Curriculum
for
Certificate Programme
in
PLUMBER
for

Maharaja Ranjit Singh Punjab Technical University,
Bathinda (Punjab)

Prepared By:

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FOREWORD

Rapid industrialization and globalization has created an environment for free flow of information and technology through fast and efficient means. This has led to shrinking of the world, bringing people from different culture and environment together and giving rise to the concept of world turning into a global village. In order to cope with the challenges of handling new materials, machines and technologies, we have to develop human resources having appropriate competencies. There is an increasing demand of skilled workforce in India in particular and the world over in general. Under the new circumstances, India faces a challenging task of meeting the technical manpower requirement, especially in the area of skilled workforce to cater to industrial needs. Efforts have to be made so that passouts from our technical institutions are acceptable at global level.

Technical education system is one of the significant components of the human resource development and has grown phenomenally during all these years. Technical institutions play an important role in meeting the requirements of trained technical manpower for industries and field organizations. The initiatives being taken by Maharaja Ranjit Singh Punjab Technical University (MRSPTU), Bathinda, Punjab to start the skill oriented integrated courses at certificate, diploma and degree level, as per the needs of the industry, are laudable.

In order to meet the future requirements of technical manpower, we will have to revamp our existing technical education system and one of the most important requirements is to develop outcome-based curricula of technical programmes at various levels. The curricula for various programmes have been revised by adopting time-tested and nationally acclaimed scientific method, laying emphasis on the identification of learning outcomes of programme and various courses.

The success of any technical programme depends upon its effective implementation. However best the curriculum document is designed, if it is not implemented properly, the output will not be as per expectations. In addition to acquisition of appropriate physical resources, availability of motivated, competent and qualified faculty is equally essential for effective implementation of the curricula.

It is expected that MRSPTU will carry out curriculum evaluation on a continuous basis to identify the new skill requirements. At the same time, it is expected that innovative methods of course offering will be used to develop desired skills and infuse the much needed dynamism in the system.

Dr. M.P. Poonia
Director
National Institute of
Technical Teachers Training & Research
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PREFACE

Curriculum document is a comprehensive plan of an educational programme. It is through the curriculum that the educational objectives of a programme are achieved. It has to be ensured that the curriculum is dynamic, articulated, balanced, data based, feasible, and as per industrial needs. Curriculum Development Centre at NITTTR, Chandigarh has been extending services to technical education system of the states in northern region in developing and updating their curriculum on regular basis.

Maharaja Ranjit Singh Punjab Technical University (MRSPTU), Bathinda, Punjab assigned the project for developing the curriculum of some integrated programmes to this institute in the month of May 2016. A series of curriculum workshops were held during the months of June-July, 2016. This curriculum document is an outcome of the extensive discussions held with the representatives from various organizations, technical institutions and industry during the curriculum workshops. While developing the study and evaluation scheme and detailed contents, the following aspects have been kept in mind:

- Employment Opportunities of Certificate holders
- Job role of certificate holders
- Learning outcome of the Programme
- Mobility of students for their professional growth

We have taken cognizance of recommendation of experts both from industry and academic institutions and have adequately incorporated segments of Industrial Training in the curriculum. Time has specifically been allocated for undertaking extra-curricular activities. Emphasis has been laid on developing and improving communication skills in the students for which units on Communication Skills have been introduced in both the semesters of the certificate course.

We hope that this curriculum document will prove useful in producing skilled manpower at desired level in the state of Punjab. The success of this outcome-based curriculum depends upon its effective implementation and it is expected that MRSPTU will make all efforts to create better facilities, develop linkages with the world-of-work and foster conducive and requisite learning environment as prescribed in the curriculum document.

Professor and Head
Curriculum Development Centre
NITTTR, Chandigarh

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Coordinator

1. SALIENT FEATURES OF THE PROGRAMME

1.	Sector	:	Construction
2.	Name of the Certificate Programme	:	Plumber
3.	Entry Qualification	:	Matriculation or equivalent NSQF Level as prescribed by MRSPTU, Bathinda
4.	Duration of the Programme	:	One Year
5.	Intake	:	30
6.	Pattern of the Programme	:	Semester Pattern
7.	NSQF Level	:	Level - III
8.	Ratio between theory and Practice	:	20 : 80 (Approx.)

2. JOB ROLE AND JOB OPPORTUNITIES

a) Job Role

A plumber is responsible for installing, repairing and maintaining pipes, fixtures and other plumbing used for water distribution and waste water disposal in domestic and commercial buildings.

b) Job Opportunities

Following job opportunities are visualized for Plumber certificate holders:

1. Maintenance Section of Government organization/Public sector
2. Construction Industries
3. Civil Contractors and Builders
4. Establishment of own enterprise by opening a repair/service centre/shop
5. Establishment of own shop of sanitary, water supply and hardware items/materials
6. Work as licensed Plumber for water supply and sanitary installations as desired by various Municipal authorities.

3. LEARNING OUTCOMES OF THE PROGRAMME

After undergoing the programme, students will be able to:

Identify and select latest materials related to plumbing

1. Perform cutting, threading, bending and jointing of GI/PPR/PVC/MDP/HDP pipes etc.
2. Lay CI pipes and perform lead filling and caulking horizontally and vertically with alignment and grade
3. Laying and joining SW/SWR/PVC pipes with alignment and grade for sewerage and rain water harvesting
4. Fix sanitary fittings and fixtures
5. Install water pumps and connect to supply lines
6. Assess the requirement of materials for a specific work and calculate the quantum of material and costing/billing
7. Work as a licensed plumber as per provisions of various laws of local Municipal authorities for release of water connection, and sewerage connection
8. Apply basic principles of mathematics and physics in solving the trade problems
9. Communicate effectively in English with others.

