CURRICULUM

FOR THE TRADE OF

PIPE FITTER

UNDER

APPRENTICESHIP TRAINING SCHEME

2017

सत्यमेव जयते
Government of India

GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENURESHIP
DIRECTORATE GENERAL OF TRAINING

CONTENTS

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3. Central Staff Training & Research Institute, Kolkata
4. Govt. Industrial Training Institute, Gariahat, Kolkata
5. Mazagon Dock Shipbuilders Ltd., Mumbai
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10. ……..

Special acknowledgement is expended by DGT to the following expert members who had contributed immensely in this curriculum.

Co-ordinator for the course : R.N.MANNA, Training Officer, CSTARI, Kolkata

Sl. No.	Name & Designation Sh./Mr./Ms.	Organization	Expert Group Designation
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2. BACKGROUND

2.1 Apprenticeship Training Scheme under Apprentice Act 1961

The Apprentices Act, 1961 was enacted with the objective of regulating the programme of training of apprentices in the industry by utilizing the facilities available therein for imparting on-the-job training. The Act makes it obligatory for employers in specified industries to engage apprentices in designated trades to impart Apprenticeship Training on the job in industry to school leavers and person having National Trade Certificate(ITI pass-outs) issued by National Council for Vocational Training (NCVT) to develop skilled manpower for the industry. There are four categories of apprentices namely; trade apprentice, graduate, technician and technician (vocational) apprentices.

Qualifications and period of apprenticeship training of trade apprentices vary from trade to trade. The apprenticeship training for trade apprentices consists of basic training followed by practical training. At the end of the training, the apprentices are required to appear in a trade test conducted by NCVT and those successful in the trade tests are awarded the National Apprenticeship Certificate.

The period of apprenticeship training for graduate (engineers), technician (diploma holders and technician (vocational) apprentices is one year. Certificates are awarded on completion of training by the Department of Education, Ministry of Human Resource Development.

2.2 Changes in Industrial Scenario

Recently we have seen huge changes in the Indian industry. The Indian Industry registered an impressive growth during the last decade and half. The number of industries in India have increased manifold in the last fifteen years especially in services and manufacturing sectors. It has been realized that India would become a prosperous and a modern state by raising skill levels, including by engaging a larger proportion of apprentices, will be critical to success; as will stronger collaboration between industry and the trainees to ensure the supply of skilled workforce and drive development through employment. Various initiatives to build up an adequate infrastructure for rapid industrialization and improve the industrial scenario in India have been taken.

2.3 Reformation

The Apprentices Act, 1961 has been amended and brought into effect from 22nd December, 2014 to make it more responsive to industry and youth. Key amendments are as given below:

- Prescription of number of apprentices to be engaged at establishment level instead of trade-wise.
- Establishment can also engage apprentices in optional trades which are not designated, with the discretion of entry level qualification and syllabus.
- Scope has been extended also to non-engineering occupations.
- Establishments have been permitted to outsource basic training in an institute of their choice.
- The burden of compliance on industry has been reduced significantly.

3. RATIONALE

(Need for Apprenticeship in Pipe Fitter trade)

- Job opportunity is very good, especially for workers with welding experience.
- Pipefitters comprise one of the largest and highest paid construction occupations.
- Apprenticeship programs generally provide the most comprehensive training.
- An excellent fit for novice students and tenured apprentices, DGT's courses offer extensive pre-technical and industrial skills courseware to empower employees with a strong knowledgebase. Help build a strong foundation through specialized programs that cover a wide variety of theoretical and practical instruction. Through pipefitter apprenticeship, students will embark on a well-rounded curriculum that covers elements of pipe fitting as well as reading of building blueprints and gas metal welding fundamentals.
- DGT's pipefitter apprenticeship programs are specifically designed to meet and ensure trainee is fully equipped with the necessary skills to succeed within the organization. A combination of formal and on-the-job training equips trainees with the proper qualifications to thrive as certified professionals.

This program will train the trainee to lay out, assemble, fabricate, maintain and repair piping systems. Those systems will carry water, steam, chemicals or fuel used in heating, cooling, lubricating and other processes. Pipefitter is one of the major pipe trades careers. Pipefitters are employed by pipeline construction contractors and sub-contractors, thermal or steam generating plants, manufacturers, utility companies, oil refineries, gas plants, pulp mills and chemical plants. Experienced pipefitters may advance to supervisory positions such as foreman, sub-contractor, contractor and construction superintendent.

4. JOB ROLES: REFERENCE NCO

7136.30 Pipe Fitter lays repairs and maintains, pipes for supply of water, gas, oil or steam in buildings, gardens, workshops, stores, ships etc., according to drawings or instructions. Examines drawings and other specifications or receives relevant instructions. Cuts passage holes for laying pipes in walls and floors. Cuts reams, threads and bends pipes according to specifications. Lays pipes in cut passage and assembles pipe sections with couplings, sockets, Tee's elbows etc. Levels position of pipes using sprit level for gravitational flow. Caulks joints, tests them for leakage with pneumatic or hydraulic pressure and secures pipe line to structure with clamps, brackets, and hangers. Fits water meters, taps etc to pipe where necessary. Repairs and replaces leaky pipe lines, taps and joints and provides connections to overhead water tanks. Helps Plumber General in fittings sanitary fittings to buildings. May join pipe sections and fittings.

