

Curriculum of Matric Tech
Plumbing and Solar Water Heating System-I
GRADE IX
2021



GOVERNMENT OF PAKISTAN
Ministry of Federal Education and Professional Training ISLAMABAD
In Collaboration with
National Vocational and Technical Training Commission.

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1.Introduction:

Pakistan is a developing country with 5th largest population in the world. More than 60% of our population is below 30 years of age which makes it second youngest country in South Asia. This “youth bulge” provides unique challenges as well as opportunities for the country’s social and economic development. The only remedy is to develop youth of Pakistan through education and training. To control the increasing un-employment, promoting entrepreneurship (self-employment), alleviate poverty and provide skilled manpower for industrial/economic growth, Govt. of Pakistan has emphasized to focus on Technical Scheme at SSC Level. For this, a stream of technical subjects has been selected including plumbing and solar water heating system as one of the elective subjects.

The construction industry, one of the leading industries in Pakistan, the Middle East and other parts of the world, offer a range of prosperous occupational areas, such as plumbing. Plumbers play a vital role in installing, repairing and maintaining pipes, fixtures and other plumbing used for water distribution and wastewater disposal in residential, commercial and industrial buildings. The increased use of solar energy has further added to the demand of Plumbers having the skills to install and maintain solar-thermal water heating systems. Thus, the ever-growing demand of industry has led to the design of this training Programme as a response to providing appropriate skills.

2.Rationale:

The construction industry is a profession that is increasingly getting attention in Pakistan, not only among the youth seeking to enter the industry but also among adults who wish to polish their skills to develop a career out of it.

On completing the curriculum, students should have acquired a set of knowledge and concepts, and have developed a range of technical, personal, interpersonal, organizational and generic skills, that can be applied in various contexts, both within and related to plumbing and solar water heating system. Furthermore, this course will stimulate the learners towards entrepreneurship in the industry

Within this qualification relating to plumbing interventions in schools, there are important interventions that integrated within school settings. The purpose of this qualification is to strengthen connections between schools and trade, and drawing on the concept of the sociotechnical network, theories the interactions between the relevant market and school contexts.

These programs have increased and continue to increase in popularity because they offer a valuable channel to engage with vulnerable groups via inclusive social activities, whilst positively impacting their lifestyle profiles.

Plumbing and Solar Water Heating System, Matric Tech (9th &10th)

3.Aims and Objectives:

Aims

The aim of this Programme is to make youth skillful who are competent to install, remove, check, repair, replace or service different types of bathrooms and kitchen fixtures, including solar water heating installations. In addition, this Programme aims to prepare youth to find employment in the construction industries or to enable them in becoming successful as entrepreneur in future.

Objectives:

After completion of training the trainees will be able to:

1. Identify plumbing materials, tools, equipment and fitting materials related to plumbing.
2. Handle plumbing related tools and equipment.
3. Identify and apply plumbing symbols.
4. Perform various bench work such as measuring, marking and filing.
5. Make various sizes of threads on galvanized iron pipes.
6. Join and connect G.I and PVC fittings.
7. Make various types of polyethylene fittings for joining the pipes.
8. Install various types of fixtures in private and public buildings.
9. Replace/repair and maintain the parts of installations and fixtures.
10. Prepare quantity estimates and costing.

Plumbing and Solar Water Heating System -I
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Plumbing and Solar Water Heating System -I (IX)

Chapter 1 (IX)

Ch.1 Introduction to Plumbing

13 Periods (T = 7, P = 6)

Theme/Content	Students' Learning Outcome	Activities/Practical	Duration	Tools	Workplace
Basics and importance of Plumbing	<p>The students will be able to:</p> <ul style="list-style-type: none"> • Know the basics of plumbing. • Consideration during plumbing. • Purposes of plumbing. • Importance of plumbing. • Scope of plumbing. • Recognition of main fixtures of plumbing. • Recognition of PPEs for workplace. 	<ul style="list-style-type: none"> • Recognition of existing fixtures. 	04 Periods(T) 04 Periods (P) (05 Hours ,20 min)	<ul style="list-style-type: none"> • PPEs 	Classroom / Plumbing Lab
Classification of Plumbing	<p>The Students will be able to:</p> <ul style="list-style-type: none"> • understand the types of plumbing systems. • Understand the difference section of plumbing system. • Know the purpose of plumbing. • Know the basic of plumbing. 	<ul style="list-style-type: none"> • Group Discussion on classification of plumbing. 	03 Periods(T) 02 Periods (P) (03 Hours ,20 Min)	<ul style="list-style-type: none"> • Multimedia or LED TV with good sound system 	Classroom / Plumbing Lab