4. STUDY AND EVALUATION SCHEME FOR CERTIFICATE PROGRAMME IN PLUMBER

FIRST SEMESTER

CODE	UNITS	STUDY SCHEME Total Hours		CREDITS	MARKS IN EVALUATION SCHEME								Total Marks
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		Th	Pr		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
CCIE1-101	*Communication Skills	8	-	1	25	-	25	25	1			25	50
CCIE1-101P	*Communication Skills Lab.	-	24	1	-	25	25	-	-	50	3	50	75
CCIE1-102	Engineering Drawing – I (Plumber)	-	-	1	-	-	-	75	3	-	-	75	75
CCIE1-102P	Engineering Drawing – I (Plumber)	-	32	1	-	50	50	-	-	-	-	-	50
CCIE1-103	Introduction to Plumbing	16	-	1	25	-	25	50	2	-	-	50	75
CCIE1-103P	Introduction to Plumbing Lab.	-	96	3	-	50	50	-	-	100	4	100	150
CCIE1-104	Plumbing Materials and Accessories	16	-	1	25	-	25	50	2	-	-	50	75
CCIE1-104P	Plumbing Materials and Accessories Lab.	-	112	4	-	50	50	-	-	100	4	100	150
CCIE1-105	Chase Cutting and Operation on Walls	16	-	1	25	-	25	50	2	-	-	50	75
CCIE1-105P	Chase Cutting and Operation on Walls Lab.	-	80	3	-	50	50	-	-	75	4	75	125
CCIE1-106	Taps and Valves	16	-	1	25	-	25	50	2	-	-	50	75
CCIE1-106P	Taps and Valves Lab.	-	96	3	-	50	50	-	-	100	4	100	150
CCIE1-107P	#Student Centred Activities (SCA)	-	48	2	-	25	25	-	-	-	-	-	25
CCIE1-108P	+4 Weeks Industrial Training (during vacation)	-	-	4	-	-	-	-	-	100	3	100	100
Total		**72**	**488**	**27**	**125**	**300**	**425**	**300**	**-**	**525**	**-**	**825**	**1250**

Typ your text

* Common with other certificate programmes

\# SCA will comprise of co-curricular activities like extension lectures on entrepreneurship, environment and energy conservation, sports, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities etc.

+ **Industrial Training**

After examination of 1st Semester, the students will go for training during vacation in a relevant industry/field organization for a minimum period of 4 weeks and will prepare a diary. The students will prepare a report at the end of training and will present it in a seminar. This evaluation will be done by concerned instructor in the presence of one industrial representative from the related programme/trade.

Total weeks per Semester = 16 Total working days per week = 5 Total hours per day = 7

Total hours in a Semester = 16 x 5 x 7 = 560

One credit is defined as one hour of lecture per week or two hours of practicals per week for one semester. Fractions in credits have been rounded to nearest integer.

SECOND SEMESTER

CODE	UNITS	STUDY SCHEME Total Hours		CREDITS	MARKS IN EVALUATION SCHEME								Total Marks
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		Th	Pr		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
CCIE1-209	*Basic Sciences	48	-	3	25	-	25	75	2	-	-	75	100
CCIE1-210	Engineering Drawing – II (Plumber)	-	-	0.5	-	-	-	75	3	-	-	75	75
CCIE1-210P	Engineering Drawing – II (Plumber)	-	32	0.5	-	50	50	-	-	-	-	-	50
CCIE1-211	Operations on Plumbing Pipes	16	-	1	25	-	25	50	2	-	-	50	75
CCIE1-211P	Operations on Plumbing Pipes Lab.	-	96	3	-	50	50	-	-	100	4	100	150
CCIE1-212	Installation and Maintenance of Sanitary Fixtures	32	-	2	25	-	25	50	2	-	-	50	75
CCIE1-212P	Installation and Maintenance of Sanitary Fixtures Lab.	-	96	3	-	50	50	-	-	100	4	100	150
CCIE1-213	Plumbing Systems	16	-	1	25	-	25	50	2	-	-	75	75
CCIE1-213P	Plumbing Systems Lab.	-	96	3	-	50	50	-	-	100	4	150	150
CCIE1-214	Estimating and Costing	16	-	1	25	-	25	50	2	-	-	50	75
CCIE1-214P	Estimating and Costing	-	64	2	-	50	50	-	-	75	4	75	125
CCIE1-215P	#Student Centred Activities (SCA)	-	48	2	-	25	25	-	-	-	-	-	25
CCIE1-216P	+4 Weeks Industrial Training	-	-	4	-	-	-	-	-	100	3	100	100
Total		**128**	**432**	**26**	**125**	**275**	**400**	**350**	**-**	**475**	**-**	**825**	**1225**

* Common with other certificate programmes

\# SCA will comprise of co-curricular activities like extension lectures on entrepreneurship, environment and energy conservation, sports, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities etc.

\+ **Industrial Training**

After examination of 2nd Semester, the students will go for training during vacation in a relevant industry/field organization for a minimum period of 4 weeks and will prepare a diary. The students will prepare a report at the end of training and will present

it in a seminar. This evaluation will be done by concerned instructor in the presence of one industrial representative from the related programme/trade.