7136.10 Plumber, General lays out, assembles, installs and maintains sanitary fittings and fixtures, sewage and drainage systems, heating and sanitary systems, gas and water pipe lines etc. Receives instructions from Sanitary Engineer or Civil Engineer regarding lay out of pipes, gas or water mains, position of fixtures and fittings, etc. Examines drawings or other specifications regarding size and dimensions of area where sanitary fittings or pipe are to be fitted or laid. Marks points at places to indicate position for fixing brackets and laying pipes. Drills passage holes in walls or floor of premises and fixes necessary brackets, stands, holders etc. to keep or hold fittings and fixtures in position, using nuts, bolts, clamps etc. and tightens them with hand tools. Cuts reams, threads and bends pipes as appropriate. Ensures that pipe lines are laid properly by Pipe Fitter. Joins pipes with sockets, Tees, elbow etc. or with molten lead or lead wool. Caulks joints (operation of making joint seam tight to withstand pressure) and tests them for leaks with pneumatic or hydraulic pressure. May repair and maintain sewerage and pipe lines by replacing washers on leaky faucets, mending burst pipes, opening clogged drains, etc. May do lead burning, dressing and bossing of lead pipe and sheet lead, inlaying of wooden tanks, construction of septic tanks etc

Reference NCO: 2004 / 7136.30, 7136.10

5. GENERAL INFORMATION

1. **Name of the Trade** **: PIPE FITTER**

2. **N.C.O. Code No.** : 2004 / 7136.30, 7136.10.

3. **Duration of Apprenticeship Training (Basic Training + Practical Training):**2years

3.1 **For Freshers :- Duration of Basic Training**: -

a) Block –I : 3 months

b) Block – II : 3 months

Total duration of Basic Training: 6 months

Duration of Practical Training (On -job Training): -

a) Block–I: 9 months

b) Block–II : 9 months

Total duration of Practical Training: 18 months

3.2 **For ITI Passed :- Duration of Basic Training**: - NIL

Duration of Practical Training (On -job Training): 12 months

4. **Entry Qualification** : 10th Passed

5. **Selection of Apprentices:** The apprentices will be selected as per Apprenticeship Act amended time to time.

6**. Rebate to ITI Passed out Trainees : one year** for the trade of **Plumber**.

Note: Industry may impart training as per above time schedule for different block, however this is not fixed. The industry may adjust the duration of training considering the fact that all the components under the syllabus must be covered. However the flexibility should be given keeping in view that no safety aspects is compromised.

6. COURSE STRUCTURE

Training duration details: -

Time (in months)	1-3	4-12	13-15	16-24
Basic Training	**Block– I**	**-----**	**Block – II**	**------**
Practical Training (On - job training)	**----**	**Block – I**	**------**	**Block – II**

[Please do not make any changes in the course structure]

Components of Training	Duration of Training in Months →																							
↓	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Basic Training Block - I																								
Practical Training Block - I																								
Basic Training Block - II																								
Practical Training Block - II																								

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7. SYLLABUS

7.1 BASIC TRAINING
(BLOCK – I & II)
DURATION: 06 MONTHS

GENERAL INFORMATION

1) **Name of the Trade** : **PIPE FITTER**
2) **Hours of Instruction** : 1000 Hrs. (500 hrs. in each block)
3) **Batch size** : **20 trainees**
4) **Power Norms** : **a) Class room: 1kw, b) Workshop : 2 kw**
5) **Space Norms** : **a) Class room: 30 sqm, . b) Workshop: 80 sqm.**
6) **Examination** : The internal assessment will be held on completion of each Block.
7) **Instructor Qualification** :

i) Degree/Diploma in **Civil/Mechanical Engg**. from recognized university/Board with one/two year post qualification experience respectively in the relevant field.

OR

ii) NTC/NAC in **Plumber** / **Pipe Fitter** trade with three year post qualification experience in the relevant field.

Preference will be given to a candidate with Craft Instructor Certificate (CIC)

8) **Tools, Equipments & Machinery required** : - As per Annexure – I

7.1.1 DETAIL SYLLABUS OF CORE SKILL

A. Block– I
Basic Training

Topic No.	a) Engineering Drawing	Duration (in hours)	b) Workshop Science & Calculation	Duration (in hours)
1	Use of drawing instruments, T-square & Drg. Board. Free hand sketching of straight line rectangles squares, circles, polygons etc. – 2 Hrs.	**30**	• Common fraction addition, subtraction, multiplication and division, application of fractions to shop problems • CGS and FPS system of units of length, weight, their conversion	**20**
2	Free hand sketching of solid bodies with dimension to scale and proportionate sketching. – 2 Hrs.		• uses of cast iron, wrought iron, plain carbon steel and alloy steel. (Brief coverage)	
3	Simple orthographic projection first angle. Simple orthographic projection third angle. (To have a general concept of objects & figures which are covered above .) - 4Hrs.		• Applied workshop problems , • uses of copper zinc lead, tin, aluminium, brass, bronze, solder, bearing metals, timber. Asbestos, plastic materials, ceramic, asphalt. • Conversion of decimals of common fraction. Applies problems.	
4	• Simple isometric drawings. Isometric views of simple objects such as squares, rectangles, cubes, rectangular blocks etc. - 4Hrs.		• Square root of a perfect square. • square root of a whole number and a decimal,	
5	Conversion of orthographic views of solid objects like cubes, parallelopoids, prisms, conces, cylinders, etc. Into isometric views. (Single line isometric drawing and double line isometric drawing reading with symbols to understand symbolic figures of pipe fittings and accessories. Reading the rotations in isometric are to be taught.) - 12 hours		• The weight of a body, unit of weight shop problems. • Average and Percentage - its application –shop problems.	
6	Construction of simple figures and solids such as cubes rectangular block cylinders etc - 2Hrs.		• Ratio and proportion, applied problems.	

7	Lettering number & alphabets. - 2Hrs.		Mensuration - areas of rectangle, square triangle.	
8	Free hand isometric sketching of simple objects with dimensions including piping isometrics - - 2Hrs.		Mensuration - areas of circle, regular polygons etc.	

