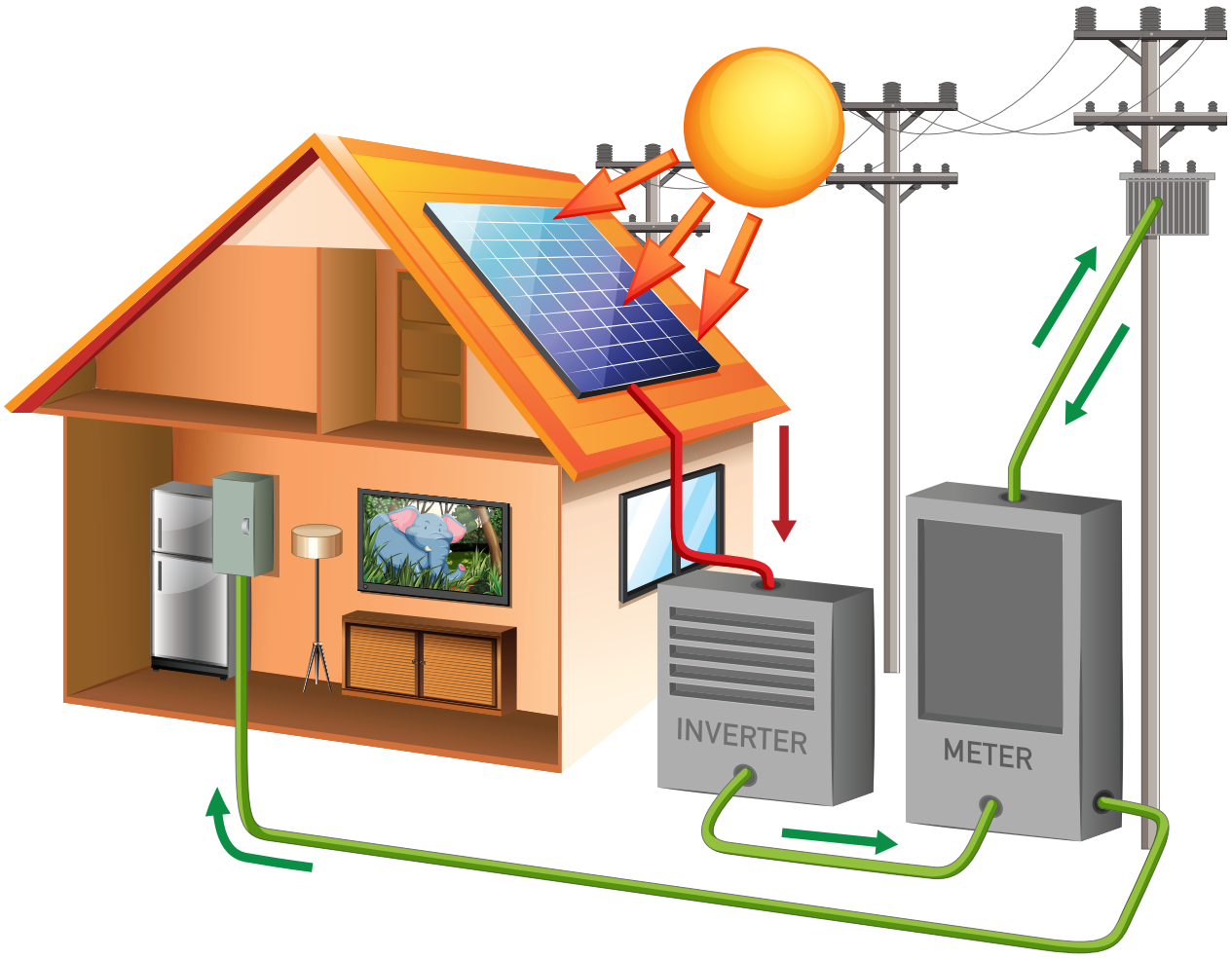
National Curriculum of Pakistan
2022-23

TECHNICAL EDUCATION

Plumbing and Solar Water Heating System

Grades 9-12



NATIONAL CURRICULUM COUNCIL SECRETARIAT
MINISTRY OF FEDERAL EDUCATION AND
PROFESSIONAL TRAINING, ISLAMABAD
GOVERNMENT OF PAKISTAN

بسم الله الرحمن الرحيم

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It is with great pride that we, at the National Curriculum Council Secretariat, present the first core curriculum in Pakistan's 75-year history. Consistent with the right to education guaranteed by Article 25-A of our Constitution, the National Curriculum of Pakistan (2022-23) aspires to equip every child with the necessary tools required to thrive in and adapt to an ever-evolving globalized world.

The National Curriculum is in line with international benchmarks, yet sensitive to the economic, religious, and social needs of young scholars across Pakistan. As such, the National Curriculum aims to shift classroom instruction from rote learning to concept-based learning.

Concept-based learning permeates all aspects of the National Curriculum, aligning textbooks, teaching, classroom practice, and assessments to ensure compliance with contemplated student learning outcomes. Drawing on a rich tapestry of critical thinking exercises, students will acquire the confidence to embark on a journey of lifelong learning. They will further be able to acknowledge their weaknesses and develop an eagerness to build upon their strengths.

