURS

15.3.1.T1 Specific Objectives

At the end of this topic, the trainee should be able to:-

a) Describe a given fire-fighting system
b) State the sources of water supply for use in a given fire protection systems
c) State the requirements of a given fire fighting systems
d) Determine appropriate pipe sizes for a cold water system using a given method
e) Describe the operation and functions of a given component in water pipelines
f) Decribe the conditions which cause a given type of flow in pipes
g) Express the continuity equation
h) Apply the quantity equation to determine pipe flow parameters
i) Calculate head loss in pipes due to friction
j) Select a pump for a given application
k) Describe methods of connection of s supplies to water mains of various diameters and materials

15.3.1.T11 Fire fighting systems
- Wet riser
- Dry riser
- Sprinkler system
- Hose reel
- External hydrants

15.3.1.T12 Fire fighting water sources
- Mains
- Elevated reservoir
- Automatic pump
- Pressure tank

15.3.1.T13 Requirements for fire-fighting systems
- Materials
- Positioning
- Sizing
- Access

15.3.1.T14 Methods of sizing of cold water systems
- Loading unit method
- Box formula method

15.3.1.T15 Operations & functions of components in water pipelines
- Air valves
- Washouts/scour valves
- Break pressure tanks
- Sluice valves
- Water meters

15.3.1.T16 Types of flow in pipes
- Steady flow
- Turbulent
- Laminar flow

15.3.1.T17 Continuity equation
- Deriving of equation
- Calculations using equation

15.3.1.T18 Application of quantity equation
- Calculation to determine discharge velocity and area
- Branchings
- Enlargements and reductions

15.3.1.T19 Frictional losses
- Darcy formular

15.3.1.T20 Pump selection
- Head
- Power
- Capacity
- Siting

15.3.1.T21 Water connections
- Saddle clips
- Goose necks
- Tapping

HOT WATER SUPPLY (LARGE BUILDING) (14 HOURS)

15.3.2.T1 Specific Objectives

At the end of this topic the trainee should able to:-

a) Illustrate the layout of a given hot water system to a large building
b) Illustrate the layout of a steam system
c) Describe various components used in steam pipe systems
d) Determine the amount of hot water required for a given population
e) Describe the operation of commercial boilers
f) Explain the purpose of boiler mountings
g) Illustrate the layout of solar water heating systems

15.3.2.T11 Hot water systems
- Centralised
- Electric
- Zoned

15.3.2.T13 Steam systems
- Gravity
- Mechanical

15.3.2.T12 Steam systems components
- Traps
- Trapping set
- Pressure reducing set
- Calorifiers

15.3.2.T14 Calculation of quantities
- Demand

15.3.2.T15 Commercial boilers
- Cast iron sectional
- Shell

15.3.2.T16 Boiler mountings
- Safety valves
- Thermostats

15.3.2.T17 Solar heating systems
- Gravity
- Pumped
- Direct
- Indirect

15.3.3T DRAINAGE ABOVE GROUND (14 HOURS)

15.3.3.T1 Specific Objectives

At the end of this topic the trainee should be able to:-

a) Determine the diameter of stacks and vent pipes for a given number of sanitary appliances

b) Explain design requirements for multi-storey buildings

15.3.3.T11 Diameter of stacks and vent pipes
- Discharge unit method

15.3.3.T12 Design requirements for multi-storey buildings
- Offsets
- Bends
- Entry to drain
- Range of appliances
- Lowest branch connection
- Ventilation

DRAINAGE BELOW GROUND (14 HOURS)

15.3.4.T1 **Specific Objectives**

At the end of this topic the trainee should be able to:

a) Describe various sewage disposal methods
b) Determine the sizes of drain pipes for a given quantity of discharge
c) Describe instruments and equipments used for setting out drains
d) Book and reduce levels for sewer lines.

15.3.4.T11 Sewage disposal methods
- Septic tanks
- Cess pools
- Soak pits
- Small treatment plants

15.3.4.T12 Drain pipes sizing
- Discharge units method
- Probable flow method
- Chezy's formula

15.3.4.T13 Setting out and levelling
(i) Instruments
- Dumpy level
- Tilting level
- Cowley level

(ii) Equipments
- Levelling staff
- Boning rod/traveller
- Sight rail
- Gradient board

15.3.4.T14 Bookings and reductions
- Procedures
- Longitudinal sections

15.3.5T ARC WELDING (10 HOURS)

15.3.5.T1 Specific Objectives

At the end of this topic the trainee should be able to:-

a) State safety precautions to be observed when using arc-welding equipments
b) Describe arc welding equipments
c) State common arc-welding joints
d) Describe a given arc-welding defect

