Syllabus for PIPE FITTER

Course Name	PIPE FITTER
Sector	Capital Goods
Course Code	CGM/2023/PIFI-RPL/271
Level	RPL LEVEL 3
Occupation	PIPE FITTER
Job Description	The job role is responsible for maintenance and repairs on plumbing systems, ensuring efficient water supply and drainage, diagnosing issues, and implementing effective solutions, with a focus on safety and compliance.
Course Duration	Total Duration 80 Hrs (T-23, P-57)
Trainees' Entry Qualification	Grade 8 with more than 5 Year Experience in the relevant Field
Trainers Qualification	Degree or Diploma in Mechanical Engineering with 1 yr experience in relevant field OR ITI in relevant trade with 3 yr experience in relevant field

Structure of Course:

Module No.	Module name	Outcome	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
1	Workplace Safety	Apply safe working practices	1	1	2
2	Basic Engineering Drawing	Practice & interpret technical drawings	2	6	8
3	Pipe Joints, Soldering Techniques and Sanitary Fittings	Demonstrate various pipe joints, soldering techniques and Sanitary Fittings in plumbing systems.	6	10	16
4	Valve and Pipe Dismantling and Renewal procedure	Describe the Dismantling and Renewal procedure of Valve and Pipe	2	6	8
5	Leak Detection and Repair Techniques	Detect the pipe leakage and its repair	2	6	8
6	Rainwater Drainage Systems	Plan and construct Rainwater Draining Systems with all its components.	2	6	8
7	Hot and Cold Water connection	Demonstrate the procedure of pipe connection to mains for hot and cold water.	2	6	8

Module No.	Module name	Outcome	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
8	Inspection Chambers, Septic Tanks, cesspools and soak pits.	Design and construct Inspection Chambers, Septic Tanks, cesspools and soak pits.	2	6	8
9	Domestic Boilers, Geysers, Ventilation, Solar Water Systems and Sensor Systems.	Demonstrate the Installation procedure of Domestic Boilers, Geysers, Ventilation, Solar Water Systems and Sensor Systems.	2	6	8
9	Employability Skill		2	4	6
		TOTAL:	23	57	80

SYLLABUS:

Module No. 1: Workplace Safety

Outcome: Apply Safe Working Practices

Theory Content:

1. Awareness of safety norms.
2. Safety-PPE usage and its benefits
3. Fire prevention and personal safety.
4. Ergonomic safety and health principles.
5. Use various PPE while working.

Practical Content:

1. Accident prevention and safety regulations while material handling, eliminating unsafe conditions, unsafe actions, discovering causes of accidents.
2. Fire prevention and personal safety.
3. Safety during machine handling.
4. Emergencies, rescue and first aid procedures.
5. Familiar with Personal protective Equipment's and clothes Different Type of Safety Sign, First Aid Box, Safety instrument and clothing

Tools & Equipment needed: Personal Protective Equipment, Safety gear (gloves, safety glasses) Cleaning Equipment and Materials, Sanitizer, Soap, Mask, First Aid Box, Fire Extinguisher/ Chart related to use of Different Fire Extinguisher.

Module No. 2: Basic Engineering Drawing

Outcome: Practice & interpret technical drawings

Theory Content:

- Introduction of technical drawing and lettering
- Use and care drawing boards and different drawing instruments, Drawing sheets and their sizes.
- Explain Types of Lines: Horizontal, Vertical, Inclined, parallel lines.

- Concept of using Scales in Drawing – Enlarging, Full Size & Reducing Scale.

Practical Content:

Introduction of technical drawing and lettering

- How to begin a drawing – Layout of drawing sheet.
- Drawing of — i) Horizontal lines, ii) Vertical lines, iii) Inclined lines, iv) Parallel lines,
- Single stroke Lettering by conventional method.
- Dimensioning—System of Dimensioning

Geometrical Construction

- Geometrical construction of Polygons (Pentagon, Hexagon & Octagon) by general method.

Orthographic Projection of Line & Lamina

- Projector; Plane of projection – Vertical Plane, Horizontal Plane & Profile Plane. Concept of 1st angle
- Projection; 3rd angle Projection. Reference Line – Symbol of methods of projection. (Demonstration with models).
- Projection of Points, Lines & Lamina (Square, rectangular, triangular, hexagonal, pentagonal and circular) parallel to VP and angle with HP & vice versa.