The National Curriculum was developed through a nationwide consultative process involving a wide range of stakeholders, including curriculum experts from the public, private, and non-governmental sectors. Representatives from provincial education departments, textbook boards, assessment departments, teacher training departments, *deeni madaris*, public and private publishers, private schools, and private school associations all contributed their expertise to ensure that the National Curriculum could meet the needs of all Pakistani students.

The experiences and collective wisdom of these diverse stakeholders enrich the National Curriculum, fostering the core, nation-building values of inclusion, harmony, and peace, making the National Curriculum truly representative of our nation's educational aspirations and diversity.

I take this opportunity to thank all stakeholders, including students, teachers, and parents who contributed to developing the National Curriculum of Pakistan (2022-23)

Dr. Mariam Chughtai
Director
National Curriculum Council Secretariat
Ministry of Federal Education and Professional Training

Progression Grid
Plumbing and Solar Water Heating System-I
Grades 9-12

Domain A: Elements of Plumbing

Standard 1: The students will be able to apply tools, techniques, and skills to install, remove, or deal with plumbing operations.

Grade 9	Grade 10	Grade 11	Grade 12
Benchmark 1: The students will be able to explain basics and importance of Plumbing and Classification of Plumbing		Benchmark 1: The students will be able to perform jointing of G.I pipes and Fittings, Installation of water supply fixtures and appliances.	
Student Explaining Outcomes			
The students will be able to: [SLO:PSWHS-09-A-01]: Explain the basics of plumbing. [SLO:PSWHS-09-A-02]: Describe the main purposes of plumbing. [SLO:PSWHS-09-A-03]: Describe the importance of plumbing. [SLO:PSWHS-09-A-04]: Describe the scope of plumbing. [SLO:PSWHS-09-A-05]:		**The Students will be able to:** [SLO:PSWHS-11-A-01]: Identify G.I pipes [SLO:PSWHS-11-A-02]: Identify different classes of G.I pipes. [SLO:PSWHS-11-A-03]: Observe the basic principle of G.I Pipes. [SLO:PSWHS-11-A-04]: Explain about fitting and their names.	

identify of main fixtures of plumbing. [SLO:PSWHS-09-A-06]: Identify the PPEs for workplace. [SLO:PSWHS-09-A-07]: Describe the types of plumbing systems. [SLO:PSWHS-09-A-08]: Describe the different sections of plumbing system. [SLO:PSWHS-09-A-09]: Explain the purpose of plumbing. [SLO:PSWHS-09-A-10]: Explain the basic of plumbing.		[SLO:PSWHS-11-A-05]: Demonstrate fittings male and female parts. [SLO:PSWHS-11-A-06]: Explain the purpose of fittings. [SLO:PSWHS-11-A-07]: Explain the uses of all G.I fittings. [SLO:PSWHS-11-A-08]: Explain the uses of male and female types of fitting. [SLO:PSWHS-11-A-09]: Explain joint types and their uses such as socket joint, union joint, threaded joint, coupling joint, long thread joint, Flange joints and welded joint. [SLO:PSWHS-11-A-10]: Explains uses of joints according to materials of pipes and nature of	

		material flowing in pipes [SLO:PSWHS-11-A-11]: Explains jointing with thread long thread, socket and coupling joints [SLO:PSWHS-11-A-12]: Explains joint gaskets, packing material and jointing materials. [SLO:PSWHS-11-A-13]: Explains jointing with union and importance of union joint. [SLO:PSWHS-11-A-14]: Explains joining Pressure line with flange plates.	
Benchmark 2: The students will be able to describeindustrial and operational safety.		Benchmark 2: The students will be able to perform installation of water supply fixtures and appliances	
Student Explaining Outcomes			
[SLO:PSWHS-09-A-11]: The Students will be able to:		**The Students will be able to:**	•

[SLO:PSWHS-09-A-12]: Explain the concept of Industrial safety [SLO:PSWHS-09-A-13]: Describe the effect of Industrial pollution on environment and humans. [SLO:PSWHS-09-A-14]: State use of Power Tools. [SLO:PSWHS-09-A-15]: Explain why: [SLO:PSWHS-09-A-16]: Not remove covering of machines [SLO:PSWHS-09-A-17]: Not to repair a machine during working. Loose clothing and carelessness factors. [SLO:PSWHS-09-A-18]: Explain safety symbols and their uses in industry [SLO:PSWHS-09-A-19]: Explain safety regarding construction sites such as high-rise building, deep execution and moving machines. • [SLO:PSWHS-09-A-20]:		[SLO:PSWHS-11-A-15: Explains service line with the main water supply line . [SLO:PSWHS-11-A-16]: Explains joining socket clamp, gasket, ferrule valve and main line fittings. [SLO:PSWHS-11-A-17]: Explains the importance of joints and damages caused by leakage. [SLO:PSWHS-11-A-18]: Describe the procedure of detection of leakage in joints. [SLO:PSWHS-11-A-19]: Demonstrate the techniques for installation of appliances. [SLO:PSWHS-11-A-20]: Describe the importance of appliances	