B. Block- II
Basic Training

Topic No.	a) Engineering Drawing	Duration (in hours)	b) Workshop Science & Calculation	Duration (in hours)
1	Views of simple solid and hollow bodies cut by section plane.	**30**	Calculation of area, calculation of volume and weight of solid bodies such as cubes, squares and hollow bodies, shop problems.	**20**
2	Symbols of Valves and Fittings Symbols of colour schemes for piping systems		Heat and temperature - Fahrenheit and centigrade scales and their conversion. Name and use of temperature measuring instruments used in workshops.	
3	Layout plan of a small village or town and mark the water line with valves of all types & the position of the reservoir. piping & installation (P&ID) diagrams / drawings details.		Geometric properties of angles, triangles and circles. Trapezoid, etc. - Simple problems	
4	Study of building plan & mark the position of the water supply line, drainage line connection to sewage line		Calculation of volume and weight of pipes of different dia and thickness Determination of pipe length.	
5	General arrangements of piping in various sections of ship hull and machinery piping layout, such as Double bottom tanks, various desks, Accommodation, refrigeration and cooling system		Electricity and its uses, electric current positive and negative terminals. Use of switches and fuses, conductor & insulators. Reading of simple graphs.	

6	Sketches of Deck and bulkhead fittings.		• Trigonometry – sine, cosine and tangent – simple problems.	
7	• Blue print reading: identify the size, material, pressure machinery valves and fittings, direction of flow, and to estimate the quantity of materials required, etc. • Hydraulic piping and system.		• Pressure testing methods in use and description of each necessary for expelling air in hydraulic testing, atmospheric pressure, etc. Danger due to creation of vacuums.	
8	• Freehand isometric sketching plan of simple objects like hexagonal bar, square bar , circular bar , piping isometrics			

7.1.2 DETAIL SYLLABUS OF *PROFESSIONAL SKILLS* & *PROFESSIONAL KNOWLEDGE.*

A. Block –I

Basic Training

Week No.	Professional Skills (275 Hrs.)	Professional Knowledge (120 Hrs.)
1	**INDUCTION TRAINING**: • Familiarization with the institute. • Importance of trade training. -Machinery used in the type of work done by trainees in the institute. • Type of jobs made by the trainees in the trade. • Introduction to safety: Equipment including fire fighting and their uses.	• Importance of safety and general precautions required for the trade. • Importance of the trade. • Types of work to be done by trainees in the institute. • Scope of a plumbing work. • Types of services have to plan. • Basic Bench fitting
2&3	• Use of steel rules, engineers square, Scriber and dividers for marking out from drawing. • Technique of handling & use properly the various Fitter's hand tools: hacksaw, centre punch, chisels, hammer, calipers, different files, bench vice and hand vice, taps ,dies and holders.	• Fitter's common hand tools - names, description and material from which they are made. • Description, types and uses of :holding device , hammers & cold chisels, cutting tools
4	• Making for drilling holes Drilling, tapping and threading on pipes. • Use of various locking devices, Fastening devices • Demonstration and uses of Carpenter's hand tools involving sawing, planning, chiseling and making simple joints.	• Description of simple drilling machine. • Method of using drills, taps and dies. • Description of simple bench drilling Machine. • Description and uses of Carpenter's hand tools used for simple operations such as marking, sawing, planning and making simple joints.
5	• Threading pipe of various sizes. Fixing of different fittings. **Practice of gas welding**: • Joining of pipes of different diameters and thickness by welding.	Different types of pipes- GI, CI, PVC / CPVC, PPR, AC and HDPE etc. **Gas welding** : • Gas purpose • Method of gas welding, • Safety precautions to be observed - Methods of soldering
6	• Use of mason hand tools : Straight edge spirit level, plumb bob, square, etc • Setting out work with tape, rule, square, line pin, and level. Cutting bricks and stones to given size and template.	**Masons hand tools**: • Names, description and their uses. - Method of making holes in walls and floors. • Types of tools used and various Processes.
7&8	• Preparation of cement mortars in different, Elementary brick work such as construction of gulley trap, inspection chamber & manhole of any convenient size.	• Concept of bricks and cement. Common brick joints. Concept of Scaffolding. • Method of construction of manhole

	• Cutting of wall with Masonry electric / power cutting tools.	etc.
9&10	• Use and care of the plumber's tools and equipments. • Cutting of pipes of different metals of different dimensions and sizes. • Bending of mild steel pipes and tubes and PVC pipes • Bending method: • Practice on cutting pipe at different angles for different joints. • steps of simple pipe connection • Bending, cutting of pipes as per drawing, • Measurement of bent pipes.	• Identify plumbing services required for each type of building according to usage. • Description of plumber tools and Equipments-ratchet, brace, threading die, pipe wrench, sliding wrench, spanner set, chain Wrench etc. and their safety. • Plumbing Symbols. • Care & use of tools. • **Pipes -** different kinds. • **Pipe fitting** – bends, elbows, sockets, tees, unions etc. their description, specification and use. water hammer in pipes.
11	• tacking pipes as per drawing. • Checking tacked pipes • Pipe welding in 1G and 2G position - butt joint, elbow joint, T-joint, angular joint, flange joint, etc. • TIG and MIG welding • Inspection and clearance using LPI testing during Root pass and cover pass • Checking pipes after welding	• Various types of pipe joints, pipe welding positions, and procedure. • Difference between pipe welding and plate welding. • Pipe welding position 1G, 2G, 5G & 6G
12	• PVC welding • PPR pipe welding joint • Layout of P.V.C. pipe according to drawing. • P.V.C. Description, Properties & use in plumbing work. Method of cutting & preparing joints. • P.V.C. fittings their description & use. • Method of laying out PVC pipe. • Fixing of pipe accessories	• Equipments and tools for hot gas welding and electric hot plate for PPR pipe joints • Impurities of water – organic and inorganic impurities • Sources of water • Different kinds of joints in joining pipes- GI,PVC/CPVCand HDPE etc.
13	**Revision 02 days**	
	Internal Assessment 03days	