Freehand Sketch

Introduction – Necessity.

b) Free hand sketches of rolled steel sections – i) T-section, ii) I-section, iii) Angle section, iv) Channel section, v) Circular section, vi) Rectangular Section, vii) Steel flat, viii) Double ended wrench, ix) Screw driver, x) Nail puller

Tools & Equipment needed: Drawing instrument box, Drawing instrument box, Set square celluloid 30°-60°, French-curves (set of 12 celluloid), T-Square or Mini drafter, Drawing board.

Module No. 3: Pipe Joints, Soldering Techniques and Sanitary Fittings

Outcome: Demonstrate various pipe joints, soldering techniques and Sanitary Fittings in plumbing systems.

Theory Content:

1. **Pipe Joints:**
    - Explanation of straight joints, branch joints, taft and blow joints, and expansion joints.
    - Understanding the purpose of each joint type in plumbing systems.
2. **Solders and Fluxes:**
    - Types of solders and fluxes used in plumbing.
    - The role of flux in ensuring clean surfaces for soldering.
3. **Principles of Soldering:**
    - Temperature considerations and safety precautions.
    - Explanation of the soldering process.
4. **Common Joint Issues:**
    - Identifying and troubleshooting common problems in pipe joints.
    - Repair techniques for leaks and faulty joints.
5. **Introduction to Sanitary Fittings**
    - Definition and Types of Sanitary Fittings(Faucets, Mixers, Toilets, Bidets, Sinks and Washbasins)
    - Importance of Proper Sanitary Fittings
6. **Technical Aspects of Sanitary Fittings**

- Water Pressure and Flow Considerations
- Proper Sizing and Installation Guidelines
- Understanding Water Supply and Drainage Systems

Practical Content:

- Demonstrate creating straight, branch, Taft and blow, and expansion joints.
- Use of actual pipes and fittings for Demonstration of Joint Types
- Demonstrate the procedure of soldering
- Application of different solders and fluxes in various scenarios.
- Use proper tools for soldering
- Troubleshoot and apply repair techniques for common joint issues.
- Demonstrate the procedure of Installation of Faucets, Mixers, Toilets, and Bidets.
- Inspect of Different Materials Used in Sanitary Fittings

Tools & Equipment needed:

1. Pipe cutters
2. Pipe reamers
3. Adjustable wrenches
4. Pipe wrenches
5. Flux and solder applicators
6. Torch for soldering
7. Deburring tool
8. Pipe and fitting materials for practical demonstrations.

Module No. 4: Valve and Pipe Dismantling and Renewal Procedure

Outcome: Describe the Dismantling and Renewal procedure of Valve and Pipe

Theory Content:

1. **Valve and Pipe Components:**
    - Identification of valve and pipe components.
    - Understanding the role of each component in the system.
2. **Dismantling Procedures:**
    - Explain the dismantling process for valves and pipes.
    - Importance of shutting off water supply and depressurizing.
3. **Renewal Techniques:**
    - Strategies for renewing damaged valves and pipes.
    - When to replace components versus repairing.

Practical Content:

- Demonstrate the dismantling method with various types of valves and pipes.
- Identification of components during the dismantling process.
- Apply renewal techniques for valves and pipes
- Use proper tools for effective dismantling and renewal.

Tools & Equipment needed:

- Pipe wrenches
- Adjustable wrenches
- Pipe cutters
- Pipe threaders
- Pipe reamers
- Plumber's tape

- Pipe sealing compounds
- Thread seal tape
- Safety gear (gloves, safety glasses)

Module No. 5: Leak Detection and Repair Techniques

Outcome: Detect the pipe leakage and its repair

Theory Content:

1. **Causes of Pipe Leaks:**
    - Understanding factors leading to pipe leaks.
    - Corrosion, physical damage, and joint failures.
2. **Systematic Leak Tracing:**
    - Techniques for systematic leak detection.
    - Identifying visible and hidden leaks.
3. **Repair Methods:**
    - Describe repair methods for different types of leaks.

Practical Content:

- Detect the leak of the pipes by using the proper tools
- Demonstrate the repairing procedure for common pipe leaks
- Apply cathodic/anodic protection system on pipes to prevent corrosion.
- Use proper tools for pipe leak detection and repair

Tools & Equipment needed:

Pressure testing equipment, Acoustic leak detectors, Dye testing kits, Pipe cutters. Pipe repair clamps, Epoxy compounds, Pipe sealing compounds, Thread seal tape, Sacrificial anodes, Cathodic protection rectifiers, Bonding and grounding equipment, Electrical resistance meters.

Module No. 6: Rainwater Drainage Systems

Outcome: Plan and construct Rainwater Draining Systems with all its components

Theory Content:

1. **System Components:**
    - Understanding the components of rainwater and drainage systems.
    - Differentiating between gutters, downspouts, and drainage pipes.
2. **Design Principles:**
    - Principles of designing an effective rainwater and drainage system.
    - Calculating slopes for proper water flow.