Chapter 2 (IX)

Ch.2 Occupational Health and Safety

27 Periods (T = 9, P = 18)

Theme/Content	Students' Learning Outcome	Activities/Practical	Duration	Tools	Workplace
Introduction to health and safety.	<p>The Students will be able to:</p> <ul style="list-style-type: none"> • Learn about the concept of health 	<ul style="list-style-type: none"> • Demonstration of health and safety rules. • Follow SOPs 	03 Periods(T) 02 Periods(P) (03 Hours ,20 Min)	<ul style="list-style-type: none"> • Multimedia, projector, or LED TV with good 	Classroom / Plumbing Lab

	and safety. • Observe the basic rules of health and safety.	regarding basic safety.		sound system	
Personal safety.	The Students will be able to: • Learn the importance of personal protective equipment. • Learn the use of personal protective equipment.	• Demonstrate use of PPEs such as safety gloves safety helmet, safety belts and industrial mask.	02 Periods(T) 04 Periods(P) (02 Hours ,40 Min)	• Safety Gloves • Safety Helmets • Safety Belts, • Industrial mask.	Classroom / Plumbing Lab
Safely handling of tools and equipment.	The Students will be able to: • State danger posed by electric equipment. • Handle plumbing tools and electric equipment safely.	• Practices safe and correct use of tools. • Demonstrate safe use of electric equipment.	02 Periods(T) 06 Periods(P) (04 Hours 00 Min)	• Plumbing Tools	Classroom / Plumbing Lab
Fire hazards	The Students will be able to: • Define Fire Hazards. • Know fire triangle. • State the use of different types of fire extinguishers according to class of fire. • Identify hazards and report it to concerned department.	• Demonstrate different types of fire extinguishers and fire safety equipment. • Demonstrate various incidents reporting through role play.	02 Periods(T) 06 Periods(P) (04 Hours ,00 Min)	• Different types of fire extinguishers. • Water & Sand Buckets	Classroom / Plumbing Lab

Chapter 3 (IX)

Ch.3 Plumbing Tools & Equipment

28 Periods (T = 10, P = 18)

Theme/Content	Students' Learning Outcome	Activities/Practical	Duration	Tools	Workplace
Identify Plumbing Tools	The Students will be able to: • Identify measuring tools • Identify marking tools • Identify cutting tools • Identify threading tools	• Enlist measuring tools. • Enlist marking tools. • Enlist cutting tools. • Enlist threading tools.	05 Periods(T) 09 Periods(P) (09 Hours ,20 Min)	• Tongue and Groove pliers • Basin wrench • Compression Sleeve puller • Pipe wrench • Adjustable wrench • Tubing cutter • Drain auger • Plunger	Classroom / Plumbing Lab

				<ul style="list-style-type: none"> • Measuring tape • Screwdrivers 	
Identify Plumbing Equipment	The Students will be able to: <ul style="list-style-type: none"> • Identify drilling machines. • Identify grinding machines. 	<ul style="list-style-type: none"> • Recognise drilling machines. • Recognise grinding machines. 	05 Periods(T) 09 Periods(P) (09 Hours ,20 Min)	<ul style="list-style-type: none"> • Hand drilling machines. • Electric operated hand drilling machines. • Pedestal type drilling machines • Grinding machines. 	Classroom / Plumbing Lab

Chapter 4 (IX)