15.3.5.T11 Safety precautions to be observed
- Equipments
- Storage
- Clothing

15.3.5.T12 Arc-welding equipments
- A.C equipment
- D.C equipment
- Electrodes

15.3.5.T13 Arc-welding joints
- Lap
- Butt
- Fillet
- Symbols used

15.3.5.T14 Welding defects
- Under cuts
- Lack of penetration
- Porosity
- Overlap
- Slag inclusion

15.3.6.T GAS SUPPLY (10 HOURS)

15.3.6.T1 Specific Objectives

At the end of this topic, the trainee should be able to:-

a) Illustrate the layout of a gas supply for domestic building
b) State purpose of given controls and components in a gas installation
c) State bye-law requirements regarding gas installation
d) Describe the procedure for testing gas pipe work.

15.3.6.T11 Layout of gas supply
- Domestic system

15.3.6.T12 Components and controls
- Meters
- Regulators
- Governors

15.3.6.T13 Bye-law requirements for gas installation
- Material
- Pipework
- Safety

15.3.6.T14 Testing gas pipework
- Air test

15.7 DESIGN ESTIMATION AND COSTING (10 HOURS)

15.3.7.T1 Specific Objectives

At the end of this topic, the trainee should be able to:-
a) Produce a working drawing for a given plumbing task
b) Estimate required quantity of materials for a given task
c) Estimate costs for a given plumbing task

15.3.7.T11 Production of working drawings
- Plans
- Sections
- Isometric pipe layout

15.3.7.T12 Estimation of materials

- Piping and fittings
- Sanitary appliances
- Builders work in connection

15.3.7.T13 Estimation of costs

- Labour
- Materials
- Overheads
- Profits
- Equipments

PLUMBING TRADE PRACTICE

INTRODUCTION

Plumbing trade practice is intended to develop a competent crafts man. Emphasis is placed on practical work which forms 80% of the trades time.

GENERAL OBJECTIVES

At the end of this subject, the trainee should be able to:-

(a) Develop skills in the use and care of plumbing materials, tools and equipment

(b) Select appropriate materials for given plumbing task

(c) Develop safety habits that are required in a working environment

(d) Use the acquired skills to perform plumbing tasks.

SUBJECT SUMMARY AND TIME ALLOCATION

PLUMBING PRACTICE

STAGE ONE (440 HOURS)

CODE	TOPIC	SUB-TOPIC	TIME
15.1.1.P	SAFETY	- General - Personal - W/shop and site	16
15.1.2.P	TOOLS & EQUIPMENT	- Hand tools - Equipment	24
15.1.3.P	MACHINE TOOLS	- Portable power tools - Fixed machine tools	24
15.1.4.P	PIPEWORK	- Mild steel - Copper - Plastics - Cast iron	90
15.1.5.P	SHEET METAL WORK	- Galvanized mild steel	60
15.1.6.P	SOLDERING	- Soft soldering	40
15.1.7.P	SANITARY APPLIANCES	- Soil appliances - Waste appliances	30
15.1.8.P	COLD WATER SUPPLY	- Indirect - Direct	60
15.1.9.P	HOT WATER SUPPLY	- Direct	60
		TOTAL	422

PLUMBING CRAFT PRACTICE STAGE ONE

SAFETY (15 HOURS)

15.1.1.P1 Specific Objectives

At the end of this topic, the trainee should be able to:-

a) Observe safety precautions in the workshop and on site
b) Wear appropriate working wear
c) Demonstrate first aid in workshop and on site
d) Demonstrate correct use of fire fighting equipment

15.1.1.P11 Safety precautions
- Workshop cleanliness
- Workshop behaviour
- Site behaviour
- Workshop layout
- Site layout and regulations

15.1.1.P12 Working wear
- Clothing
- Shoes
- Helmets
- Goggles & Shields

15.1.1.P13 First-Aid
- First aid kit
- Cuts and bleedings
- Burns
- Electric shock treatment
- Removal of foreign bodies in the eye
- Poison treatment

15.1.1.P14 Correct use of fire fighting equipment
- Portable fire extinguishers
- Fire blanket
- Hose reel

15.1.1.P13 Identifying appropriate equipment
- Bending
- Working benches
- Heating
- Forming (Box pan folder, slip roller Anvils + Brake machine)
- Cutting (Guilotine Shears)

15.1.1.P14 Demonstration of ability to use equipments (Give projects to use the following equipments)
- Working benches
- Heating
- Forming
- Cutting

15.1.1.P15 Caring and maintaining, tools and equipments
(i) Tools
- Measuring
- Marking
- Cutting
- Forming
- Fastening
- Welding