Practical Content:

- Construct rainwater draining systems.
- Application of design principles for rainwater and drainage system.
- Conducting tests to ensure proper functionality.
- Inspection techniques for identifying potential issues.

Tools & Equipment needed: Gutters, Downspouts, Drainage pipes, Pipe brackets and hangers, Pipe, connectors and fittings, Sealing compounds, Fasteners (screws, nails), Level and measuring tools, Inspection mirrors or cameras.

Module No. 7: Hot and Cold Water connection

Outcome: Demonstrate the procedure of pipe connection to mains for hot and cold water.

Theory Content:

1. **Domestic Water Systems:**
   - Explanation of domestic hot and cold water supply systems.
   - Understanding the role of expansion tanks and pressure regulators.
2. **Water Hammer Prevention:**
   - Causes and prevention techniques for water hammer.
   - Installation of water hammer arrestors.

Practical Content:

- Demonstrate the procedure of pipe connection to mains for hot and cold water.
- Testing for leaks and pressure regulation.
- Demonstration of water hammer and methods to prevent it.
- Application of water hammer arrestors.

Tools & Equipment needed: Pipe wrenches, Adjustable wrenches, Pipe cutters, Pipe threaders, Pipe reamers, Plumber's tape, Pipe sealing compounds, Thread seal tape, Safety gear (gloves, safety glasses), Pressure testing equipment, Leak detection tools, Pressure regulators, Water hammer arrestors, Teflon tape, Pipe clamps and supports.

Module No. 8: Inspection Chambers, Septic Tanks, cesspools and soak pits.

Outcome: Design and construct Inspection Chambers, Septic Tanks, cesspools and soak pits.

Theory Content:

1. **Sewage System Components:**
   - Understanding components like inspection chambers, septic tanks, and drains.
   - Differentiating between types of traps.
2. **Drainage System Layout:**
   - Principles of designing an efficient drainage system layout.
   - Understanding the importance of traps.
3. **Introduction to Sanitary Systems**
   - Basics of Sanitation and Wastewater Management
   - Role of Cesspools and Soak Pits in Sanitation
4. **Cesspools and Soak Pits Design Principles**
   - Purpose and Function of Cesspools and Soak Pits
   - Site Selection Criteria
   - Determining Design Capacity
5. **Construction Materials and Techniques**
   - Selection of Construction Materials
   - Construction Methods for Cesspools
   - Construction Methods for Soak Pits

Practical Content:

- Install the inspection chambers and septic tanks.
- Layout design of the inspection chambers and septic tanks and application.
- Install the different types of traps.
- Demonstrate the procedure of the proper ventilation and water seal.
- Identify Suitable Locations for Cesspools and Soak Pits
- Demonstrate the Construction procedure of Cesspools and Soak Pits

Tools & Equipment needed: Shovels and excavation tools, Concrete mixers and tools, Pipe cutters, Pipe connectors and fittings, Sealing compounds, Level and measuring tools, Safety gear (gloves, safety glasses), Drafting tools (paper, pencils, rulers), Measurement tools (tape measures, rulers), Various types of traps (P-traps, S-traps, drum traps), Pipe wrenches, Adjustable wrenches, Pipe cutters, Pipe sealing compounds, Level and measuring tools.

Module No. 9: Domestic Boilers, Geysers, Ventilation, Solar Water Systems and Sensor Systems.

Outcome: Demonstrate the Installation procedure of Domestic Boilers, Geysers, Ventilation, Solar Water Systems and Sensor Systems.

Theory Content:

1. **Domestic Boilers and Geysers**
    - Introduction to Domestic Boilers and Geysers
    - Types of Boilers and Geysers
2. **Ventilation Methods and Precautions Against Air Poisoning**
    - Importance of Adequate Ventilation in Plumbing Systems
    - Ventilation Pipe Design and Installation
    - Precautions to Prevent Air Poisoning in Enclosed Spaces
3. **Fixing Solar Water Systems**
    - Principles of Solar Water Heating
    - Components of a Solar Water System
4. **Sensor Systems for Urinals and Wash Basins**
    - Overview of Sensor Technology in Plumbing
    - Installation and Calibration of Sensor Systems
    - Water Conservation Benefits of Sensor Systems
5. **Corrosion Due to Electrolytic Action and Cathodic/Anodic Protection**
    - Understanding Corrosion in Plumbing Systems
    - Common Causes of Corrosion
    - Electrolysis in Plumbing Systems
    - Cathodic and Anodic Protection Methods
    - Application of Cathodic Protection in Corrosion Prevention

Practical Content:

- Demonstrate the procedure of Installation of Domestic Boilers, Geysers and Ventilation.
- Demonstrate the procedure of Installation of Solar Water System and Sensor Systems
- Identify Corrosion Causes and Application of Prevention Methods

Tools & Equipment needed: Pipe wrenches, Adjustable wrenches, Pipe cutters, Pipe threader, Hacksaw, Screwdrivers, Pliers, Power drills and bits, Multimeter.