B. Block –II
Basic Training

Week No.	Professional Skills (275 Hrs.)	Professional Knowledge (120 Hrs.)
1.	• Laying out of hummed and wrought iron / PVC pipes -according to drawing alignment of pipes and joining them. • Repair of leaks. (The pipe of minimum dia should be used).	• Use of hummed and asbestos pipes of different sizes. • Method of laying out pipes alignment and joining.
2	• Fabricate steel / metal pipes as per drawing – knowledge on part list in identifying, picking up and collecting correct items. • Joining of pipes with different materials and diameters with various fittings. • Cupro nickel / aluminium brass pipes and joints	• Description of various pipe joints- straight, Branch, Taft and blow, Expansion joints. Solders and fluxes used in joints.
3&4	• Construction of inspection chamber, manholes, gully traps. • Testing of drainage lines smoke test, water test, smell test, ball test, mirror test, etc.	• Inspection chamber, septic tank, description of drains, cess pools, soak pits etc. • Types of traps • layout of drainage system • Method of bending pipes by hot and cold process.
5	• Tracing out leakages and repairing of water supply system. • Removal of air locks. • Rain water harvesting system	• Method of dismantling and renewal of the valves and pipes. Leaks in pipes and noises in plumbing. • Installation of water meters. Air lock in pipes and its removal.
6&7	• Erecting simple water supply system including Installation of water meter. • Branching of pipes. Fixing, testing & repair of Bath tub, wash. basin etc. • Erecting rain water and drainage piping system. • Installation of sanitary fittings like water closets, urinals	• Erecting rain water and drainage pipe system, • installation of sanitary fitting s, inspection and testing of water supply system. • -Pipe alignment and slope. -Prevention of water hammer. • Storage tanks for general water supply propose. • Test for water supply pipes. • Description of sanitary fittings, • general points to be observed when choosing sanitary fittings.
8&9	• Fixing of C.I. external water pipe with branch to receive lead waste pipe from	• **Domestic drainage system**: • General layout,

	bath & wash basin and another branch – lead waste pipe from sink. • Fixing of external soil pipe with sand branch fitted to take lead soil pipe from W.C. • Fixing of rain water gutter, outlet and ground pipe. • Preparation and fixing of lead sink waste. Measurement, preparation and fixing up of lead wastes from wash basin and bath.	• one pipe system, • specifications of materials required. • Method of testing leakage. -Different types of traps, ventilation, anti syphonage and sinks.
10&11	• Measurement, cutting, preparation and fixing up of rising mains and • Distributing pipes as per layout. • Preparation and fixing of hot and cold services to the bath and wash basin as per layout. • Installation of hot water system. Erection of Geysers. • Description of solar water heating system.	• Domestic hot and cold water. • General layout, specification of materials required and Connection of pipes to mains. • Tracing leakage. • Repairs to service main. • Domestic boilers and Geysers. • Method of ventilating pipe. Precaution against air Poisoning. Fixing of solar water system.
12	• Cleaning of sanitary installations including pipes. Reconditioning and testing of taps, valves, overhead tanks, Flushing cisterns, etc. • Scraping and painting of pipes. • Repairing of broken or cracked sanitary fittings.	Sensor system for urinals and was basin, etc. Corrosion - causes and remedies, prevention. corrosion due to electrolytic action. Cathodic / Anodic protection. The effect of water and frost on materials. Layout of pipes as per drawing.
13.	• Testing plumbing installations.	
	Internal Assessment 03 days	

7.1.3 EMPLOYABILITY SKILLS

GENERAL INFORMATION

1)	**Name of the subject**	**:**	**EMPLOYABILITY SKILLS**
2)	**Applicability**	**:**	ATS- Mandatory for fresher only
3)	**Hours of Instruction**	**:**	**110 Hrs. (55 hrs. in each block)**
4)	**Examination**	**:**	The examination will be held at the end of two years Training by NCVT.
5)	**Instructor Qualification**	**:**	

i) MBA/BBA with two years experience or graduate in sociology/social welfare/Economics with two years experience and trained in Employability skill from DGET Institute.

And

Must have studied in English/Communication Skill and Basic Computer at 12th /diploma level

OR

ii) Existing Social Study Instructor duly trained in Employability Skill from DGET Institute.

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7.1.3.1 SYLLABUS OF EMPLOYABILITY SKILLS

A. Block – I
Basic Training

Topic No.	Topic	Duration (in hours)
	English Literacy	**15**
1	**Pronunciation :** Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)	
2	**Functional Grammar** Transformation of sentences, Voice change, Change of tense, Spellings.	
3	**Reading** Reading and understanding simple sentences about self, work and environment	
4	**Writing** Construction of simple sentences Writing simple English	
5	**Speaking / Spoken English** Speaking with preparation on self, on family, on friends/ classmates, on know, picture reading gain confidence through role-playing and discussions on current happening job description, asking about someone's job habitual actions. Cardinal (fundamental) numbers ordinal numbers. Taking messages, passing messages on and filling in message forms Greeting and introductions office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication.	
	I.T. Literacy	**15**
1	**Basics of Computer** Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.	
2	**Computer Operating System** Basics of Operating System, WINDOWS, The user interface of Windows OS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD etc, Use of Common applications.	
3	**Word processing and Worksheet** Basic operating of Word Processing, Creating, opening and closing Documents, use of shortcuts, Creating and Editing of Text, Formatting the Text, Insertion & creation of Tables. Printing document. Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets	
4	**Computer Networking and INTERNET** Basic of computer Networks (using real life examples), Definitions of Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks), Meaning of World Wide Web (WWW), Web Browser, Web Site, Web page and Search Engines. Accessing the Internet using Web Browser, Downloading and	