Ch:4 Measuring, Marking and Filing

30 Periods (T = 8, P = 22)

Theme/Content	Students' Learning Outcome	Activities/Practical	Duration	Tools	Workplace
Measuring	The students will be able to: <ul style="list-style-type: none"> • Uses of measuring tools. • Carry out measurements. • Identified measuring tools as per object to be measured or job requirements. • Perform linear measurement of different sizes of pipes. • Measure diameter of pipes (internal and external). 	<ul style="list-style-type: none"> • Practice to measure work pieces according to job requirements. • Perform linear measurement of different sizes of pipes. • Practice to measure diameter of pipes (internal and external). 	03 Periods(T) 08 Periods(P) (07 Hours ,20 Min)	<ul style="list-style-type: none"> • Hook tape • Measuring tape • Steel scale • Spirit level • Plumb bob • Try square • Bench vice • Pipe vice • Marking tool • Folding tape • Safety equipment 	Class Room & Plumbing Lab
Marking	The students will be able to: <ul style="list-style-type: none"> • Know the correct tools for marking out. • Understand the use of marking tools. 	<ul style="list-style-type: none"> • Identify work pieces according to job requirements. • Mark the dimension as per drawing. • Mark the point as per drawing. 	03 Periods(T) 08 Periods(P) (07 Hours ,20 Min)	<ul style="list-style-type: none"> • Hook tape • Measuring tape • Steel scale • Spirit level • Plumb bob • Try square • Bench vice • Pipe vice • Marking tool • Folding tape • Safety 	Class Room & Plumbing Lab

				equipment	
Filing	<p>The students will be able to:</p> <ul style="list-style-type: none"> • Know the correct tools for filing. • Carry out method of using files. • Work piece filed 	<ul style="list-style-type: none"> • Read drawing • File the work piece by using scale. • Clamp work piece on the vice. • File the work piece using appropriate file. • Check filing surface level and perpendicular using by back square. • Measure the final dimension. 	02 Periods(T) 06 Periods(P) (05 Hours ,20 Min)	<ul style="list-style-type: none"> • Triangles half • Round file • Square file • Needle file • Pe file • Wooden file • Bench vice • Pipe vice • Safety equipment 	Class Room & Plumbing Lab

Chapter 5 (IX)

Ch:5 Cutting and Drilling

30 Periods (T = 8, P = 22)

Theme/Content	Students' Learning Outcome	Activities/Practical	Duration	Tools	Workplace
Pipe Cutting.	<p>The students will be able to:</p> <ul style="list-style-type: none"> • Know the correct tools for cutting. • Cutting of pipes of different metals, dimensions and sizes. 	<ul style="list-style-type: none"> • Practice of cutting pipes of different materials as per requirements. • Practice of cutting copper tubing. 	05 Periods(T) 16 Periods(P) (14 Hours ,00 Min)	<ul style="list-style-type: none"> • Hack Saw • Mitre Saw • Wooden Saw • Chisel • Pocket Knife • Pipe Cutter • Scissor • Pad Saw • Pipe Cutter • Multilayer • Composite tube • Cutter • Cold Chisel • Pipe Vice • Bench Vice • Safety Equipment 	Class Room & Plumbing Lab

Drilling	<p>The students will be able to:</p> <ul style="list-style-type: none"> • Importance of drilling. • Know about types of Drill bits. • State the procedure of drilling in different materials. 	<ul style="list-style-type: none"> • Practice for drilling in pipes. • Drilling on different materials. 	03 Periods(T) 06 Periods(P) (06 Hours ,00 Min)	<ul style="list-style-type: none"> • Pipe vice • Bench vice • Drill machines • Drill bits 	Class Room & Plumbing Lab
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Chapter 6 (IX)

Ch.6 Threading and Reaming

30 Periods (T = 08, P= 22)

Theme/Content	Students' Learning Outcome	Activities/Practical	Duration	Tools	Workplace
Perform Pipe Threading	<p>The Students will be able to:</p> <ul style="list-style-type: none"> • Identify tools for threading. • Adopt safety measures • Fix work piece for threading. • Fix cheesier in Threading die. • Observe OHSA 	<ul style="list-style-type: none"> • Perform threading of pipe (internal and external). • Cleaning and lubricating of die. 	05 Periods(T) 16 Periods(P) (14 Hours ,00 Min)	<ul style="list-style-type: none"> • Plumbing pliers, • Plumbing wrenches • Plumbing spanners, • PPEs • Threading Tools 	Class Room & Plumbing Lab
Perform Pipe Reaming.	<p>The Students will be able to:</p> <ul style="list-style-type: none"> • Identify tools for Reaming. • Adopt safety measures • Fix work piece for reaming. • Observe OHSA 	<ul style="list-style-type: none"> • Perform reaming on different diameter of pipes. 	03 Periods(T) 06 Periods(P) (06 Hours ,00 Min)	<ul style="list-style-type: none"> • Plumbing pliers, • Plumbing wrenches • Plumbing spanners • PPEs • Reamer 	Class Room & Plumbing Lab