Explain the Importance of first aid and select material to use as first aid [SLO:PSWHS-09-A-21]: Apply first aid in case of accidents and electric socks.		[SLO:PSWHS-11-A-21]: Demonstrate how to change appliances [SLO:PSWHS-11-A-22]: Describe the working procedures of different appliances [SLO:PSWHS-11-A-23]: Explain the scope of appliances at Industry (Hotels, Accommodations) . [SLO:PSWHS-11-A-24]: Explore the importance of appliances [SLO:PSWHS-11-A-25]: Explain about different types of water supply appliances. [SLO:PSWHS-11-A-26]: Explain about different types of sanitary appliances. [SLO:PSWHS-11-A-27]:	

		Classify house appliances by type, location and price. [SLO:PSWHS-11-A-28]: Carry out electric safety check (if required) [SLO:PSWHS-11-A-29]: Describe and identify loose unions [SLO:PSWHS-11-A-30]: Describe how to disconnect and remove pump from foundation [SLO:PSWHS-11-A-31]: Describe how to reconnect pumps to existing services. [SLO:PSWHS-11-A-32]: Check for leakage. [SLO:PSWHS-11-A-33]: Check level of pump at foundation	

		[SLO:PSWHS-11-A-34]: Check gas pressure [SLO:PSWHS-11-A-35]: Uninstall existing gas meter [SLO:PSWHS-11-A-36]: Install new gas meter [SLO:PSWHS-11-A-37]: Identify the tanks. [SLO:PSWHS-11-A-38]: Check: [SLO:PSWHS-11-A-39]: water pressure [SLO:PSWHS-11-A-40]: Shut down valve [SLO:PSWHS-11-A-41]: Locate position for installation [SLO:PSWHS-11-A-42]:	

		Replace pipe with fittings [SLO:PSWHS-11-A-43]: Identify a Geyser [SLO:PSWHS-11-A-44]: Check: [SLO:PSWHS-11-A-45]: water pressure [SLO:PSWHS-11-A-46]: Shut down valve [SLO:PSWHS-11-A-47]: Locate position for installation [SLO:PSWHS-11-A-48]: Fix union for inlet and out let pipes [SLO:PSWHS-11-A-49]: Fix pipes connection for hot and cold Water [SLO:PSWHS-11-A-50]: Identify Water Cooler or Dispenser	

		[SLO:PSWHS-11-A-51]: Check: [SLO:PSWHS-11-A-52]: water pressure [SLO:PSWHS-11-A-53]: Shut down valve [SLO:PSWHS-11-A-54]: Locate position for installation [SLO:PSWHS-11-A-55]: Fix union for inlet and out let pipes [SLO:PSWHS-11-A-56]: Check drain pipes	
• Benchmark 3: Introduction to different types of Plastic Pipes and their purposes			
Student Explaining Outcomes			
The Students will be able to: [SLO:PSWHS-09-A-22]:			

Identify PVC pipes applicable to a specific plumbing project. [SLO:PSWHS-09-A-23]: Receive and inspect pipes. [SLO:PSWHS-09-A-24]: Observe basic principles for PVC pipes. [SLO:PSWHS-09-A-25]: Monitor the uses of PVC pipes. [SLO:PSWHS-09-A-26]: Observe the purpose of PVC pipes in water supply scheme. [SLO:PSWHS-09-A-27]: Check the difference between PVC pipes. [SLO:PSWHS-09-A-28]: Identify the PPRC, PEX, ABS, HDPE pipes. [SLO:PSWHS-09-A-29]: Identify PPRC, PEX, ABS, HDPE pipes applicable to a specific plumbing project. [SLO:PSWHS-09-A-30]: Check for safety hazards. [SLO:PSWHS-09-A-31]: Receive and inspect pipes.			

[SLO:PSWHS-09-A-32]: Observe basic principles for PPRC, PEX, ABS, HDPE pipes. [SLO:PSWHS-09-A-33]: Describe the purpose of PPRC, PEX, ABS, HDPE pipes [SLO:PSWHS-09-A-34]: Monitor the uses of PPRC, PEX, ABS, HDPE pipes [SLO:PSWHS-09-A-35]: Observe the purpose and classification of PPRC, PEX, ABS, HDPE pipes. [SLO:PSWHS-09-A-36]: Check the difference between PPR and PVC pipes. [SLO:PSWHS-09-A-37]: Observe the advantages and disadvantages of PPRC, PEX, ABS, HDPE pipes.			

Domain B: Plumbing Operations

Standard 1: Students will be able to measure, mark and cut plastic pipes, join fittings, and water supply fixtures with plastic pipes and install various equipment fixtures.