	Printing Web Pages, Opening an email account and use of email. Social media sites and its implication. Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes.	
	Communication Skill	**25**
1	**Introduction to Communication Skills** Communication and its importance Principles of Effective communication Types of communication - verbal, non verbal, written, email, talking on phone. Non verbal communication -characteristics, components-Para-language Body - language Barriers to communication and dealing with barriers. Handling nervousness/ discomfort. Case study/Exercise	
2	**Listening Skills** Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening. Triple- A Listening - Attitude, Attention & Adjustment. Active Listening Skills.	
3	**Motivational Training** Characteristics Essential to Achieving Success The Power of Positive Attitude Self awareness Importance of Commitment Ethics and Values Ways to Motivate Oneself Personal Goal setting and Employability Planning. Case study/Exercise	
4	**Facing Interviews** Manners, Etiquettes, Dress code for an interview Do's & Don'ts for an interview	
5	**Behavioral Skills** Organizational Behavior Problem Solving Confidence Building Attitude Decision making Case study/Exercise	

[Please do not make any changes in the Employability Skill syllabus]

B. Block– II
Basic Training

Topic No.	Topic	Duration (in hours)
	Entrepreneurship skill	**15**
1	**Concept of Entrepreneurship** **Entrepreneurship**- Entrepreneurship - Enterprises:-Conceptual issue Entrepreneurship vs. Management, Entrepreneurial motivation. Performance & Record, Role & Function of entrepreneurs in relation to the enterprise & relation to the economy, Source of business ideas, Entrepreneurial opportunities, The process of setting up a business.	
2	**Project Preparation & Marketing analysis** Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of Product Life Cycle (PLC), Sales & distribution Management. Different Between Small Scale & Large Scale Business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix.	
3	**Institutions Support** Preparation of Project. Role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.	
4	**Investment Procurement** Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes.	
	Productivity	**10**
1	**Productivity** Definition, Necessity, Meaning of GDP.	
2	**Affecting Factors** Skills, Working Aids, Automation, Environment, Motivation How improves or slows down.	
3	**Comparison with developed countries** Comparative productivity in developed countries (viz. Germany, Japan and Australia) in selected industries e.g. Manufacturing, Steel, Mining, Construction etc. Living standards of those countries, wages.	
4	**Personal Finance Management** Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.	
	Occupational Safety, Health & Environment Education	**15**
1	**Safety & Health** Introduction to Occupational Safety and Health importance of safety and health at workplace.	

2	**Occupational Hazards** Basic Hazards, Chemical Hazards, Vibro-acoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention.	
3	**Accident & safety** Basic principles for protective equipment. Accident Prevention techniques - control of accidents and safety measures.	
4	**First Aid** Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person	
5	**Basic Provisions** Idea of basic provision of safety, health, welfare under legislation of India.	
6	**Ecosystem** Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance.	
7	**Pollution** Pollution and pollutants including liquid, gaseous, solid and hazardous waste.	
8	**Energy Conservation** Conservation of Energy, re-use and recycle.	
9	**Global warming** Global warming, climate change and Ozone layer depletion.	
10	**Ground Water** Hydrological cycle, ground and surface water, Conservation and Harvesting of water	
11	**Environment** Right attitude towards environment, Maintenance of in -house environment	
	Labour Welfare Legislation	**5**
1	**Welfare Acts** Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen's compensation Act.	
	Quality Tools	**10**
1	**Quality Consciousness :** Meaning of quality, Quality Characteristic	
2	**Quality Circles :** Definition, Advantage of small group activity, objectives of quality Circle, Roles and function of Quality Circles in Organization, Operation of Quality circle. Approaches to starting Quality Circles, Steps for continuation Quality Circles.	
3	**Quality Management System :** Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.	
4	**House Keeping :** Purpose of Housekeeping, Practice of good Housekeeping.	
5	**Quality Tools** Basic quality tools with a few examples	

[Please do not make any changes in the Employability Skill syllabus]

7.2 PRACTICAL TRAINING (ON-JOB TRAINING)
(BLOCK – I & II)
DURATION: 18 MONTHS (9 months in each block)

GENERAL INFORMATION

1) **Name of the Trade** : **PIPE FITTER**

2) **Duration of On-Job Training** : a) Block–I: 9 months
b) Block–II : 9 months

Total duration of Practical Training: 18 months

3) **Batch size** : a)Selection of Apprentices as per apprenticeship guidelines.
b) Max. 20 trainees per group

4) **Examination** : i) The internal assessment will be held on completion of each block
ii) NCVT exam will be conducted at the end of 2nd year.

5) **Instructor Qualification** :

i) Degree/Diploma in **Civil/Mechanical Engg.** from recognized university/Board With one/two year post qualification experience in the relevant field.

OR

ii)NTC/NAC in **Plumber trade** with three year post qualification experience in the relevant field.