5. GUIDELINES FOR ASSESSMENT OF STUDENT CENTRED ACTIVITIES (SCA)

It was discussed and decided that the maximum marks for SCA should be 25 as it involves a lot of subjectivity in the evaluation. The marks may be distributed as follows:

i. 5 Marks for general behavior and discipline
(by Principal in consultation with all the trainers)

ii. 5 Marks for attendance as per following:
(by the trainers of the department)

a)	75%	Nil
b)	75 - 80%	2 Marks
c)	80 - 85%	3 Marks
d)	Above 85%	5 Marks

iii. 15 Marks maximum for Sports/NCC/Cultural/Co-curricular/ NSS activities as per following:
(by In-charge Sports/NCC/Cultural/Co-curricular/NSS)

a)	15	-	National Level participation or inter-University competition
b)	10	-	Participation in two of above activities
c)	5	-	Participation in internal sports of the University

Note: There should be no marks for attendance in the internal sessional of different subjects.

UNIT – 1.1
Subject Code: CCIE1-101
COMMUNICATION SKILLS

LEARNING OUTCOMES:
After undergoing this unit, the students will be able to:

- Speak confidently.
- Overcome communication barriers.
- Write legibly and effectively.
- Listen in proper prospective.
- Read various genres adopting different reading techniques.
- Respond to telephone calls effectively.

Practical (24 Hours)	**Theory (08 Hours)**
	Basics of Communication • Process of communication • Types of communication - formal and informal, oral and written, verbal and non-verbal • Objectives of communication • Essentials of communication • Barriers to communication (1 hour)
• Looking up words in a dictionary (meaning and pronunciation) (2 hours)	Functional Grammar and Vocabulary • Parts of speech • Tenses • Correction of incorrect sentences (2 hours)
• Self and peer introduction • Greetings for different occasions (1 hour)	Listening • Meaning and process of listening • Importance of listening • Methods to improve listening skills Speaking • Importance • Methods to improve speaking • Manners and etiquettes (2 hours)
• Newspaper reading (1 hour)	Reading • Meaning • Techniques of reading: skimming, scanning, intensive and extensive reading (1 hour)
• Vocabulary enrichment and grammar exercises • Exercises on sentence framing accurately (6 hours)	Functional Vocabulary • One-word substitution • Commonly used words which are often misspelt • Punctuation • Idioms and phrases (2 hours)

• Reading aloud articles and essays on current and social issues • Comprehension of short paragraph (5 hours)	
• Write a short technical report • Letter writing (3 hours)	
• Participate in oral discussion • Respond to telephonic calls effectively • Mock interview (6 hours)	

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work
- Viva-voce

UNIT: 1.2
Subject Code: CCIE1-102
ENGINEERING DRAWING – I (PLUMBER)

LEARNING OUTCOME:
After undergoing this unit, the students shall be able to:

- Draw free hand sketches of simple objects
- Prepare and interpret drawings of various fixtures of plumbing.

Practical (32 hours)	**Theory**
• Lettering – Number and alphabets (2 hours) • Free hand sketches in isometric of simple objects (2 hours) • Drawing a plan and elevation of different types of bars (2 hours) • Prepare layout plan for showing the water line for a residential building (6 hours) • Studying of building plan for marking the position of the sanitary fittings (6 hours) • Preparation of simple working drawing (8 hours) • Drawing a longitudinal section of the house drainage (6 hours)	

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Sketching
- Drawing

UNIT - 1.3
Subject Code: CCIE1-103
INTRODUCTION TO PLUMBING

LEARNING OUTCOMES:

After undergoing the unit, students will be able to:

- Use various types of tools and equipment required in plumbing.
- Define the specifications and conventions.
- Identify and select various types of plumbing materials.
- Use good house-keeping practices and safety measures

Practical (96 hrs)	**Theory (16 hrs)**

• Identification of basic tools and equipments used in plumbing works and their sketches (10 hrs)
• Demonstration of plumbing tools and equipment. (22 hrs)
• Use of protective clothing, boots, goggles and equipment as applicable to plumbing related task. (15 hrs)
• Demonstration of good housekeeping practices, proper handling of materials and waste disposal. (18 hrs)
• Demonstration of safety precautions, use of safety belts and helmets while working at site (20 hrs)
• Exposure to methods for storage/laying plumbing materials at work in safe manner (8 hrs)
• Water supply – direct/overhead (2 hrs)
• Sanitary (1 hr)
	• Introduction to plumbing (1 hrs)
	• Safety precautions:
	  • While using different hand tools
	  • While using raw materials
	  • With co-workers
	  • On the machines & equipment (3 hrs)
	• Different types of basic tools and equipment used in plumbing such as Cutter, Vices, Ratchet Type, Pipe Threading Die, Electric Hand Drilling Machine, Socket, Fusion device for PPR pipe etc. (4 hrs)
	• Various types of plumbing materials such as Galvanized Iron(GI), Cast Iron(CI), Poly Vinyl Chloride (PVC), PPR, C-PVC, Stoneware(SW), Stainless Steel pipe, Wrought Iron (WI), Lead, Chinaware(CW), Chrome plated (CP) fittings etc. (8 hrs)

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Viva-voce

UNIT - 1.4
Subject Code: CCIE1-104
PLUMBING MATERIALS AND ACCESSORIES

LEARNING OUTCOMES:
After undergoing the unit, students will be able to:

- Identify and select various types of pipes available in the market.
- Identify and select various types of specials.