Chapter 7 (IX)

Ch.7 Communications Skills

22 Periods (T = 22)

Theme/Content	Students' Learning Outcome	Activities/Practical	Duration	Tools	Workplace
Listening Skills	<p>The Students will be able to:</p> <ul style="list-style-type: none"> • Understand Listening comprehension • learn Principles for teaching listening comprehension 	<ul style="list-style-type: none"> • Listening English documentary 	04 Periods(T) (02 Hours ,40 Min)	<ul style="list-style-type: none"> • Multimedia or LED TV with good sound system. 	Classroom

	<ul style="list-style-type: none"> • understand how to listening skill be developed 				
Speaking Skills	<p>The Students will be able to:</p> <ul style="list-style-type: none"> • Understand Starting and Ending conversations • Introduce oneself and others • Greeting, praising and complimenting. • Interviewing skills 	<ul style="list-style-type: none"> • Presentation • Group discussion 	06 Periods (T) (04 Hours)	<ul style="list-style-type: none"> • Multimedia or LED TV with good sound system. 	Classroom
Reading Skills	<p>The Students will be able to:</p> <ul style="list-style-type: none"> • Understand Skimming, Scanning and Guessing • Intensive and extensive reading. • Understand how to improve reading skill 	<ul style="list-style-type: none"> • Reading English Newspaper, Novels and Books. 	06 Periods(T) (04 Hours)	<ul style="list-style-type: none"> • Multimedia or LED TV with good sound system. 	Classroom
Writing Skills	<p>The Students will be able to:</p> <ul style="list-style-type: none"> • Understand What is writing • learn Guided writing, Free writing and Creative writing. • Know Kinds of writing • Understand What is effective writing • Understand the process of writing 	<ul style="list-style-type: none"> • Preparation of report writing. 	06 Periods(T) (04 Hours)	<ul style="list-style-type: none"> • Multimedia or LED TV with good sound system. 	Classroom

5. Assessment and Evaluation:

Assessment is the practice of collecting evidence of student learning. It aims at improving learning and teaching as well as recognizing the achievement of students. It determines students 'progression through their learning experiences and enables them to demonstrate that they have achieved the intended learning outcomes. The assessment is aligned with curriculum aims, design and learning processes.

Evaluation is an integral part of teaching-learning process. It involves gathering information through various assessment techniques, making valuable judgment and sound decisions. Assessment

provides information and teaching about students' achievement in relation to learning objectives. With this information, the teacher makes informed decisions about what should be done to enhance the learning of students or to improve teaching methods. Assessment must be:

- mainly open-ended, allowing for discussion and revision of new understanding.
- tolerant of divergent thinking of students and promote the notion of no ‘one right answer’.
- presented in alternative mode, not just paper-and-pencil responses to limiting questions.
- designed to foster analysis, comparison, generalization, prediction, and modification according to the grade and development level.
- capable of promoting collaboration and team effort in demonstration of competence.
- ongoing and cumulative, showing growth over time.

Formative (Internal) Assessment:

Internal assessment refers to the assessment practices employed as part of the learning and teaching process. It is an ongoing process throughout the session and uses Test — Feedback — Adjust cycle repeatedly to improve students' performance and efficiency in learning and teaching. In designing internal assessment for the subject, teachers should maintain a proper balance between the formative and summative functions of assessment. It should be comprehensive to cover all the objectives as per curriculum. A diversity of assessment modes should be adopted so that students are given opportunities to develop and demonstrate the full range of learning outcomes of the curriculum, including those of knowledge, skills and values and attitudes.

Methods for Internal/Formative Assessment:

Following tasks can help in formative assessment.

- Assignments
- Quizzes
- Tests
- Group discussions
- Oral/multimedia presentations
- Worksheets
- Online interactive activities
- Role play
- Demonstration
- Practical exercises

Feedback on students' work in all the above tasks must be prompt, effective, and efficient assessment should have questions setting that specifically help in finding out knowledge, understanding and skills.