Module No. 10: Employability Skills

Detail Content

- **Basic English Skills**

1. Converse using basic English sentences.
2. How to Greet others
3. Read and interpret text written in basic English
4. Write a short note/paragraph / letter using basic English

- **Communication Skills**

1. Demonstrate how to communicate effectively using verbal and nonverbal communication Etiquette.
2. Discuss the significance of working collaboratively with others in a team

- **Financial Skills**

1. Outline the importance of selecting the right financial institution, product and service
2. Demonstrate how to carry out offline and online financial transactions, safely and securely like net banking, wallet payment, UPI.
3. List the common components of salary and compute income, expenditure, taxes, investments etc.

- **Essential Digital Skills**

1. Familiarization of working with computer
2. Discuss the significance of displaying responsible online behavior while browsing using various social media platforms, e-mails, etc., safely and securely
3. Send email with attachment. Receive email and download attachment

- **Customer Service Skills**

1. Explain the significance of identifying customer needs and responding to them in a professional manner.
2. Discuss the significance of maintaining hygiene and dressing appropriately

Learning Outcome – Assessment Criteria

Module No.	Outcome	Assessment Criteria
1	Apply safe working practices	**After completion of this module students will be able to:** 1.1 Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements. 1.2 Identify basic first aid and use them under different circumstances. 1.3 Identify different fire extinguisher and use the same as per requirement. 1.4 Identify safety alarms accurately 1.5 Follow about General safety precaution
2	Practice & interpret technical drawings	**After completion of this module students will be able to:** 2.1 Draw plane figures applying drawing instruments with proper layout and folding of drawing sheets. 2.2 Construct Line, Lettering, Dimensioning, and Scale – Plain, Diagonal 2.3 Draw plan, elevation, side view of different objects with appropriate type of lines and dimensions as per standard convention. 2.4 Draw simple geometrical figure like square, rectangle, circle using CAD.

Module No.	Outcome	Assessment Criteria
3	Demonstrate various pipe joints and soldering techniques in plumbing systems.	**After completion of this module students will be able to:** 3.1 Explain the straight joints, branch joints, taft and blow joints. 3.2 Illustrate taft and blow joint applications. 3.3 Explain the Types of solders and fluxes and their proper uses. 3.4 Demonstrate the procedure of soldering. 3.5 Troubleshoot and apply repair techniques for common joint issues. 3.6 Definition and Types of Sanitary Fittings(Faucets, Mixers, Toilets, Bidets, Sinks and Washbasins) 3.7 Demonstrate the procedure of Installation of Faucets, Mixers, Toilets, and Bidets.
4	Describe the Dismantling and Renewal procedure of Valve and Pipe	**After completion of this module students will be able to:** 4.1 Identify the components of the valve and pipe with their specification 4.2 Demonstrate the dismantling method with various types of valves and pipes. 4.3 Apply renewal techniques for valves and pipes 4.4 Use proper tools for effective dismantling and renewal.
5	Detect the pipe leakage and its repair	**After completion of this module students will be able to:** 5.1 Explain the various causes of Pipe Leaks 5.2 Detect the leak of the pipes by using the proper tools 5.3 Demonstrate the repairing procedure for common pipe leaks 5.4 Apply cathodic/anodic protection system on pipes to prevent corrosion. 5.5 Use proper tools for pipe leak detection and repair
6	Plan and construct Rainwater Draining Systems with all its components.	**After completion of this module students will be able to:** 6.1 Explain the components of rainwater and drainage systems. 6.2 Apply design principles for rainwater and drainage systems. 6.3 Construct rainwater draining systems. 6.4 Calculate the slopes for proper water flow. 6.5 Describe the Inspection techniques for identifying potential issues.
7	Demonstrate the procedure of pipe connection to mains for hot and cold water.	**After completion of this module students will be able to:** 7.1 Demonstrate the procedure of pipe connection to mains for hot and cold water.