(ii) Equipments
- Bending
- Working benches
- Heating
- Forming
- Cutting

15.1.2P TOOLS & EQUIPMENTS (24 HOURS)

15.1.2.P1 Specific Objectives

At the end of this topic, the trainee should be able to:-
a) Select appropriate hand tools for a given task
b) use hand tools correctly and safely

c) Identify appropriate equipment for a given project
d) Demostrate ability to use equipments correctly and safely
e) Care and maintain tools and equipmenrs

15.1.3.P11 Selection of hand tools (Projects to make use of the following tools) for:
- Measuring
- Marking
- Cutting
- Forming
- Fastening
- Holding

15.1.2.P12 Using hand tools
- Measuring
- Marking
- Cutting
- Forming
- Fastening
- Holding

15.1.2.P13 Identifying appropriate equipment
- Bending
- Working benches
- Heating
- Forming (Box fan folder, slip roller, Anvils and swage machine)
- Cutting (guillotine and sheers)

15.1.2.P14 Demonstrating ability to use equipment (Give projects to use the following equipments)
- Working benches
- Heating
- Forming
- Cutting

15.1.3.P15 Caring and maintaining tools and equipment

(i) Tools
- Measuring
- Marking
- Cutting
- Forming
- Fastening
- Holding

(ii) Equipments
- Bending
- Working benches
- Heating
- Forming
- Cutting

15.1.3.P MACHINE TOOLS (24 HOURS)

15.1.3.P1 Specific Objectives

At the end of this topic, the trainee should be able to:-

a) Use portable power tools correctly and safely
b) Use fixed machine tools correctly and safely
c) Care and maintain portable and machine power tools.

15.1.3.P11 Using portable power tools
- Electrical drill
- Portable grinder

15.1.3.P12 Using fixed power machine tools
- Cutting
- Heating
- Drilling

15.1.3.P13 Caring and maintaining power portable tools and machines used for:-
- Cutting
- Heating
- Drilling

PIPEWORK (80 HOURS)

15.1.4.P1 Specific Objectives

At the end of this topic, the trainee should be able to:-

a) Perform correctly and safely a plumbing task
b) Use the appropriate jointing methods on a given pipe material
c) Support and protect pipe correctly in a given task
d) Perform pipe bending exercises correctly and safely
e) Interpret a working drawing for a given pipework task

15.1.4.P11 Performing a plumbing task
(Pipework projects involving the following)
- Mild steel (upto 25 mm Ø)
- Copper (" " ")
- Plastics (" " ")
- Fibre glass pipe

15.1.4.P12 Jointing methods
- Rigid joints
- Flexible joints

15.1.4.P13 Supporting and protecting
(i) Supporting
- Hangers
- Brackets
- Clips
(ii) Protecting
- Mechanical damage
- Corrosion

15.1.4.P14 Pipe bending (upto 25 mm diameter)
- Heat bending
- Cold bending

15.1.4.P15 Interpreting a working drawing
- Working drawing.

15.1.5P SHEET METALWORK (60 HOURS)

15.1.5.P1 Specific Objectives

At the end of this topic, the trainee should be able to:-

a) Use different materials to make a sheetmetal joint

b) Interpret a working drawing for a given sheetmetal task

15.1.5.P11 (i) Sheet metal materials (up to 26 S.W.G.)
- Galvanised mild steel
- Aluminium

(ii) Sheet metal joints (Projects involving)
- Welts
- Seams
- Riveting

15.1.5.P12 Interpreting working drawings
- Working drawing

15.1.6P SOLDERING (40 HOURS)

15.1.6.P1 Specific Objectives

At the end of this topic, the trainee should be able to:-

a) Use appropriate tools to make a soldered joint.

15.1.6.P11 Making a solderred joint
(Joints on galvanised sheets upto 26. S.W.G.)
- Fluxes
- Solders
- Tools
- Safety

15.1.7P SANITARY APPLIANCES (60 HOURS)

15.1.7.P1 Specific Objectives

At the end of this topic, the trainee should

be able to:-

a) Install different types of sanitary appliances in accordance with regulations and By-laws

b) Handle sanitary appliances of different material safely.