Summative /External Assessment

Summative assessment will be managed by concerned Board of Intermediate and Secondary Education. It will be composed of two parts.

- 1) **Theory Assessment /Written examination:** The theory examination is suggested to consist of a wide variety of questions. Its overall weight age should be 40 %. It should be based on the curriculum rather than textbook. The assessment should be designed to examine the candidate's understanding of the whole syllabus and should test the range of abilities according to Bloom Taxonomy.
- 2) **Practical Assessment/Practical examination:** This is designed to test Practical skills of students. Its overall weight age should be 60%.

A standards-referenced approach will be adopted for grading and reporting student performance. The purpose of this approach is to recognize what each student can do in the subject at the end of the 2-year secondary school level education. The performance of each student will be matched against a set of performance standards, rather than comparing to the performance of other students. It makes the implicit standards explicit by providing specific indication of individual student performance. Descriptions will be provided for the set of standards.

6.Guidelines for Writing a Textbook:

A textbook is an important teaching and learning resource and one of the most extensively used resources in classrooms. To reflect national needs and aspirations the needs and aspirations, the textbooks should be written in accordance with this curriculum. This curriculum meets not only the general aims and objectives but also fulfills the specific requirements of the individual subject. As the textbook serves as a framework for teaching, the author/authors should consider the following features:

- A textbook must include an introduction to the textbook, explaining how to use the textbook
- The textbook must be in line with the National Curriculum, covering all SLOs of each theme or concept.
- Content and illustrations must be culturally, contextually and age appropriate.
- All text and material must be accurate, up-to-date and error-free.
- The continuity of the concepts, their integration and logical development should be ensured.
- Horizontal and vertical overlapping of the concepts should be avoided.
- The textbook should be informative and interactive with questions to be put at suitable intervals to provoke the students to think.
- The language used should be simple, clear, straight forward, unambiguous, and easily comprehensible by the students of the level.
- Simple questions may be asked within the chapter, which requires students to recall, think, and apply what they have just learnt as well as to reinforce the learning of the concepts and principle.
- The examples and applications should be from everyday life and be supportive of our cultural values.
- Photographs and illustrations should be clear, labeled, and supportive of the text. Tables, flow charts and graph may be given wherever needed.
- Key points at the end of each chapter should provide a summary of the important concepts and principles discussed in the chapter.

- End-of-the-Chapter exercises must include a variety of assessment styles based on levels of Bloom's Taxonomy. These should encourage students to think, develop skills, and use information for a variety of purposes.
- Textbooks should be free from all kinds of biases including, gender, religion, occupation, social background etc.
- To make the students self-learner use of IT based resources may be encouraged. Relevant internet links and other online resources may be included.
- Glossary of the new vocabulary must be included.

7.Guideline for planning and writing a chapter:

The textbook author may decide the titles of each chapter and can choose to cover students' learning outcomes (SLOs) from any themes in developing the content of the chapter. The textbook author must also keep in mind that a number of SLOs cannot be addressed in the text (as if this is done it would lead students to simply memorize the text and not serve the realization of the curriculum). These SLOs could be realized through questions and practical activities within and at the end of the chapter exercises.

- Learning outcomes must be given at beginning of each chapter.
- Decide on key ideas, facts, concepts, skills, and values that can be developed.
- Illustrations must clearly convey the desired concept.
- Activities must demand from students to do inquiry and problem solving according to grade level.
- Ensure that the content is up to date, accurate and developmentally appropriate.
- Contents must be in line with chapter outcomes.
- Language must be consistent, culturally appropriate, and grammatically correct (as if talking to a group).
- Language must engage and hold reader's attention.
- Recall previous learning, where possible.
- Structure the writing so that the sentence is simple, paragraphs deal with single ideas etc.
- Interesting information in the form of tidbits, fact file, point to ponder etc. must be given.
- Write a summary/concept map at end of each chapter, reviewing key knowledge and skills.
- End-of-chapter exercises
- Recall and integrate previous learning
- Engage students and develop their creativity
- Move from lower to higher order thinking
- Focus on multiple intelligences
- Keep the text contextually relevant in line with local teaching and learning.
- Provide website links for further research.