Grade 9	Grade 10	Grade 11	Grade 12

Benchmark 1: The students will be able to measure, make or cut, plumbing pipes and sanitary fixtures.		Benchmark 1: The students will be able to perform jointing of G.I pipes and Fittings, Installation of water supply fixtures and appliances.	
Student Explaining Outcomes			
The students will be able to: [SLO:PSWHS-09-B-01]: Select appropriate measuring tool for plumbing work [SLO:PSWHS-09-B-02]: Ascertain the functionality & correctness of the instrument. [SLO:PSWHS-09-B-03]: State the support interval for different dia. PPR & PVC pipes [SLO:PSWHS-09-B-04]: Measure internal and internal diameters.		**The Students will be able to:** [SLO:PSWHS-11-B-01]: Explain the meanings for wastewater sanitary fittings. [SLO:PSWHS-11-B-02]: Describe the importance of fittings [SLO:PSWHS-11-B-03]: Manage to change the fittings [SLO:PSWHS-11-B-04]: Describe the working procedures of different fittings [SLO:PSWHS-11-B-05]: Explain the scope of fittings at Industry	•

[SLO:PSWHS-09-B-05]: Select appropriate pipe, fitting and fixture. [SLO:PSWHS-09-B-06]: Measure length of selected pipe. [SLO:PSWHS-09-B-07]: Do the marking of Pipes and fixtures [SLO:PSWHS-09-B-08]: Mark the pipe for cutting as per drawing. [SLO:PSWHS-09-B-09]: Mark the position of fixture on site for its installation or cutting of pipes [SLO:PSWHS-09-B-10]: Select the appropriate tool for cutting of pipes. [SLO:PSWHS-09-B-11]: Observe WHS requirements in cutting the pipes.		(Residence and Hotels Accommodations). [SLO:PSWHS-11-B-06]: Explore importance of waste water fittings [SLO:PSWHS-11-B-07]: Explain the different Types of waste water fittings. [SLO:PSWHS-11-B-08]: Explain the different Types of fittings as price. [SLO:PSWHS-11-B-09]: Familiarize themselves with the house fittings specially. [SLO:PSWHS-11-B-10]: Classify appliances by type and location. [SLO:PSWHS-11-B-11]: Identify coupling [SLO:PSWHS-11-B-12]: Identify Sockets	

		[SLO:PSWHS-11-B-13]: Check waste pressure [SLO:PSWHS-11-B-14]: Describe specification [SLO:PSWHS-11-B-15]: Uninstall existing socket [SLO:PSWHS-11-B-16]: Install new fitting (socket)between [SLO:PSWHS-11-B-17]: Differentiate between coupling and sockets [SLO:PSWHS-11-B-18]: Identify Tee & Elbow [SLO:PSWHS-11-B-19]: Check pressure [SLO:PSWHS-11-B-20]: Shut down valve for water supply	

		[SLO:PSWHS-11-B-21]: Uninstall existing fittings [SLO:PSWHS-11-B-22]: Replace fittings with new one [SLO:PSWHS-11-B-23]: Select procedures using work health and safety (WHS) and environmental requirements. [SLO:PSWHS-11-B-24]: Identify Y & Cross valves [SLO:PSWHS-11-B-25]: Check waste water pressure [SLO:PSWHS-11-B-26]: Shut down valve of water supply [SLO:PSWHS-11-B-27]: Locate position for installation	

		[SLO:PSWHS-11-B-28]: Replace pipe with fittings [SLO:PSWHS-11-B-29]: Differentiate between “Y” and Cross [SLO:PSWHS-11-B-30]: Select procedures using work health and safety (WHS) and environmental requirements. [SLO:PSWHS-11-B-31]: Identify waste pipe [SLO:PSWHS-11-B-32]: Identify workplace [SLO:PSWHS-11-B-33]: Check waste pressure [SLO:PSWHS-11-B-34]: Locate position for installation [SLO:PSWHS-11-B-35]:	

		Replace pipe with fittings [SLO:PSWHS-11-B-36]: Fix new pipe with proper joint and fittings [SLO:PSWHS-11-B-37]: Check for proper working (waste flow) [SLO:PSWHS-11-B-38]: Check depth for waste pipe [SLO:PSWHS-11-B-39]: Calculate earth work [SLO:PSWHS-11-B-40]: Locate position for waste pipe [SLO:PSWHS-11-B-41]: Clear the work area, [SLO:PSWHS-11-B-42]: dispose off extra materials in accordance with state	

		and territory legislation [SLO:PSWHS-11-B-43]: Adopt workplace policies and procedures.	
Benchmark 2: the students will be able to complete Joint fittings and water supply fixtures with plastic pipes		Benchmark 2: The students will be able to classify the waste water fixtures and Install Traps, W.Cs, Sink, hand wash basin, and Bathtub.	
Student Explaining Outcomes			
The students will be able to: [SLO:PSWHS-09-B-12]: Select appropriate heater for supplied pipes and fitting. [SLO:PSWHS-09-B-13]: Fix and remove required diameter heating sockets with heater. [SLO:PSWHS-09-B-14]:		**The Students will be able to:** [SLO:PSWHS-11-B-44]: Explain the meanings for installation of sanitary fittings and fixtures. [SLO:PSWHS-11-B-45]: Describe the importance of appliances. [SLO:PSWHS-11-B-46]:	•