Preference will be given to a candidate with Craft Instructor Certificate (CIC)

6) **Tools, Equipments & Machinery required** : - As per Annexure – II

7.2.1 BROAD SKILL COMPONENT TO BE COVERED DURING ON-JOB TRAINING

A. BLOCK – I

1.	Instruction to safety precautions on the shop floor. Chipping, Filing, Grinding of chisels, Drilling, Threading with Taps and dies, Soldering, brazing, Welding (Gas and Arc),
2.	Cutting of sheet metal of size. Preparation of sheet metal articles involving development. Forming of rolls, welts corners & slashing in sheet. Measurements wire gauge and sheet gauge. Preparing gasket,
3.	Marking for excavation. Cement joining of pipes. Pipe fitting practice using standard G. I. pipe fittings, Copper pipe work : branch opening, diameter reduction / expansion / development of pipe.
4.	Pipe bending, hot bending and cold bending process.
5.	Pipe fabrication system: (a) Following simple sketches taken on ships and other shore ablation. (b) Pre-fabrication of pipe lines on shop Floor from detailed diagrams and working drawing (supplied)
6.	Method of jointing of different metal pipes (ferrous and non-ferrous metal) - flanging, screwing, butt-welding, wiping, brazing, lead burring, cementing, etc.
7.	Fabrication of accommodation pipe fittings : liquid seal, scupper box, refrigeration scupper box, gulley scupper box, wash basin brackets, air pipe hoods strainer (filters) mud boxes, rose boxes
8.	Dismantling and repairing, cleaning, painting of pipe lines as per I S colour codes. Erection of various piping system on board, special care regarding control valves like glove valves, gate valve (SDNR), Screw down non-return valve, check valves quick closing valves, Safety Valves, spring loaded safety valves, lever system (Relief valve)
9.	Pump connections layout of piping system-bilge, ballast, fire service (liquid and gas) sea water cooling, fresh water cooling, hydrophour lines, sea water, fresh water, hot water circulation, drainage, feed lines.
10.	System and exhaust piping, boiler feed water supply boiler exhaust gas lines, main engine exhaust gas lines, auxiliary generator exhaust gas lines
11.	Layout of heating coils system and principle of pipe lay- out, clamping, Ranger & Support, testing, etc. Pipe routing, preparing drawing from true layout on board, study the structural drawing, coordinating other fittings on board and finalizing the other piping system. Making simple sketches.

12.	Insulation of piping systems / lagging of pipe. Expansion joints in steel pipe and its applications. Testing of all piping systems before and after installation.
13.	Composition of water--hard & soft water- ternporary hardness and permanent action of water on lead-water softness-test for water-static hardness. Water on pressures and measurement of pressure - bursting pressure – expansion of water on freezing and heating. Pascal's Law. Pressure of water on the sides of cistern or tank, water hammer in pipes.

B. BLOCK – II

1	Soldering and brazing-ferrous and non-ferrous metals. Different joints for different pipes. Use types of fluxes. Precautions to be taken while fixing. Fitting of different joints for different pipes, water fittings.
2	Layout of drains, manholes, cess-pools and septic tank- drainage system, types of traps. Cutting and preparing joints. PVC fittings, laying of PVC pipes.
3	Laying out pipes-alignment and jointing: hummed and wrought iron / PVC pipes of different sizes. (various joints - straight joints, branch joints, Taft and blown joints, expansion joints in lead pipes and block flange joints. Solders and fluxes used in joints.
4	Layout Water supply systems of a small town. use Types of pumps - Suction pump, suction and force pump, plumber force pump, centrifugal pumps etc. use of pipe dies - their, care and precaution. Bending. Jointing and fixing pipe. Jointing material for water and gas pipes. Use of blow lamp.
5	Prepare template and use. Use Bending machine - bend pipes in hot condition or cold condition.
6	Use cocks and valves of different types. Repairing of the valve and pipe line - dismantling and reconditioning. Repair leaks in pipes, noises in plumbing, setting of meters, Air lock in pipes and its removal.
7	Erection of rain water and drainage- pipe system-installation of sanitary fittings-inspection and testing of water supply system pipe alignment and slope, Prevention of water hammer Storage tanks for general water supply purposes. Tests for water supply pipes.
8	Bending of lead pipes - Precaution. Bending of galvanized and other heavy pipes, their methods.
9	Domestic drainage system –general layout. One pipe – system. Specification of materials required. Method of testing leakage. Different types of traps W. C. and sinks.

	Ventilation and anti syphonage.
10	Layout for Domestic hot and cold water, estimate materials required and connect pipes to mains. Tracking leakage and repair. Fitting domestic boiler and Geysers, Methods of ventilating pipes. Precautions against air poisoning.
11	Prevention of corrosion, corrosion due to electrolytic action. Cathodic / Anodic protection.
12	Exhaustive training on ship welding piping a) Fabrication of Steel / Metal pipes b) Reading isometric drawings c) Knowledge on part list reading & identifying & picking up / collecting right items . d) Bending cutting, grinding, measurement of bent pipes, tacking of pipes as per drawing. e) Checking of tacked pipes. f) Checking the pipes after the welding.

[Please check the broad skill sets to be covered during the on-job training.]

8. ASSESSMENT STANDARD

8.1 Assessment Guideline:

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking assessment. Due consideration to be given while assessing for team work, avoidance/reduction of scrape/wastage and disposal of scarp/wastage as per procedure, behavioral attitude and regularity in training.

The following marking pattern to be adopted while assessing:

a) Weightage in the range of 60-75% to be allotted during assessment under following performance level:

For this grade, the candidate with occasional guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of an acceptable standard of craftsmanship.

In this work there is evidence of:

- good skill levels in the use of hand tools, machine tools and workshop equipment
- many tolerances while undertaking different work are in line with those demanded by the component/job.
- a fairly good level of neatness and consistency in the finish
- occasional support in completing the project/job.

b) Weightage in the range of above75%- 90% to be allotted during assessment under following performance level:

For this grade, the candidate, with little guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of a reasonable standard of craftsmanship.

In this work there is evidence of:

- good skill levels in the use of hand tools, machine tools and workshop equipment
- the majority of tolerances while undertaking different work are in line with those demanded by the component/job.
- a good level of neatness and consistency in the finish
- little support in completing the project/job

c) Weightage in the range of above 90% to be allotted during assessment under following performance level:

For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.