Practical (112 hrs)	**Theory (16 hrs)**
• Identification of different types of pipes and specials used in plumbing work. (15 hrs) • Demonstration of various types of pipes like G.I., C.I., PVC, PPR, SWR and SW pipes etc. (15 hrs) • Demonstration of various types of specials like: (36 hrs) – G.I. Specials: Elbow, Tee, reducing elbow, union, sockets, reducing socket, plugs – C.I. Specials: Collars, bends, door bends, door pieces, Various types of junctions, offsets, floor trap, traps, cowl etc.. – PVC/PPR Specials: Elbow, Tee, reducing elbow, Union, socket, cap plug, clamps, coupler, Cross-Tee etc. – SWR Specials: Gully Trap, intercepting trap etc.	• Description of various pipes like Galvanized Iron (G.I), Cast Iron (C.I), Poly Vinyl Chloride(PVC), Poly Propylene Random (PPR), Soil Waste Rain(SWR) and Stoneware (SW) with their specific uses, availability, specification and cost. (5 hrs) • Description and sketch of various types of specials like junctions, elbow, traps etc. their application, availability, specifications and cost. (6 hrs)
• Practice on fixing of chinaware fittings such as water closet (Orissa pan/European pan) wash basin, bath tub, urinal pots and their partitions and kitchen sink etc. Mixtures/shower/geysers/solar water heating system. (30 hrs) • Practice on fixing C.P. fittings, like bib cock, angle cock, shower, towel ring/rail, soap dish etc. (16 hrs).	• Description of various standards for fixing sanitary fittings such as standard height, orientation and location. • Basic knowledge (5 hrs)

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work
- Viva-voce
- Sketching
- Workshop job

UNIT - 1.5
Subject Code: CCIE1-105
CHASE CUTTING AND OPERATION ON WALLS

LEARNING OUTCOMES:

After undergoing the unit, students will be able to:

- Use various mason tools
- Use construction materials in masonry work.
- Execute small masonry work.

Practical (80hrs)	**Theory (16 hrs)**
• Demonstration of various mason tools and materials. (12 hrs) • Practice of chase cutting for various sizes of pipes (24 hrs) • Practice of operations on walls such as drilling, nailing, clipping, finishing and hammering/cutters (26 hrs) • Practice of preparing cement mortar (1:4) and concrete mortar (1:2:4) and its application for filling chase and hole cutting (18 hrs)	• Introduction to mason tools and materials used in masonry work-their use, availability and cost (5 hrs) • Description of various sizes of Chase cutting required for various sizes of pipes (6 hrs) • Mixing of cement mortar and its use (5 hrs)

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Viva-voce
- Workshop job

UNIT - 1.6
Subject Code: CCIE1-106
TAPS & VALVES

LEARNING OUTCOMES:
After undergoing the unit, students will be able to:

- Explain working principles of taps and valves
- Identify and select various types of taps and valves
- Repair the taps and valves

Practical **(96 hrs)**	**Theory** **(16 hrs)**
• Selection of taps and valves followed by demonstration by instructor, the trainee will dismantle taps & Valves, inspect packing glands and washers, replace packing gland and washers, adjust locking nuts ensuring no leaks when tested. (54 hrs) • Fixing of latest/ advanced mixer, bib cocks, angle valves, push cocks, pillar cock etc. (42 hrs)	• Working principles of taps and valves and their methods of testing and use of basic tools and bench vice. (6 hrs) • Safe handling of tools and fittings (2 hrs) • Types of gland packing. (2 hrs) • Various types of valves; sluice valve, air relief valve, drain valve, foot valve, check valve, (6 hrs)

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Viva-voce
- Workshop job
- Assembly and disassembly

Subject Code: CCIE1-108
INDUSTRIAL TRAINING – I (4 Weeks)

The purpose of industrial training is to:

- Develop understanding regarding the size and scale of operations and nature of industrial/field work in which students are going to play their role after completing the courses of study.
- Develop confidence amongst the students through firsthand experience to enable them to use and apply institute based knowledge and skills to perform field activities
- Develop special skills and abilities like interpersonal skills, communication skills, attitudes and values.

It is needless to emphasize further the importance of Industrial Training of students during their one-year certificate programme. It is industrial training, which provides an opportunity to students to experience the environment and culture of world of work. It prepares students for their future role as skilled person in the world of work and enables them to integrate theory with practice.

An external assessment of 100 marks have been provided in the study and evaluation scheme of 1st Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations.

The instructor along with one industrial representative from the concerned trade will conduct performance assessment of students. The components of evaluation will include the following:

a) Punctuality and regularity 20%

b) Industrial training report 50%

c) Presentation and viva-voce 30%

UNIT – 2.1
Subject Code: CCIE1-209
BASIC SCIENCES

LEARNING OUTCOMES:
After undergoing this unit, the students will be able to:

- Apply the basic principles of Maths in solving the basic problems of the trade.
- Apply the basic principles of physics in solving the basic problems of the trade.

Practical	Theory (48 Hours)
	Mathematics • Basic Algebra – algebraic formula. Simultaneous equation – quadratic equations (4 hours) • Simultaneous linear equation in two variables (3 hours) • Arithmetic and geometric progression, sum of n-terms, simple calculations. (3 hours) • Mensuration – Find the area of regular objects like triangle, rectangle, square and circle; volumes of cube, cuboid, sphere cylinder (6 hours) • Trigonometry - Concept of angle, measurement of angle in degrees, grades and radians and their conversions, T-Ratios of Allied angles (3 hrs) • Co-ordinate Geometry - Cartesian and polar coordinates, conversion from Cartesian to polar coordinates (2 hrs) • Concept of Differentiation and Integration (3 hrs)
	Physics • FPS, CGS, SI units, dimensions and conversions (2 hours) • Force, speed, velocity and acceleration – Definition, units and simple problems (3 hours) • Stress and strain, modulus of elasticity (2 hours) • Heat and temperature, its units and specific heat of solids, liquids and gases (4 hours) • Electricity and its uses, basic electricity

	terms and their units, D.C. and A.C., positive and negative terminals, use of switches and fuses, conductors and insulators (5 hours) • Work, Power and Energy-Definition, units and simple problems (4 hours) • Concept of force, Inertia, Newton's First law of motion; momentum and Newton's second law of motion; Impulse; Newton's third law of motion. (2 hrs) • Friction and Lubrication (1 hour) • Law of conservation of energy (1 hour)

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Model/prototype making

UNIT - 2.2
Subject Code: CCIE1-210
ENGINEERING DRAWING – II (PLUMBER)

LEARNING OUTCOME:
After undergoing this unit, the students will be able to:

- Draw free hand sketches of simple objects
- Prepare and interpret drawings of various fixtures of plumbing.