Module No.	Outcome	Assessment Criteria
		7.2 Describe the role of expansion tanks and pressure regulators in water supply systems 7.3 Describe causes and prevention techniques for water hammer. 7.4 Install water hammer arrestors and their application.
8	Design and construct Inspection Chambers, Septic Tanks, cesspools and soak pits.	**After completion of this module students will be able to:** 8.1 Explain various types of components like inspection chambers, septic tanks, and drains. 8.2 Install the inspection chambers and septic tanks. 8.3 Layout design of the inspection chambers and septic tanks and application. 8.4 Install the different types of traps. 8.5 Demonstrate the procedure of the proper ventilation and water seal. 8.6 Explain the basics of Sanitation and Wastewater Management 8.7 Identify Suitable Locations for Cesspools and Soak Pits 8.8 Demonstrate the Construction procedure of Cesspools and Soak Pits
9	Demonstrate the Installation procedure of Domestic Boilers, Geysers, Ventilation, Solar Water Systems and Sensor Systems.	9.1 Explain Domestic Boilers and Geysers and their types 9.2 Describe Ventilation Methods and Precautions Against Air Poisoning 9.3 Explain Solar Water Heating and sensor systems in Plumbing 9.4 Describe Corrosion Due to Electrolytic Action and Cathodic/Anodic Protection 9.5 Demonstrate the procedure of Installation of Domestic Boilers, Geysers and Ventilation. 9.6 Demonstrate the procedure of Installation of Solar Water System and Sensor Systems 9.7 Identify Corrosion Causes and Application of Prevention Methods
10	Employability Skill	As per guided curriculum

List of Tools, Equipment & materials needed for 30 Trainees (Practical)

Sl No	Items Name	Specification	Qty
1	Personal Protective Equipment	Standard PPE including gloves, safety glasses, masks, etc.	30 sets
2	Cleaning Equipment and Materials	Cleaning supplies for maintaining a safe workplace	Shared
3	Sanitizer, Soap	Hand sanitizers and soap for hygiene	Shared
4	First Aid Box	Standard first aid kit	1 (shared)

Sl No	Items Name	Specification	Qty
5	Fire Extinguisher/Chart	Different types of fire extinguishers and related charts	Shared
6	Drawing instrument box	Standard set of drawing instruments	30 sets
7	Set square celluloid 30°-60°	Set of set squares	30 sets
8	French-curves (set of 12 celluloid)	Set of French-curves	10 sets (shared)
9	T-Square or Mini drafter	T-Square or Mini drafter	30 sets
10	Drawing board	Standard drawing board	30 sets
11	Pipe cutters	Tubing cutters, up to 2 inches	6
12	Pipe reamers	Inner/outer reamers	6 (shared)
13	Adjustable wrenches	10-inch, chrome-plated	6
14	Pipe wrenches	14-inch adjustable, heavy-duty	6
15	Flux and solder applicators	Standard flux and solder applicators	As required
16	Torch for soldering	Standard soldering torch	As required
17	Deburring tool	Standard deburring tool	6 (shared)
18	Pipe threaders	Manual threaders	6 (shared)
19	Pressure testing equipment	Standard pressure testing equipment	As required
20	Acoustic leak detectors	Standard acoustic leak detectors	As required
21	Dye testing kits	Standard dye testing kits	As required
22	Pipe repair clamps	Standard pipe repair clamps	6
23	Epoxy compounds	Standard epoxy compounds	6 tubes
24	Thread seal tape	Thread seal tape, 1/2 inch	6 rolls
25	Gutters	Standard gutters	As required
26	Downspouts	Standard downspouts	As required
27	Drainage pipes	Standard drainage pipes	As required
28	Pipe brackets and hangers	Standard pipe brackets and hangers	As required
29	Pipe connectors and fittings	Standard pipe connectors and fittings	As required
30	Sealing compounds	Standard sealing compounds	As required
31	Fasteners (screws, nails)	Standard fasteners	6
32	Level and measuring tools	Standard level and measuring tools	As required
33	Inspection mirrors or cameras	Standard inspection mirrors or cameras	As required
34	Plumber's tape	Teflon tape, 1/2 inch	6 rolls
35	Pipe sealing compounds	Pipe joint compounds	6 tubes
36	Thread seal tape	Thread seal tape, 1/2 inch	6 rolls
37	Shovels	Round-point shovels	6
38	Excavation tools	Picks, trenching shovels	6
39	Concrete mixers	Portable electric mixers	1
40	Level	24-inch spirit level	6
41	Measuring tools	Tape measures, rulers	10 sets
42	Drafting tools	Drafting paper, pencils, rulers	6 sets