In this work there is evidence of:

- high skill levels in the use of hand tools, machine tools and workshop equipment
- tolerances while undertaking different work being substantially in line with those demanded by the component/job.
- a high level of neatness and consistency in the finish.
- minimal or no support in completing the project

8.2 FINAL ASSESSMENT- ALL INDIA TRADE TEST (SUMMATIVE ASSESSMENT FOR TWO YEARS TRADE)

SUBJECTS	Marks	Internal assessment based on competency	Full Marks	Pass Marks	Duration of Exam.
Basic Training(Block-I)		**250**	**250**	**150**	
Professional Skill	250		250	150	**08 hrs.**
Professional Knowledge	100		100	40	3 hrs.
Workshop Cal. & Sc.	50		50	20	3 hrs.
Engineering Drawing	50		50	20	4 hrs.
Employability Skill	50		50	20	3 hrs.
Basic Training (Block-II)		**250**	**250**	**150**	
Grand Total	**500**	**500**	**1000**	**550**	

Note: - The candidate pass in each subject conducted under all India trade test.

9. FURTHER LEARNING PATHWAYS

- On successful completion of the course trainees can opt for Diploma course (Lateral entry). [Applicable for candidates only who undergone ATS after CTS]

- On successful completion of the course trainees can opt for CITS course.

Employment opportunities:

On successful completion of this course, the candidates may be gainfully employed in the following industries:

1. Production & Manufacturing industries.
2. Building & construction, Structural, Fabrication industries.
4. Service industries
5. Ship building and repair
6. Infrastructure and defence organisations
7. In public sector (Central and State) and private industries of related field in India & abroad.
8. Self employment

[Please do make changes in the above content as per trade requirement, if necessary]

ANNEXURE – I

10. TOOLS & EQUIPMENT FOR BASIC TRAINING

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

TRADE: PIPE FITTER
LIST OF TOOLS & EQUIPMENTS FOR 20 APPRENTICES

A : TRAINEES TOOL KIT:-

Sl. No.	Name of the items	Quantity (indicative)
1.	Rule Steel 300 mm both in inch and mm	21 Nos.
2.	Rule Wooden 4 fold, 600 mm	21 Nos.
3.	Hacksaw Frame adjustable for 250 to 300 mm	21 Nos.
4.	Scriber 200 mm	21 Nos.
5.	Centre punch 100 mm	21 Nos.
6.	Chisel Cold, flat 20 mm	21 Nos.
7.	Hammer ball pein 800 grams	21 Nos.
8.	Hammer ball pein 50 grams	21 Nos.
9.	File flat rough 300 mm	21 Nos.
10.	Level spirit wooden 300 mm	21 Nos.
11.	Plumb bob 50 grams	21 Nos.
12.	Trowel C-125-I S: 6013	21 Nos.
13.	Stillson wrench 200 & 350 mm	21 Nos.
14.	Screw Driver 250 mm	21 Nos.
15.	Wooden Mallet small I S: 2022	21 Nos.
16.	Cutting pliers 200mm I S : 3650	21 Nos.
17.	Steel tape (5m)	21 Nos.

B : TOOLS INSTRUMENTS AND GENERAL SHOP OUTFITS

Sl. No.	Name of the items	Quantity (indicative)
1.	Marking Table 900X600X900mm high	1 no.
2.	'V' Blocks with-63AIS2949clamps 80/7	1no.
3.	Combination set 200 mm	2 nos.
4.	Scribing Block, Universal, 300 mm	1 no.
5.	Hand Vice, Jaw 50 mm	2 nos.
6.	File Flat, Smooth 200 mm	2 nos.
7.	File Half Round, Rough 300 mm	2 nos.
8.	File, Square, rough 250 mm	2 nos.
9.	File, Square, Smooth 200 mm	2 nos.
10.	File Triangular Rough 250 mm	2 nos.
11.	File Flat Rasp 250 mm	2 nos.
12.	File Triangular Smooth 200 mm	2 nos.
13.	Chisel Cold Flat 20 mmX300mm	2 nos.
14.	Chisel Cross Cut 6X150 mm I S-402	2 nos.
15.	Chisel Round Nose 3X150 mm I S -402	2 nos.
16.	Chisel Diamond Point 6X150mm	2 nos.
17.	Tap and Die set to cut B.S.F. , B.S.W.	1 set each
18.	metric threads of sizes M-6 to M-12	1 set each
19.	Screw Pitch gauge to cover above threads	1 set
20.	Punch , Letter set	1 no.
21.	Punch , Number set	1no.
22.	Saw Plumber 300mm	2 nos.
23.	Spanner monkey up to 50mm	2 nos.
24.	Stove melting solder	1 no.
25.	Cutter ,Pipe, wheel type 6mm to 25mm	1no.
26.	Oil stone 150X50X25mm	2 nos.
27.	Soldering Iron , Copper , Bit , Fire heated , Hatched , Straight , 500 grams	4 nos.
28.	Snip Straight 250mm	2 nos.
29.	Snip bend 250mm	2 nos.
30.	Try square 200mm	2 nos.
31.	Inside Caliper 150mm	2 nos.
32.	Caliper outside 150mm	2 nos.
33.	Odd leg caliper 200mm	2 nos.
34.	Tenon saw	2 nos.
35.	Hand Saw.	2 nos.
36.	Mortise Chisel	2 sets.
37.	Firmer Chisel	2 sets.
38.	Mallet Medium IS: 2922	2 nos.
39.	Jack plane	2 nos.
40.	Gas Welding set with oxygen acetylene cylinder	1 no
41.	Goggles pair welder 100 mm	2 pairs
42.	Brush Steel Wire 150X 50 mm	1 no
43.	Table welding 1200X 750 mm with fire bricks top and stand	1 no.
44.	Pliers combination, 200 mm	2 nos.
45.	Blow lamp 500 milliliter	2 nos.

