

PLUMBING 1, 2
(COURSE CODES: 6280, 6281)

COURSE DESCRIPTION: Plumbers install, repair and maintain pipes, fixtures and other plumbing equipment used for water distribution and waste water disposal in residential, commercial and industrial buildings. They are employed in maintenance departments of factories, plants and similar establishments, by plumbing contractors, or they may be self-employed. Plumbers perform some or all of the following duties:

1. Read blueprints, drawings and specifications to determine layout of plumbing system, water supply network and waste and drainage systems
2. Install, repair and maintain domestic, commercial or industrial plumbing fixtures and systems
3. Locate and mark positions for pipe connections, passage holes and fixtures in walls and floors
4. Cut opening in walls and floors to accommodate pipe and pipe fittings
5. Measure, cut, bend and thread pipes using hand and power tools or machines
6. Join pipes using couplings, clamps, screws, bolts, cement or soldering, brazing and welding equipment
7. Test pipes for leaks using air and water pressure gauges
8. May prepare cost estimates.

If a student takes Introduction to Construction and scores 70% on all assessments (00101-15-00108-15), he or she does not have to repeat these modules in HVAC Technology, Building Construction, Cabinetmaking, Carpentry, Electricity, Masonry, Mechatronics, Plumbing, and Welding.

OBJECTIVE: Given the necessary equipment, materials, and instruction, the student, on completion of the prescribed course of study, will be able to successfully accomplish the following core competencies.

RECOMMENDED GRADE LEVELS:	9 - 12
CREDIT:	(120 hours) or 2 (240 hours) Carnegie units per course code
PREREQUISITE:	None
COMPUTER REQUIREMENT:	One computer per student
RESOURCES:	SC Instructional Materials and Resources

A. NCCER® CORE MODULES

MODULE A: SAFETY

Proficient construction professionals demonstrate basic safety knowledge. The following accountability criteria are considered essential for students in all the Construction programs of study.

1. Identify the responsibilities and personal characteristics of a professional craftsman.
2. Describe the safe work requirements for elevated work.
3. Identify and explain how to avoid struck-by and caught-in-between hazards.
4. Explain the appropriate safety precautions around common job-site hazards.
5. Demonstrate the use and care of appropriate personal protective equipment (PPE).
6. Identify and describe other specific job-site safety hazards.
7. Follow safe procedures for lifting heavy objects.
8. Describe safe behavior on and around ladders and scaffolds.
9. Explain the importance of the Hazard Communication Standard (HazCom) requirement and Safety Data Sheets (SDS)
10. Describe fire prevention and firefighting techniques.
11. Define safe work procedures around electrical hazards.
12. Complete 10-hour OSHA course/assessment and receive card. (SDE Requirement)
13. Complete Performance Tasks.

MODULE B: CONSTRUCTION MATH (OPTIONAL)

Proficient construction professionals demonstrate basic math skills. The following accountability criteria are considered essential for students in all the Construction programs of study.

1. Add, subtract, multiply, and divide whole numbers, with and without a calculator.
2. Use a standard ruler and a metric ruler to measure.
3. Add, subtract, multiply, and divide fractions.
4. Add, subtract, multiply, and divide decimals, with and without a calculator.
5. Convert decimals to percent and percent to decimals.
6. Convert fractions to decimals and decimals to fractions.
7. Explain what the metric system is and how it is important in the construction trade.
8. Recognize and use metric units of length, weight, volume, and temperature.
9. Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.

MODULE C: INTRODUCTION TO HAND TOOLS (OPTIONAL)

Proficient construction professionals demonstrate how to safely use various hand tools. The following accountability criteria are considered essential for students in all the Construction programs of study.

1. Recognize and identify various types of basic hand tools used in the construction trade.
2. Identify and describe how to use various types of measurement and layout tools.
3. Identify and explain how to use various types of cutting and shaping tools.
4. Use these tools safely.
5. Describe the basic procedures for taking care of these tools.
6. Complete Performance Tasks.