Practical (32 hours)	**Theory**
• Construction of simple figures and solids, such as cubes, rectangular blocks, cylinders etc., with dimensions and title. Use of different types of scales in inches and millimetres. (3 hrs)	
• Freehand isometric sketching of simple objects with dimensions. (3 hrs)	
• Line diagram of the water service line. Free hand isometric sketching of simple objects with dimensions. (4 hrs)	
• Free hand sketching plan and elevation of simple objects like hexagonal bar, square bar, circular bar, tapered bar, hollow bar. Views of simple solid and hollow bodies cut by section plane. (4 hrs)	
• Layout plan of a small village or town and mark the water line with valves of all types & the position of the reservoir. (6 hrs)	
• Study of building plan & mark the position of the sanitary fittings, water supply line, drainage line connection to sewage line. (4 hrs)	
• Free hand sketching of simple objects related to the plumbing and preparation of simple working drawings from the sketches. (4 hrs)	
• Longitudinal section of the house drain. Drainage arrangements of workshop of an institution. (4 hrs)	

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Viva-voce
- Sketching
- Drawing

UNIT - 2.3

Subject Code: CCIE1-211

OPERATIONS ON PLUMBING PIPES

LEARNING OUTCOME:

After undergoing the subject, students will be able to:

- Define various types of jointing materials.
- Perform different operations such as cutting, bending, threading and jointing.

Practical **(96 hrs)**	**Theory** **(16 hrs)**
• Carry out cutting, threading & tightening operations on GI pipes (10 hrs) • Practice on cutting of various types of pipes (10 hrs) • Practice on making threads in pipes (6 hrs) • Practice on making bends in pipes at different angles (6 hrs) • Practice on jointing for various types of pipes such as socket and spigot joint, thread joint, expansion joint, underhand joint, detachable joint etc. (10 hrs)	• Description of various types of pipe cutters such as soil pipe cutter, PPR/PVC Pipe cutter, Electric cutting machine etc. (1 hr) • Knowledge about various type of threads, pitch etc. such as British Standard Practice (BSP) threads. (1 hr) • Description of various types of joints with sketches, joint materials (1 hr)
• Cutting/Threading/Bending of GI/ PPR Pipes from a given Layout plan, calculate and measure length of pipe required. Mark out and cut to size. Threading and Bending of pipes to within given tolerances: - Marking out & Cutting to ± 1mm. Bending/off Setting to the following Quality & Tolerances: Free from throating, rippling and abnormal marks. Pipe diameter to be maintained, no distortion. Angle of bends and off sets, accurate to ± 1°. (24 hrs)	• Reading and Interpreting basic sketches & plumbing drawings. (1 hr) • Use of Hand tools. Measuring & Mark out tool. Cutting Tools, Bending Machine, Stock & Dies, Pipe Vice, lubrication. (1 hr)
• Practice on jointing P.V.C. pipe with socket joints so that joint length is not less than 1.5 time pipe diameter. Assemble exercise and secure with	• Use of hand tools, beveling reamer, applying heat with blow lamp. Preparation of Socket, Cleanliness. (1 hr)

solvent cement to tolerance of ± 2mm & square to ± 1°. (10 hrs)	• Application of solvent cement assembly methods. (1 hr) • Testing method of water supply pipes with pipe testing machine. (1 hr)
• Practice on fitting of various types of traps, working with another trainee in his group, from a given sketch and with necessary tools, lay and join S.W. Pipes to correct fall and alignment. Remove surplus materials and test to meet local by-laws. (10 hrs)	• Leveling and joining methods. (1 hr) • Drain gradients. (1 hr) • Use of sight rails and boning rods. (1 hr) • Testing methods i.e. smoke/air/ colour/water tests (1 hr)
• Practice on fitting of various types of traps, working with another trainee in his group and from a given sketch cut and Join Cast Iron pipe, set up and secure to correct alignment. Seal using lead on one joint and cement or drip/seal/ putty on others. (10 hrs)	• Define traps and its types, water seals, Safety in handling lead. (1 hr) • Methods of jointing cast iron pipes. Precautions in jointing, when and where to use. (1 hr) • Use of melting pots, ladle, splash stick, caulking chisel (1 hr) • Introduction to gasket (1 hr)

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Viva-voce
- Sketching
- Workshop job
- Assembly and disassembly

UNIT - 2.4
Subject Code: CCIE1-212
INSTALLATION AND MAINTENANCE OF SANITARY FIXTURES

LEARNING OUTCOME:

After undergoing the unit, students will be able to:

- Define local by-laws for installation of sanitary fixtures.
- Fix the latest sanitary fixtures.
- Repair and maintain sanitary fixtures

Practical **(96 hrs)**	**Theory** **(28 hrs)**
• Fixing low level cistern with water closet and connect to inspection chamber, seal connections and test to meet the bylaws enforced by the local authority. (14 hrs) • Fixing European WC and connect to inspection chamber, seal connections and test to meet the bylaws enforced by the local authority. (14 hrs) • Lavatory suit with sensors and other latest sanitary fixtures such as double syphonic cistern, showers, bath tubs, jacuzzi urinals with automatic flushing sensors, RO water purifying system, geysers etc. (10 hrs) • Practice on fixing of overhead PVC tank on roofs (10 hrs) • Practice of making water supply connection along with water meter fixing. (8 hrs) • Practice of making connection of house sewer to main sewer (8 hrs) • Tracing out leakage and its repairing (12 hrs) • Removal of Air lock in pipes (10 hrs) • Repair of taps and value (10 hrs)	• Handling and fitting sanitary fixtures. (6 hrs) • Care in fitting & leveling. (6 hrs) • By–laws in local authority. (6 hrs) • Sanitary fixtures (6 hrs) • Method of tracing out leakages (4 hrs) • Air locks in pipe (4 hrs)