8. Guidelines for Writing Learner Workbook:

Workbooks are books that contain writing activities and exercises that build upon each chapter in the textbook. Workbook exercises help students to develop conceptual understanding of the concepts dealt with in the text, to develop skills and to apply knowledge to new situations. Basic features of a workbook A workbook should have:

- Various exercises and activities for each chapter, topic, subtopic.
- Exercises and activities that will enable student to develop and practice the content knowledge, skills and higher order thinking.
- Accurate and variety of exercises.
- Clear illustrations/ examples/ explanations to show what students are supposed to do, and/or what product looks like.
- Exercises and activities with a variety of purposeful, stimulating, challenging and innovative items to encourage students to review and practice the knowledge and skills they have learnt.
- Exercises that include both constructed and restricted response items.
- Activities, which requires readily available, acceptable, and affordable materials and resources.

9. Basic Requirements for Plumbing Lab (Tools/Equipment):

1. Adjustable wrench 6",8",12"
2. Pipe Bender Machine Hydraulic complete set
3. Chisel set
4. Trowel
5. Electric Drill machine (hammering with healti)3/4"
6. Die (Ratchet), Die Fix 1/2,3/4,1,2
7. Tape and Die.
8. Extension board 10-meter 2 core
9. First Aid box
10. Gloves lather,rubber
11. Safety goggles Plastic, glass
12. Hand Electric Grinder Electric Wall Cutter
13. Grip plier 10"
14. Hammer 250gm,500gm,1000gm,1500gm,2000gm
15. Hand bit 1/4", 3/8"
16. Helmet ABS Material
17. Hacksaw 12" with blade
18. Spirit Level 6",12",8"
19. L-key set Star L key Set
20. Measuring tape 3meter ,10 meter
21. Pipe wrench ,10",12",14",18"
22. Plier
23. Long nose plier.
24. Pipe cutter (1/2"- 2")
25. PPRC Heater 750W to 1000W
26. PPRcutter
27. G.I cutter.
28. Tubing cutter.
29. Safety boots (Shoes)
30. Screw driver set (6",8",10",12")
31. Spanner set (6mm to 24mm)

32. Line testing pump (leakage) (Hand type)
33. Tools box iron+3 draws
34. Torch Chargeable
35. Vice with iron stand(2nos)
36. Compass Spring type 8"
37. Solar Water Heater (Complete Set) Different denominations with different types i.e., pressurized and gravity based thermosyphon.
38. Water Filling Pumps Centrifugal pump ½" Reciprocating 1/2
39. Pipe Insulation Material
40. Caulking tools.
41. Ladle
42. Melting pot.
43. Bench Vice 5" with bench
44. Oil Can
45. Center Punch
46. Hand bit tool
47. Wire Brush
48. Broom.
49. Vernier caliper.
50. Hand grinder.
51. Pipe Reamer
52. Gi Pipe (½",3/4",1")
53. Gi fitting ½",3/4",1" (Elbow, tee, socket etc.)
54. PPRC pipe 25mm,32mm
55. PPRC fitting 25mm,32mm
56. PVC pipe 2",3",4"
57. UPVC 2",3",4"
58. P trap 4"
59. Solution PVC
60. All types of valves ½",3/4",1"
61. Plastic Pipe ½",3/4",1"

10. Curriculum Development Committee :

The following members participated in the Curriculum development Committee:

SN.	Name	Designation	Organization
1.	Engr. Azhar Iqbal	Principal	GCT, Raiwind Road, Lahore.
2.	Mr. Imtiaz Awan	Sr. Instructor	, GCT Rasul, Mandi Bahauddin.

3.	Mr. Amjad Rafique	Principal,	GCT Rasul, Mandi Bahauddin.
4.	Engr. Arsalan Hameed Khan	Assistant Manager	P & P Department, LWMC, Lahore.
5.	Engr. Rebab Maria Mehmood	Site Engineer,	IMC, Lahore.
6.	Mr. Adnan Shaukat	Instructor,	FIT, Rawalpindi.
7.	Mr. Inam Ul Haq	Instructor,	CTTI, Islamabad.
8.	Muhammad Nasir Khan	DACUM Facilitator	Islamabad.