State the system of supply of water- dead end (tree), radial, grid iron and circular system [SLO:PSWHS-09-B-15]: Heat the pipe and perform fitting observing WHS requirements. [SLO:PSWHS-09-B-16]: Join pipes and cool the joint. [SLO:PSWHS-09-B-17]: Demonstrate the jointing of plastic Pipes. [SLO:PSWHS-09-B-18]: Mark the location of fixtures as per plan. [SLO:PSWHS-09-B-19]: Select the appropriate installation mechanism. [SLO:PSWHS-09-B-20]: Install the fixtures observing WHS requirements		Manage to change fixtures. [SLO:PSWHS-11-B-47]: Describe the working procedures of different fixtures [SLO:PSWHS-11-B-48]: Explain the scope of fixtures at Industry (Hotels and Accommodations). [SLO:PSWHS-11-B-49]: Explore the importance of fixtures [SLO:PSWHS-11-B-50]: Explain the different Types of fixtures [SLO:PSWHS-11-B-51]: Explain the types of sanitary fixtures according to working, location and materials [SLO:PSWHS-11-B-52]: Explain the types of sanitary fixtures	

		according to their price. [SLO:PSWHS-11-B-53]: Identify Traps [SLO:PSWHS-11-B-54]: Identify workplace [SLO:PSWHS-11-B-55]: Adopt safety policies [SLO:PSWHS-11-B-56]: Select procedures usingse work health and safety (WHS) and environmental requirements. Check manufacturer's specifications [SLO:PSWHS-11-B-57]: Check sewage pressure [SLO:PSWHS-11-B-58]: Check depth for trap [SLO:PSWHS-11-B-59]: Calculate earth work	

		[SLO:PSWHS-11-B-60]: Locate position for trap [SLO:PSWHS-11-B-61]: Identify W.C. [SLO:PSWHS-11-B-62]: Apply workplace policies [SLO:PSWHS-11-B-63]: Adopt procedures, [SLO:PSWHS-11-B-64]: Isolate services. [SLO:PSWHS-11-B-65]: Locate place [SLO:PSWHS-11-B-66]: Fix trap [SLO:PSWHS-11-B-67]: Fix W.C. [SLO:PSWHS-11-B-68]: Check Levels	

		[SLO:PSWHS-11-B-69]: Pour concrete around W.C. [SLO:PSWHS-11-B-70]: Identify Sink. [SLO:PSWHS-11-B-71]: Apply workplace policies and procedures [SLO:PSWHS-11-B-72]: Locate place [SLO:PSWHS-11-B-73]: Fix stands in wall [SLO:PSWHS-11-B-74]: Fix bolt kits [SLO:PSWHS-11-B-75]: Identify Sink. [SLO:PSWHS-11-B-76]: Apply workplace policies and procedures	

		[SLO:PSWHS-11-B-77]: Fix stands in wall [SLO:PSWHS-11-B-78]: Fix bolt kits [SLO:PSWHS-11-B-79]: Identify wash hand basin [SLO:PSWHS-11-B-80]: Check water pressure [SLO:PSWHS-11-B-81]: Shut down valve [SLO:PSWHS-11-B-82]: Locate position for installation [SLO:PSWHS-11-B-83]: Adopt safety policies [SLO:PSWHS-11-B-84]: Use work health and safety (WHS) and environmental requirements.	

		[SLO:PSWHS-11-B-85]: Check manufacturer’ s specifications [SLO:PSWHS-11-B-86]: Select procedures, usingwork health and safety (WHS) and environmental requirements. [SLO:PSWHS-11-B-87]: Use proper tools [SLO:PSWHS-11-B-88]: Check water pressure [SLO:PSWHS-11-B-89]: Shut down valve [SLO:PSWHS-11-B-90]: Locate position for installation [SLO:PSWHS-11-B-91]: Fix bath tub	

		[SLO:PSWHS-11-B-92]: Clear the work area after performing complete task. [SLO:PSWHS-11-B-93]: Dispose off extra materials in accordance with state and territory legislation and workplace policies and procedures	
Benchmark 3: The students will be able to perform Installation of fixtures			
Student Explaining Outcomes			
The students will be able to: [SLO:PSWHS-09-B-21]: Access, read and determine water service installation requirements from job specifications, relevant Australian Standards, codes, manufacturers' instructions and jurisdictional requirements.			

[SLO:PSWHS-09-B-22]: Obtain, interpret and follow workplace, work health and safety (WHS) and environmental requirements. [SLO:PSWHS-09-B-23]: Create a materials list and collect materials. [SLO:PSWHS-09-B-24]: Select and check serviceability of appropriate tools and equipment including personal protective equipment (PPE). [SLO:PSWHS-09-B-25]: Set out and install pipework and connection points according to drawings, relevant specifications, local Standards, codes and jurisdictional requirements. [SLO:PSWHS-09-B-26]:			

Test installed pipework according to relevant local Standards, codes, manufacturers' instructions and jurisdictional requirements. [SLO:PSWHS-09-B-27]: Install the fixtures observing WHS requirements [SLO:PSWHS-09-B-28]: Clean up the operation site			

Domain C: Plumbing testing, Interpretation and management

Standard 1: Students will be able to develop Plumbing Layout Drawing, conduct Quantity Calculations and recognize the personal and professional development opportunities.