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Viva-voce
- Workshop job
- Assembly and disassembly

UNIT - 2.5
Subject Code: CCIE1-213
PLUMBING SYSTEMS

LEARNING OUTCOME:
After undergoing the unit, students will be able to:

- Explain working principles of water pump, septic tank and soak pit,
- Connect supply pipes to supply mains and sewerage connection.
- Construct inspection chamber, manholes, septic tanks and soak pit.
- Apply working principle of rain harvesting and solar system

Practical (96 hrs)	**Theory (16 hrs)**
Installing Water Pump and Connecting Supply Pipe • Demonstration followed by practice on Location, level, fix and secure pump to pump base. Connect supply pipes to supply mains and sewerage connection, foot valves etc to ensure air tight connections. Test to meet by-laws enforced by local authority (36 hrs)	• Types of pumps (2 hrs) • Handling and fitting sanitary fixtures. (2 hrs) • Care in fitting & leveling. (2 hrs) • By–laws in local authority. (2 hrs) • One pipe system and two pipe system (2 hrs)
Septic Tank & Soak Pit • Demonstration followed by practice on Construction of inspection chamber, manholes, septic tanks and soak pits etc. (34 hrs)	• Working principles of septic tank and soak pit and differentiate between them (2 hrs) • Importance of vent pipe in the septic tank (2 hrs)
Rain Harvesting and Solar System • Demonstration followed by practice ib construction of rain harvesting systems and installation of solar systems. (26 hrs)	• Working principles of rain harvesting and solar systems (2 hrs)

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Viva-voce
- Workshop job
- Assembly and disassembly

UNIT - 2.6
Subject Code: CCIE1-214
ESTIMATING AND COSTING

LEARNING OUTCOME:
After undergoing the unit, students will be able to:

- Read working drawings of plumbing
- Work out the quantity of materials and prepare rough estimates.

Practical (64 hrs)	**Theory (16 hrs)**
• Practice on reading simple working drawings and sketches related to water supply and sanitary. (16 hrs) • Practice on calculation of various quantities of materials required for a particular job. (20 hrs) • Practice on working out cost of a particular job. (20 hrs) • Testing of water supply pipes – testing of all types of GI pipes, PPR pipes etc. (2 hrs) • Sewerage/Rainwater pipes – CI Pipes, HCI Pipes, PVC Pipes etc. (4 hrs) • Testing of GI and floor traps (2 hrs)	• Study of various types of latest plumbing materials used in plumbing work such as Soil Waste Rain (SWR), Unplasticised Poly Vinyl Chloride(U-PVC), Poly Propylene Random (PPR) etc. (6 hrs) • Introduction to relevant BIS codes (4 hrs) • Methods of calculation of materials (3 hrs) • Units of measurement (3 hrs)

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Report writing
- Viva-voce

Subject Code: CCIE1-216
INDUSTRIAL TRAINING – II (4 Weeks)

The purpose of industrial training is to:

- Develop understanding regarding the size and scale of operations and nature of industrial/field work in which students are going to play their role after completing the courses of study.
- Develop confidence amongst the students through firsthand experience to enable them to use and apply institute based knowledge and skills to perform field activities
- Develop special skills and abilities like interpersonal skills, communication skills, attitudes and values.

It is needless to emphasize further the importance of Industrial Training of students during their one-year certificate programme. It is industrial training, which provides an opportunity to students to experience the environment and culture of world of work. It prepares students for their future role as skilled person in the world of work and enables them to integrate theory with practice.

An external assessment of 100 marks have been provided in the study and evaluation scheme of 2nd semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations.

The instructor along with one industrial representative from the concerned trade will conduct performance assessment of students. The components of evaluation will include the following:

a) Punctuality and regularity 20%
b) Industrial training report 50%
c) Presentation and viva-voce 30%

7. RESOSURCE REQUIREMENTS

7.1 LIST OF TOOLS/EQUIPMENT

A) TRAINEES TOOL KIT FOR 30 TRAINEES AND ONE INSTRUCTOR

Sr. No.	Name of items	Quantity
1.	Rule Steel 300 mm both in inch and mm	31
2.	Rule Wooden 4 fold, 600 mm	31
3.	Hacksaw Frame adjustable for 250 to 300 mm	31
4.	Centre punch 100 mm	31
5.	Chisel Cold, flat 20 mm	31
6.	Hammer ball pein 800 grams	31
7.	File flat rough 300 mm	31
8.	Level spirit wooden 300 mm	31
9.	Plumb bob 50 grams	31
10.	Trowel C-125-I S: 6013	31
11.	Stillson wrench 200 & 350 mm	31
12.	Screw Driver 250 mm	31
13.	Wooden Mallet small I S: 2022	31
14.	Cutting pliers 200mm I S : 3650	31
15.	Steel tape (5m)	31