MODULE D: INTRODUCTION TO POWER TOOLS (OPTIONAL)

Proficient construction professionals demonstrate how to safely use power tools. The following accountability criteria are considered essential for students in all the Construction programs of study.

1. Identify and explain how to use various types of power drills and impact wrenches used in the construction trade.
2. Identify and explain how to use various types of power saws.
3. Identify and explain how to use various grinders and grinder attachments.
4. Identify and explain how to use miscellaneous power tools.
5. Use power tools safely.
6. Explain how to maintain power tools properly.
7. Complete Performance Tasks.

MODULE E: INTRODUCTION TO CONSTRUCTION DRAWINGS/RECOMMEND BLUEPRINT READING (OPTIONAL)

Proficient construction professionals demonstrate knowledge and the use of blueprints/construction drawings. The following accountability criteria are considered essential for students in all the Construction programs of study.

1. Identify and describe various types of construction drawings, including their fundamental components and features.
2. Recognize and identify basic blueprint terms, components, and symbols.
3. Relate information on blueprints to actual locations on the print.
4. Recognize different classifications of drawings.
5. Interpret and use drawing dimensions.
6. Complete Performance Tasks.

MODULE F: BASIC RIGGING (OPTIONAL)

Proficient construction professionals demonstrate how to use basic rigging. The following accountability criteria are considered essential for students in all Construction programs of study.

1. Explain how ropes, chains, hoists, loaders, and cranes are used to move material and equipment from one location to another on a job site.
2. Describe inspection techniques and load-handling safety practices.
3. Explain the American National Standards Institute (ANSI) hand signals.
4. Complete Performance Tasks.

MODULE G: BASIC COMMUNICATION SKILLS (SDE Requirement)

Proficient construction professionals demonstrate appropriate communication skills. The following accountability criteria are considered essential for students in all the Construction programs of study.

1. Describe the communication, listening and speaking processes and their relationship to job performance.
2. Describe good reading and writing skills and their relationship to job performance
3. Demonstrate telephone and e-communication skills necessary in the workplace.
4. Complete Performance Tasks.

MODULE H: BASIC EMPLOYABILITY SKILLS (SDE Requirement)

Proficient construction professionals demonstrate appropriate workplace behavior. The following accountability criteria are considered essential for students in all the Construction programs of study.

1. Describe the opportunities in the construction business and how an individual enters the construction workforce.
2. Explain the importance of critical thinking and how to solve problems in the workplace.
3. Explain the importance of social skills and identify ways good social skills are applied in the construction trade.
4. Describe computer systems and their industry applications.
5. Explain interpersonal relationship skills, self-presentation, and key workplace issues such as sexual harassment, stress, and substance abuse.

MODULE I: MATERIALS HANDLING (OPTIONAL)

Proficient construction professionals demonstrate appropriate skills handling materials. The following accountability criteria are considered essential for students in all the Construction programs of study.

1. Describe the hazards associated with handling materials and provides techniques to avoid both injury and property damage.

LEVEL 1 (240 HOURS)

B. INTRODUCTION TO THE PLUMBING PROFESSION

Proficient plumbing professionals demonstrate knowledge of the plumbing industry and its impact in society. The following accountability criteria are considered essential for students in the plumbing program of study.

1. Describe the history of the plumbing profession.
2. Identify the responsibilities of a person working in the construction industry.
3. State the personal characteristics of a professional.

4. Identify the stages of progress within the plumbing profession and its positive impact on society.

C. PLUMBING SAFETY

Proficient plumbing professionals demonstrate basic safety knowledge. The following accountability criteria are considered essential for students in the Plumbing program of study.

1. Describe the common unsafe acts and unsafe conditions that cause accidents.
2. Describe how to handle unsafe acts and unsafe conditions.
3. Explain how the cost of accidents and illnesses affects everyone on site.
4. Demonstrate the use and care of appropriate personal protective equipment.
5. Identify job-site hazardous work specific to plumbers.
6. Demonstrate the proper use of ladders.
7. Demonstrate how to maintain hand and power tools safely.
8. Explain how to work safely in and around a trench.
9. Describe and demonstrate the lockout/tagout process.