15.1.7.P11 Installing sanitary appliances

(i) Waste appliances
- Wash hand basins
- Sinks

(ii) Soil appliances
- W.C. pan (inc. seat and cover)
- W.C. cistern

15.1.7.P12 Handling sanitary appliances (appliances made of)
- Vitreous china
- Stainless steel
- Plastics
- Glazed mild steel

1.8P COLD WATER SUPPLY (30 HOURS)

15.1.8.P1 Specific Objectives

At the end of this topic, the trainee should be able to:-

a) Install cold water supply systems to a single storey domestic building

b) Interpret drawings of direct and indirect cold water supply systems

15.1.8.P11 Installing cold water systems
- Materials
- Direct system
- Indirect system

15.1.8.P12 Interpreting drawings
- Working drawings

15.1.0P HOT WATER SUPPLY (30 HOURS)

15.1.0.P1 Specific Objectives

At the end of this topic, the trainee should be able to:-

a) Install a hot water supply system to a single storey domestic building
b) Install heating appliances for a domestic house
c) Interpret working drawings of hot water supply systems

15.1.0.P11 Installing a hot water system
- Materials
- Direct system

15.1.0.P12 Installation of heating appliances
- Independent boiler
- Immersion heater

15.1.0.P13 Interpreting working drawings
- Working drawings

SUBJECT SUMMARY AND TIME ALLOCATION

PLUMBING PRACTICE

STAGE TWO (414 HOURS)

	TOPIC	SUB-TOPIC	TIME
S.P	SAFETY	- Tools safety - Materials safety	8
P.P	PIPEWORK	- Mild steel - Copper - Plastics - Concrete - Cast iron	70
S.P	SHEETMETAL	- Galvanized mild steel - Aluminium	44
A.P	SANITARY APPLIANCES	- Soil appliances - Waste appliances	52
C.P	COLD WATER SUPPLY	- Direct - Indirect	52
H.P	HOT WATER SUPPLY	- Direct - Indirect	52
W.P	WELDING	- Gas welding	44
S.P	SOLDERING	- Hard soldering - Soft soldering	42
D.P	DRAINAGE	- Above ground drainage - Below ground drainage	52
		TOTAL	414

PLUMBING CRAFT PRACTICE STAGE TWO

15.2.1P SAFETY (6 HOURS)

15.2.1.P1 Specific Objectives

At the end of this topic, the trainee shou
be able to:-

a) Observe safety precautions when using tools and equipment

b) Exercise safety measures when handlin and storing materials

15.2.1.P11 Safety precautions

- Hand tools
- Machine tools
- Power tools

15.2.1.P12 Exercising safety measures

- Pipes
- Sheetmetal
- Appliances
- Fuels

15.2.2P PIPEWORK (70 HOURS)

15.2.2.P1 Specific Objectives

At the end of this topic, the trainee shoul
be able to:-

a) Perform correctly and safely a plumbin task

b) Use appropriate jointing methods in a given pipe material

c) Support and protect pipework in a give task

d) Perform pipe bending exercises correctl and safely

e) Produce working drawings for given pip work tasks

15.2.2.P11 Performing plumbing tasks
(Pipework projects involving the following)
- Mild steel (up to 32 mm Ø)
- Copper (up to Ø 25 mm)
- Plastic (up to 32 mm Ø)

15.2.2.P12 Jointing methods
- Rigid
- Flexible

15.2.2.P13 Supporting and protecting pipework
(i) Supporting
- Hangers
- Brackets
- Clips
(ii) Protecting
- Mechanical damage
- Corrosion

15.2.2.P14 Pipe bending
(i) Heat bending
- mild steel (up to 38 mm diameter)
- Plastic (up to 30 mm diameter)
- Copper (up to 35 mm diameter)
(ii) Cold bending
- Mild steel (up to 28mm diameter)
- Plastic (up to 28mm diameter)
- Copper (up to 35 mm diameter)

15.2.2.P15 Producing working drawings
- Working drawings

15.2.3 SHEETMETAL WORK (40 HOURS)

15.2.3.P1 Specific Objectives

At the end of this topic, the trainee should be able to:-
a) Use different materials to produce rain water goods and weathering

b) Install rain water goods and weathering to buildings

c) Produce a working drawing for a given sheet metal task

15.2.3.P11 Materials to produce sheetmetal task

(i) Materials
- Galvanized mild steel sheet (up to S.W.G. 26)
- Aluminium sheet

(ii) Rain water goods & weatherings
-Flashings
-Gutters
-Downpipes
-Offsets, tees and ductions

15.2.3.P12 Installing rainwater goods & weatherings
- Flashings
- Gutters
- Downpipes

15.2.3.P13 Producing working drawings
- Working drawings

15.2.4 SANITARY APPLIANCES (52 HOURS)

15.2.4.P1 Specific Objectives

At the end of this topic, the trainee should be able to:-

a) Install different types of sanitary appliances in accordance with : regulations and By laws

b) Maintain and repair sanitary appliances

15.2.4.P11 Installing sanitary appliances

(i) Waste appliances
- Wash hand basins
- Sinks
- Bath tubs
- Shower trays
- Drinking fountains