B) LIST OF TOOLS

Sr. No.	Name of items	Quantity
1	Pipe Die Set - 1/2" to 1" & 1 1/4" to 2"	3 each
2	Pipe Wrench (Size No.8) & (Size No.12)	6 each
3	Pipe Vice (Size No.2) & (Size No.3)	4 each
4	Wooden Bench (3' x 6' height - 4')	3
5	Hammer Sledge (2 pound) & (1 pound)	4 each
6	Flat Chisel (1') & Point Chisel (1')	5 each
7	Flat Punch (1/2') & Point Punch (1/2')	5 each
8	Rawel Jumper Bit set (6 mm) & (8 mm)	5 each
9	Pipe Wheel Cutter (upto 2" cutting)	5
10	Spanner Set (Double End)	2
11	Tube Level (1/4" Hose White)	30m
12	Screw Spanner (Size No.12)	5
13	Grip Plier (266 - 10)	5
14	Pocker (Taparia 871)	10
15	Try Square (small)	4
16	Cocking Chisel (1" 1/4")	5 each
17	Blow lamp	5
18	Spade with handle	1
19	Mortar Pan	5 each
20	Hand Drilling Machine (Electric)	3
21	Cleaning Brush & Painting Brush (2")	2
22	Oil Can (Small)	3
23	Chain Wrench (upto 3")	2
24	Pipe Bending Machine (1/2" to 1") (Hydraulic)	1

25	Ladder (10 feet height)	2
26	Electric PPR Pipe Welding Machine	5
27	Spun Yarn	50 kg
28	Hydraulic Pressure Test Pump	1
29	Safety Belt	5
30	Safety Shoes & Safety Helmet	20 each
31	Cotton Hand Gloves	20
32	Plumber's Laddle	3
33	Plumber's Metal Melting Pot (10 Kg.)	3

7.2 LIST OF CONSUMABLES

Sr. No.	Name of items	Quantity
1	GI Pipe 1/2", 3/4", 1", 1 1/4", 1 1/2", 2" (i/d)	50m each
2	PVC Pipe 1/2", 3/4", 1", 1 1/4", 1 1/2", 2"(e/d)	50m each
3	CI Pipes 4", 6" 2 M length (3",4" (i/d)	10
4	Lead and Spun Yarn	25 kg
5	Stone Ware Pipe 4",6",8" (i/d)	20
6	White Wash Basin	2
7	White I.W.C Cistern	2
8	White E.W.C (Normal)	2
9	White `p' Trap 4"	2
10	White `s' Trap 4'	2
11	White kitchen Sink	1
12	White Urinal (Flat)	1
13	White Urinal (magnon)	1
14	1/2" Bibcock (l) & (s)	5 each
15	1/2" Pillar cock & Angle Cock	5 each
16	1/2" Ball Valve	5
17	1" Gate Valve, Globe Valve & Check Valve	5 each
18	1" NRV	5
19	1" Foot Valve & 2" Foot Valve Pipe Fittings	3 each
20	1/2" G.I. Elbow	10
21	3/4" G.I Elbow	10
22	1" G.I Elbow	10
23	1/2 " 3/4" G.I. Tee	30
24	1"x 3/4", 1/4" x 1/2", 1"x 1/2"	30
25	G.I Reducer Elbow 1"x 3/4", 1" x 1/2"	10 each
26	G.I Reducer Elbow 3/4"x 1/2"	10
27	G.I Coupling 1/2" x 3/4" x 1"	30
28	G.I Straight Reducer 1" x 3/4" x 1 1/2"	30
29	G.I Bend 1/2", 3/4", 1"	30
30	G.I union 1/2", 3/4", 1"	30
31	Solvent Cement	2 litre
32	Shellac	20
33	Thread Ball	50
34	GI-Socket 1/2", 3/4", 1"	5 each
35	Hacksaw Blade	300
36	White Lead	1 Kg.
37	Water Meter	1

7.3 LIST OF RECOMMENDED BOOKS

a) BIS Codes

Sr.No.	Title	BIS Code
1	Pipe wrenches	IS : 4003
2	Pipe vices	IS : 2587
3	Pipe threads for fastening purposes dimensions for	IS : 2643
4	Horizontal centrifugal pumps for clear, cold and fresh water	IS : 1520
5	Gland packing asbestos	IS : 4487
6	Cork composition sheets (part I &II)	IS : 4253
7	Selection installation and maintenance of sanitary appliances, code of practices for	IS : 2064
8	Water meters (domestic type) code of practice for selection installation & maintenance	IS : 2001
9	Water supply in buildings, code of practice for	IS : 2065
10	Caulking lead	IS : 782
11	Enameled steel bath tubs	IS : 3489
12	Formulas for water services	IS : 3489
13	Flushing systems for water closets and urinals	IS : 774
14	Glazed earthen ware sanitary appliances	IS : 771
15	Pillar Taps	IS : 1795
16	Plug cocks for water supply purposes	IS : 3004
17	Sanitary appliances, enameled C.I. general requirements	IS : 772
18	Waste fittings for wash basins and sinks non-ferrous	IS : 2963
19	Water closets, enameled and C.I.	IS : 773
20	Vitreous sanitary appliances(Part –I) general requirements	IS : 2556
21	Bend pipes	IS : 404
22	Zinc	IS : 209
23	Soft Solder	IS : 198
24	Pipes & fittings C.I. rain water	IS : 1230
25	Pressure pipes for water gas and sewage C.I. fittings for	IS : 1538
26	Pipe lines, colour code for the identification of	IS : 2379
27	Lead and its compounds, code of safety for	IS : 4312
28	Excavation work, safety code for	IS : 3764
29	Scaffolds & carders (Part I & II) safety code for	IS : 3696
30	Manhole converse & Games intended for use in drainage work C.I.	IS : 1726
31	Laying C.I. pipes code of practice for	IS : 3114
32	Laying of concrete pipes code of practice for	IS : 783
33	Asbestor cement pressure pipes	IS : 1592
34	Glossary of terms relating to corrosion of metals	IS: 3531
35	Engineering drawing general code of practice for	IS: 696

b) RECOMMENDED BOOKS/CATALOGUE

1. Plumbing Technology Design and Installation by Lee Smith & Hary Slater.
2. Plumbing and Sanitation Engg. by Pritam Thakur published by Royal Book Depot, Jalandhar.
3. CPWD Specifications for Sanitary Installation, Water supply and drainage.
4. Product Catalogue of Finolex.
5. Product Catalogue of Vectus.
6. Product Catalogue of Excel.
7. Product Catalogue of Jaguar.
8. Plumbing and Sanitation Engineering by G.S. Birdi; Dhanpat Rai & Sons.
9. Plumber by National Instructional Media Institute (NIMI), Channai.