Grade 9	Grade 10	Grade 11	Grade 12
Benchmark 1: the students will be able to create simple, Notate, and process oriented sketches and drawings.		Benchmark 1: The students must be able to Carry out initial preparatory activities for leakage detection Test by smoke and water.	
Student Explaining Outcomes			

The students will be able to: [SLO:PSWHS-09-C-01]: State types of drawings. [SLO:PSWHS-09-C-02]: State key features to be recorded [SLO:PSWHS-09-C-03]: Identify and follow Work health and safety (WHS) requirements on site. [SLO:PSWHS-09-C-04]: State Tools and equipment required for inspection and measurement and for producing plumbing the drawings. [SLO:PSWHS-09-C-05]: State PPEs for safety and serviceability. [SLO:PSWHS-09-C-06]: Inspect area and record required measurements.		**The Students will be able to:** [SLO:PSWHS-11-C-01]: Access relevant job instructions from Explaining information management system (LIMS). [SLO:PSWHS-11-C-02]: Prepare workplace for task [SLO:PSWHS-11-C-03]: Assemble / collect all required equipment and materials [SLO:PSWHS-11-C-04]: Plan task / work sequences for optimum efficiency [SLO:PSWHS-11-C-05]: Identify the specimen [SLO:PSWHS-11-C-06]: Identify leakage testing machine	•

[SLO:PSWHS-09-C-07]: Create Suitable views and simple sketches and drawings using standard drawing conventions. [SLO:PSWHS-09-C-08]: Create standard Sectional drawings of structural elements. [SLO:PSWHS-09-C-09]: Observe sustainability principles and concepts in undertaking work processes. [SLO:PSWHS-09-C-10]: Record information on the drawing with symbols and abbreviations. [SLO:PSWHS-09-C-11]: Label according to organizational administration and quality procedures.		[SLO:PSWHS-11-C-07]: Detect the leakage of smoke. [SLO:PSWHS-11-C-08]: Identify the specimen [SLO:PSWHS-11-C-09]: Identify leakage testing machines. [SLO:PSWHS-11-C-10]: Evaluate the amount of leakage of water.	
Benchmark 2: The students will be able to the Calculate quantities for domestic plumbing system and prepare the lists of required		Benchmark 2: The student must also be able to identify and utilize available	

materials for commercial building plumbing system		entrepreneurial opportunities.	
Student Explaining Outcomes			
[SLO:PSWHS-09-C-12]: **The students will be able to:** [SLO:PSWHS-09-C-13]: Access, read and determine requirements from plumbing plans and specifications. [SLO:PSWHS-09-C-14]: Identify amendments to ensure plans and specifications are the most current version. [SLO:PSWHS-09-C-15]: Confirm drawing conventions used and their application. [SLO:PSWHS-09-C-16]: Explain and use the simple formulas for		[SLO:PSWHS-11-C-11]: **The Students will be able to:** [SLO:PSWHS-11-C-12]: Define entrepreneurship [SLO:PSWHS-11-C-13]: Explain key concepts of entrepreneurship. [SLO:PSWHS-11-C-14]: Describe main component of entrepreneurship. [SLO:PSWHS-11-C-15]: Explain how to identify business opportunity. [SLO:PSWHS-11-C-16]: Explain how to develop Feasibility and Business Plan.	•

the solution of triangles. [SLO:PSWHS-09-C-17]: Explain and use the simple formulas for solution of quadrilaterals. [SLO:PSWHS-09-C-18]: Explain and use the simple formulas for solution of the circle. [SLO:PSWHS-09-C-19]: Apply the above formulas to calculate numbers, length and areas of simple plane figures. [SLO:PSWHS-09-C-20]: Determine type of materials. [SLO:PSWHS-09-C-21]: Calculate dimensions of required materials. [SLO:PSWHS-09-C-22]: Calculate the quantities of		[SLO:PSWHS-11-C-17]: prepare a business plan. [SLO:PSWHS-11-C-18]: Explain about concept of marketing and marketing mix [SLO:PSWHS-11-C-19]: Describe 6P's of marketing. [SLO:PSWHS-11-C-20]: calculate costing and pricing	

materials for plumbing system [SLO:PSWHS-09-C-23]: Read the drawing of a commercial building. [SLO:PSWHS-09-C-24]: Calculate the quantities of materials from the help of a given plumbing plan.			
Benchmark 3: the students will be able to prepare an effective resume, apply for job on various job portals and Describe the concept of e-commerce			
Student Explaining Outcomes			
The students will be able to: [SLO:PSWHS-09-C-25]: Explain the importance of cv in job application [SLO:PSWHS-09-C-26]: create and format CV/resume			

[SLO:PSWHS-09-C-27]: access and register email account on various online job portals [SLO:PSWHS-09-C-28]: search job as per job description and title [SLO:PSWHS-09-C-29]: familiarize oneself with online travel ecommerce websites [SLO:PSWHS-09-C-30]: Explain about hotel websites [SLO:PSWHS-09-C-31]: Explain about freelancing websites			

Domain D: Solar Water Heating System Fundamentals

Standard 1: Students will be able to Explain, Describe and practice techniques to identify alternative heating sources for solar water heating system control and perform relevant protection procedures and operations.