46.	Washer cutter	1 no.
47.	Mirror 100X150 mm	2 nos.
48.	Scribing gauge	1 no.
49.	Soil pot with brush	1 no.
50.	Pot- Hook	1no.
51.	D. E. Spanners 7X8, 10X11, 13X1. 7, 19X2.2, 24X27 IS:2028	2 sets.
52.	Branch Gimlets	2 nos.
53.	Bending Spring	1 set.
54.	Plumbers Ladle	2 nos.
55.	Tool caulking set of 5	2 nos.
56.	Plumbers' metal melting pot 10 kg	1 no.
57.	Pipe stock and dies complete with stocks, bushing , bushing holders, Taps and wrenches sizes covered, to suit pipes of bore dia 6,8,10,20,25,32,40,&50mm	4 sets
58.	Pipe vice to grip up to 77 mm is -2587	8 nos.
59.	Stillson pattern pipe wrenches 450 mm to take pipe up to 52 mm dia I s -4003	2 sets.
60.	Stillson pattern pipe wrenches 300mm to take pipe 20 mm to 32mm	2 sets.
61.	Chain :pipe wrench 90mm -650 is 4123	2 sets.
62.	Adjustable, spanner, A-375, IS- 6149	2 nos.
63.	Anvil 50 or 63 kg. IS- 510	1 no.
64.	Pipe bender, manually operated	1 no.
65.	Leg vice, 75mm jaw on Stand IS -2588	1 no.
66.	Hand drill 6mm capacity with drill chuck (Electric)	1 no.
67.	Drill Twist (straight shank) 3mm to 6mm	1 set.
68.	Portable forge ,450mmwith hand blower	1 no.
69.	Flat smithy tong	2 nos.
70.	working bench 2400x1200x750mm with 4 voice 125 mm jaws	2 nos.
71.	Bath tub small size	1 no.
72.	Wash Basin (16"X14"X10")Equivalent	2 nos.
73.	Water Heater 10 liter	1 no.
74.	Water closet (European type p) complete with over head cistern	1 set.
75.	Water closet (Indian type) complete with over head cistern	1 set.
76.	Urinal wall type complete with automatic system	1 set.
77.	Water meter	2 nos.
78.	Fire Extinguisher	1 no.
79.	Fire Buckets with stand	1 no.
80.	Sight rail and boning rod	1 no.
81.	Ratchet pipe die 15 mm to 32 mm	1 no.
82.	Double face hammers	2 nos.
83.	Dormat, Pickaxe, Spade, Girmale	1 each
84.	Solar water heater system	1 no.
85.	Ring gauge 15 mm,20mm,25mm,32mm	1 each

C : GENERAL MACHINERY INSTALLATIONS:-

Sl. No.	Name & Description of Machines	Quantity (indicative)
1.	Hammering drilling machine	1 no.
2.	Electric PPR pipe welding machine	1 no.
3.	Electric pump, 1 HP	1 no.
4.	D.E. pedestal grinder with two wheels 175mm rough and smooth	1 no.
5.	Hydraulic pressure machine for testing leakage in GI pipe fittings etc.	1 no.
6.	Bench drilling machine with chuck and key upto 15mm capacity	1 no.
7.	Pipe bender(Hydraulic type)	1 no.

Note: In case of basic training setup by the industry the tools, equipment and machinery available in the industry may also be used for imparting basic training.

[Kept optimum no. of tools and equipments with minimum specification which are essential for imparting basic training Please check]

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: PIPE FITTER

LIST OF TOOLS& EQUIPMENTS FOR 20 APPRENTICES

1) **Space Norms** : 45 Sq. m.(For Engineering Drawing)

2) Infrastructure:

A : TRAINEES TOOL KIT:-

Sl. No.	Name of the items	Quantity (indicative)
1.	Draughtsman drawing instrument box	20+1 set
2.	Set square celluloid 45^0 (250 X 1.5 mm)	20+1 set
3.	Set square celluloid 30^0-60^0 (250 X 1.5 mm)	20+1 set
4.	Mini drafter	20+1 set
5.	Drawing board (700mm x500 mm) IS: 1444	20+1 set

B : FURNITURE REQUIRED

Sl. No.	Name of the items	Quantity (indicative)
1.	Models : Solid & cut section	as required
2.	Drawing Table for trainees	as required
3.	Stool for trainees	as required
4.	Cupboard (big)	01
5.	White Board (size: 8ft. x 4ft.)	01
6.	Trainer's Table	01
7.	Trainer's Chair	01

[Please Do Not Change The Items In The Above Tool List. Mention the Quantity in the Vacant Place]

ANNEXURE – II

11. INFRASTRUCTURE FOR ON-JOB TRAINING

TRADE: PIPE FITTER

For Batch of 20 APPRENTICES

Actual training will depend on the existing facilities available in the establishment. However, the industry should ensure that the broad skills defined against On-Job– Training part (i.e. 9 months + 9 months) are imparted. In case of any short fall the concerned industry may impart the training in cluster mode / in any other industry / at ITI.

ANNEXURE-III

12. GUIDELINES FOR INSTRUCTORS AND PAPER SETTERS

1. Due care to be taken for proper & inclusive delivery among the batch. Some of the following some method of delivery may be adopted:

A) LECTURE
B) LESSON
C) DEMONSTRATION
D) PRACTICE
E) GROUP DISCUSSION
F) DISCUSSION WITH PEER GROUP
G) PROJECT WORK
H) INDUSTRIAL VISIT

2. Maximum utilization of latest form of training viz., audio visual aids, integration of IT, etc. may be adopted.

3. The total hours to be devoted against each topic may be decided with due diligence to safety & with prioritizing transfer of required skills.

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