8. RECOMMENDATIONS FOR EFFECTIVE CURRICULUM IMPLEMENTATION AND EVALUATION

Since this skill development course is tailor made i.e. designed to meet the requirement of selected group of students for developing desired competencies in the given trade, it is pertinent for trainers to understand the design philosophy and arrange teaching-learning process using appropriate strategies. The following points may be considered by the trainer at the time of planning the training programme and subsequently during the implementation and evaluation stages:

1. There are multiple competencies in each unit. The course curriculum also includes a core unit on developing effective communication and entrepreneurial qualities. Each unit has specific competencies which trainees are expected to acquire at the end of the each unit. In order to achieve these competencies, the curriculum describes the practice tasks/exercises and related theoretical knowledge. Time has been allocated for both of these components.

2. The curriculum is designed for contact period of 35 hours per week but can be increased/changed as per convenience of the trainees and the trainer.

3. The trainer will assess the attainment of each specific learning outcome of the individual learner and will maintain record whether the trainee has achieved desired level i.e. Yes/No. In case of 'No' the trainee will work further to learn and attain the desired skills till s/he earns 'Yes'.

4. Each learning outcome will be assessed/tested by the trainee as per acceptable norms and record will be maintained for final certification. The final assessment of skills attained through practice jobs and acquisition of relevant knowledge should preferably be carried out appropriately.

5. The examiner will set an objective type question paper for theory examinations of each unit under final assessment. Preferably the question paper should aim at testing the understanding of basic principles and concepts by students and their applications.

6. The final assessment of practical skills development should not be limited to testing a few units, but should spread over to all the acquired skills in an integrated manner. It should ultimately assess the ability of the student to accomplish the desired learning outcomes of the programme.

9. LIST OF CONTRIBUTORS/EXPERTS

a) Following experts participated in the workshop to design curriculum of certificate programme in 'Plumber' with NSQF alignment for MRSPTU, Bathinda on 4-5 July, 2016 at NITTTR, Chandigarh.

1.	Prof. SK Sharma, Department of Civil Engineering, PEC University of Technology, Sectotr-12,Chandigarh
2.	Shri VK Bansal, Principal, Govt. Industrial Training Institute, Patiala, Punjab
3.	Shri Parmod Kumar, SDE (Public Health), UT, Chandigarh
4.	Shri Dharam Pal, Instructor, Govt. Industrial Training Institute, Patiala, Punjab
5.	Shri Amarjit Singh, Instructor, Govt. Industrial Training Institute, Sector-28, Chandigarh
6.	Shri Punitinder Singh, Plumber, PGIMER, Sector-14, Chandigarh
7.	Shri Iqbal Singh, Instructor, Govt. Industrial Training Institute, Patiala, Punjab
8.	Shri Karnail Singh, Foreman Instructor, CCET (Diploma Wing), Sector-26, Chandigarh
9.	Dr. AB Gupta, Professor & Head, Curriculum Development Centre, NITTTR, Chandigarh
10.	Prof. SK Gupta, Associate Professor, Curriculum Development Centre, NITTTR, Chandigarh **Coordinator**

b) Following experts participated in the workshop to design curriculum of certificate programme in 'Plumber' with NSQF alignment for MRSPTU, Bathinda on 28 July, 2016 at NITTTR, Chandigarh.

1.	Shri Amarjit Singh, Instructor, Govt. Industrial Training Institute, Sector-28, Chandigarh
2.	Shri Karnail Singh, Foreman Instructor, CCET (Diploma Wing), Sector-26, Chandigarh
3.	Dr. AB Gupta, Professor & Head, Curriculum Development Centre, NITTTR, Chandigarh
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c) Following experts participated in the workshop to review curriculum of certificate programme in "Plumber" for MRSPTU, Bathinda held on 6 January, 2017 at NITTTR, Chandigarh.

1.	Dr. Ashok Kumar Goel, Director, College Development Council, MRSPTU Campus, Bathinda, Punjab
2.	Dr. Balraj Singh, Director, PIT, Rajpura
3.	Shri HS Kalra, Ex-Principal, Govt. Industrial Training Institute, Sector-28, Chandigarh
4.	Shri GS Sethi, Consultant, IndiaCan, A-301, Rishi App, Sector 70, Mohali
5.	Shri Asheesh Kumar Saini, Centre Head, IL&FS, IIS, Ropar
6.	Shri Jasvir Singh Tiwana, Associate Professor, GZSCCET, Bathinda
7.	Shri Sikander Singh Sidhu, Assistant Professor, GZSCCET, Bathinda
8.	Shri J Ghosh Roy, Aryabhat Polytechnic, Delhi
9.	Shri Jagdeep Singh, Central Tool Room, A-5, Phase-5, Focal Point, Ludhiana
10.	Shri Rakesh Goel, Estate Officer, NITTTR, Chandigarh
11.	Dr. AB Gupta, Professor & Head, Curriculum Development Centre, NITTTR, Chandigarh **Coordinator**