Grade 9	Grade 10	Grade 11	Grade 12

	Benchmark 1: tudents will be able to explain the effect of solar water heater system on Plumbing operations.		Benchmark 1: The students will be able to explain alternative heating Sources.
Student Explaining Outcomes			
	The students will be able to: [SLO:PSWHS-10-D-01]: Describe the solar water heater system [SLO:PSWHS-10-D-02]: Describe use of solar water heater in buildings [SLO:PSWHS-10-D-03]: Explain the advantage of solar water heater system [SLO:PSWHS-10-D-04]: Describe solar water heater and conventional water heating system		**The students will be able to:** [SLO:PSWHS-12-D-01]: Explain the need of auto devices for cloudy weather to control alternative energy. [SLO:PSWHS-12-D-02]: Describe the types of alternative Energy sources [SLO:PSWHS-12-D-03]: Explain the components of Electric Systems in SWHS [SLO:PSWHS-12-D-04]:

	[SLO:PSWHS-10-D-05]: Explain the importance of renewable energy. [SLO:PSWHS-10-D-06]: Review the cost saving electricity or gas [SLO:PSWHS-10-D-07]: Calculate cost saving of electricity or gas [SLO:PSWHS-10-D-08]: Explain eco friendly effect of solar water heater [SLO:PSWHS-10-D-09]: define the greenhouse effect [SLO:PSWHS-10-D-10]: Interpret effect of solar on greenhouse gasses (GHG)		Supervise installation of Electric components in SWHS [SLO:PSWHS-12-D-05]: Explain use of Gas Energy in SWHS [SLO:PSWHS-12-D-06]: Explain Component of Gas Systems in SWHS [SLO:PSWHS-12-D-07]: Explain use of LPG Energy in SWHS
	Benchmark 2: the students will be able to recognize common		Benchmark 2: the students will be able to describe solar water

	types of solar water heater		heating system control and protection
Student Explaining Outcomes			
	[SLO:PSWHS-10-D-12]: The Students will be able to: [SLO:PSWHS-10-D-13]: Describe main components of solar water heater. [SLO:PSWHS-10-D-14]: Describe collector and its types, storage tank, circulating system and boost heater or alternative source. [SLO:PSWHS-10-D-15]: Install Flat plate collector system [SLO:PSWHS-10-D-16]: Install Evacuated tube collector [SLO:PSWHS-10-D-17]:		**The students will be able to:** [SLO:PSWHS-12-D-08]: Describe The need for Control and protection [SLO:PSWHS-12-D-09]: Explain Protection of Corrosion [SLO:PSWHS-12-D-10]: Describe Water temperature control. [SLO:PSWHS-12-D-11]: Describe Frost damage and its protection devices.

	Install Split or pumped storage systems [SLO:PSWHS-10-D-18]: Install Heat pump systems		

Domain E: Solar Water Heating System Operations

Standard 1: The students must be able to identify and recognize valves used in solar water heating system and interpret basic design and site selection practiced in solar water heating systems.

Grade 9	Grade 10	Grade 11	Grade 12
	Benchmark 1: the students will be able to Describe solar radiation and positioning of collectors		Benchmark 1: the students will be able to use and analyze valves used in solar water heating system
Student Explaining Outcomes			
	The Students will be able to: [SLO:PSWHS-10-E-01]: Describe the basics solar radiation and positioning of collectors		**The students will be able to:** [SLO:PSWHS-12-E-01]: Explain Introduction and necessity of Valves in SWHS

	[SLO:PSWHS-10-E-02]: Draw positioning of different types of collectors [SLO:PSWHS-10-E-03]: Student will able to determine the best flat plate collector orientation and inclination to calculate the angle of inclination [SLO:PSWHS-10-E-04]: Draw angle of inclination. [SLO:PSWHS-10-E-05]: Calculate the difference between ideal and variant orientation		[SLO:PSWHS-12-E-02]: Describe Types of Valves for SWHS [SLO:PSWHS-12-E-03]: Explains function of all valves used in SWHS. [SLO:PSWHS-12-E-04]: Install Non return Valve and [SLO:PSWHS-12-E-05]: Install Pressure Reducing Valve [SLO:PSWHS-12-E-06]: Install Cold Water expansion Valve or Pressure Relief Valve [SLO:PSWHS-12-E-07]: Read Pressure and Temperature Relief Valve. [SLO:PSWHS-12-E-08]:

			Install Combined Valve [SLO:PSWHS-12-E-09]: Ensure function of valve and check [SLO:PSWHS-12-E-10]: Install Air Vent Valve [SLO:PSWHS-12-E-11]: Install Float Valve. [SLO:PSWHS-12-E-12]: Install Cold water shut off Valve [SLO:PSWHS-12-E-13]: Install Line Strainer [SLO:PSWHS-12-E-14]: Install Safety valve
	Benchmark 2: the students will be able to comprehend solar system operating principles		Benchmark 2: the students will be able to interpret system design and site selection

Student Explaining Outcomes			
	The students will be able to: [SLO:PSWHS-10-E-06]: Describe the types of operating principles. [SLO:PSWHS-10-E-07]: Apply solar system operating principles (with diagram) [SLO:PSWHS-10-E-08]: Define Conduction, convection & Radiation. [SLO:PSWHS-10-E-09]: Calculate the temperature of heated water. [SLO:PSWHS-10-E-10]: Calculate the pressure in SWH due to temperature [SLO:PSWHS-10-E-11]:		**The students will be able to:** [SLO:PSWHS-12-E-15]: Create Pre Installation Plan [SLO:PSWHS-12-E-16]: Conduct the site Assessment [SLO:PSWHS-12-E-17]: Prepare site Assessment reports [SLO:PSWHS-12-E-18]: Calculate system sizing for [SLO:PSWHS-12-E-19]: Collector , tank and system parts [SLO:PSWHS-12-E-20]: Explain about System selection criteria

	Calculate the expansion due to rise in temperature [SLO:PSWHS-10-E-12]: Differentiate between thermo siphon and principles of thermo siphon [SLO:PSWHS-10-E-13]: Analysis stratification in hot water storage tanks [SLO:PSWHS-10-E-14]: Analysis of stratification in hot water tanks of (domestic and commercial)		[SLO:PSWHS-12-E-21]: Explain about Alternative energy system The students will be able to [SLO:PSWHS-12-E-22]: Prepare check list [SLO:PSWHS-12-E-23]: Follow principle of Risk assessment

Domain F: Solar Water Heating System Procedures

Standard 1: The students must be able to carry out installation and commissioning and practice maintenance and troubleshooting of solar water heating system.

Grade 9	Grade 10	Grade 11	Grade 12
	Benchmark 1: the students will be able to Explain collector types and operating principles		Benchmark 1: the students will be able to perform installation and commissioning of solar water heating system

Student Explaining Outcomes			
	The Students will be able to: [SLO:PSWHS-10-F-01]: Describe the collector types and operating principles install the flat plate collector system [SLO:PSWHS-10-F-02]: Install absorber plate system [SLO:PSWHS-10-F-03]: Install Transparent collector system [SLO:PSWHS-10-F-04]: Install Collector box [SLO:PSWHS-10-F-05]: Replace collector box [SLO:PSWHS-10-F-06]: install the evacuated tube collectors		**The students will be able to:** [SLO:PSWHS-12-F-01]: Explain about installation process [SLO:PSWHS-12-F-02]: Calculate Estimated cost for installation material [SLO:PSWHS-12-F-03]: Check installation check list [SLO:PSWHS-12-F-04]: Install piping and pump with glycol loop. [SLO:PSWHS-12-F-05]: Install inlet and supply pipes. Install Controls. [SLO:PSWHS-12-F-06]: Insulate piping and glycol lines

	[SLO:PSWHS-10-F-07]: Evaluate the performance of collector in winter and summer season		[SLO:PSWHS-12-F-07]: Install auto control and control valves. [SLO:PSWHS-12-F-08]: Install alternate energy devices [SLO:PSWHS-12-F-09]: Test and commission a system [SLO:PSWHS-12-F-10]: Check leakage and also energy losses
	Benchmark 2: the students will be able to Describe the designing and construction of storage tanks of swhs		Benchmark 2: the students will be able to conduct maintenance and trouble shooting of solar water heating system.
Student Explaining Outcomes			
	[SLO:PSWHS-10-F-08]: The Students will be able to: [SLO:PSWHS-10-F-09]:		**The students will be able to:** [SLO:PSWHS-12-F-11]:

	Identify materials and construction requirements of tank [SLO:PSWHS-10-F-10]: Identify insulation material for tank [SLO:PSWHS-10-F-11]: Identify outer casing material of tank [SLO:PSWHS-10-F-12]: Design tank shape size as per specification [SLO:PSWHS-10-F-13]: Calculate the tank size and shape as per approved drawing. [SLO:PSWHS-10-F-14]: Connect the tank with collectors		Describe the importance of Maintenance and trouble Shooting [SLO:PSWHS-12-F-12]: Describe Preventative maintenance for system performance and safety [SLO:PSWHS-12-F-13]: Explain Corrosion and Scale formation [SLO:PSWHS-12-F-14]: Control Damages to system by Corrosion and Scale formation [SLO:PSWHS-12-F-15]: Take Preventive measure for Corrosion and Scale formation [SLO:PSWHS-12-F-16]: Explain Sedimentation Preventives. [SLO:PSWHS-12-F-17]: Damages to system by sedimentation

			[SLO:PSWHS-12-F-18]: Make safe insulation [SLO:PSWHS-12-F-19]: Identify effects of Deterioration factor of insulation on system efficiency [SLO:PSWHS-12-F-20]: Identify Trouble shooting problems and rectify trouble [SLO:PSWHS-12-F-21]: Find the dripping sound of water [SLO:PSWHS-12-F-22]: Rectify the dripping sound of water as per procedure [SLO:PSWHS-12-F-23]: Describe Dripping noise and its remedies [SLO:PSWHS-12-F-24]:

			Identify quickly running out of hot water. [SLO:PSWHS-12-F-25]: Rectify the quickly running water as per procedure [SLO:PSWHS-12-F-26]: Shut down of system in summer as per procedure [SLO:PSWHS-12-F-27]: Permanently / long time disconnect system as per procedure. [SLO:PSWHS-12-F-28]: Explain Use of SWHS as central heating system and its benefits

NATIONAL CURRICULUM COUNCIL SECRETARIAT
MINISTRY OF FEDERAL EDUCATION AND
PROFESSIONAL TRAINING, ISLAMABAD
GOVERNMENT OF PAKISTAN