D. PLUMBING TOOLS

Proficient plumbing professionals demonstrate basic knowledge and use of various plumbing tools. The following accountability criteria are considered essential for students in the Plumbing program of study.

1. Identify the basic hand and power tools used in the plumbing trade.
2. Demonstrate the proper use of plumbing tools.
3. Demonstrate the ability to know when and how to select the proper tool(s) for various tasks.
5. Demonstrate the proper maintenance for caring for hand and power tools.
6. Demonstrate how to prepare a surface for tool use.

E. INTRODUCTION TO PLUMBING MATH

Proficient plumbing professionals demonstrate basic math skills. The following accountability criteria are considered essential for students in the Plumbing program of study.

1. Add, subtract, multiply, and divide whole numbers.
2. Add, subtract, multiply, and divide fractions.
3. Add, subtract, multiply, and divide decimals.
4. Convert decimals to percentages and percentages to decimals.
5. Convert fractions to decimals and decimals to fractions.
6. Explain what the metric system is and how it is important in the plumbing trade.
7. Square various numbers and take square roots of numbers, with and without a calculator.
8. Identify the parts of a fitting and use common pipe-measuring techniques.
9. Use fitting dimension tables to determine fitting allowances and thread make-up.
10. Calculate end-to-end measurements using fitting allowances and thread makeup.

F. INTRODUCTION TO PLUMBING DRAWINGS

Proficient plumbing professionals demonstrate knowledge and use of plumbing drawings. The following accountability criteria are considered essential for students in the Plumbing program of study.

1. Identify pictorial (isometric and oblique), schematic, and orthographic drawings, and discuss how different views are used to depict information about objects.
2. Identify the basic symbols used in schematic drawings of pipe assemblies.
3. Explain the types of drawings that may be included in a set of plumbing drawings and the relationship among the different drawings.
4. Interpret plumbing-related information from a set of plumbing drawings.
5. Sketch orthographic and schematic drawings.
6. Use an architect's scale to draw lines to scale and to measure lines drawn to scale.
7. Discuss how code requirements apply to certain drawings.

G. PLASTIC PIPE AND FITTINGS

Proficient plumbing professionals demonstrate knowledge and use of various plastic pipe and fittings. The following accountability criteria are considered essential for students in the Plumbing program of study.

1. Identify types of materials and schedules of plastic piping.
2. Identify proper and improper applications of plastic piping.
3. Identify types of fittings and valves used with plastic piping.
4. Identify and determine the kinds of hangers and supports needed for plastic piping.
5. Identify the various techniques used in hanging and supporting plastic piping.
6. Properly measure, cut, and join plastic piping.
7. Explain proper procedures for the handling, storage, and protection of plastic pipes.

H. COPPER PIPE AND FITTINGS

Proficient plumbing professionals demonstrate knowledge and use of various copper pipe and fittings. The following accountability criteria are considered essential for students in the Plumbing program of study.

1. Identify the types of materials and schedules used with copper piping.
2. Identify the material properties, storage, and handling requirements of copper piping.
3. Identify the types of fittings and valves used with copper piping.
4. Identify the techniques used in hanging and supporting copper piping.
5. Properly measure, ream, cut, and join copper piping.
6. Identify the hazards and safety precautions associated with copper piping.

I. CAST-IRON PIPE AND FITTINGS

Proficient plumbing professionals demonstrate knowledge and use of various cast-iron pipe and fittings. The following accountability criteria are considered essential for students in the Plumbing program of study.

1. Recognize proper and improper applications of cast-iron piping.
2. Identify the material properties, storage, and handling requirements of carbon steel piping.
3. Identify the types of materials and schedules used in cast-iron piping.
4. Identify the types of fittings used with cast-iron piping.
5. Identify the various techniques used in handling and supporting cast-iron piping.
6. Properly measure, cut, and join cast-iron piping.
7. Identify the hazards and safety precautions associated with cast-iron piping.

J. CARBON STEEL PIPE AND FITTINGS

Proficient plumbing professionals demonstrate knowledge and use of various carbon steel pipe and fittings. The following accountability criteria are considered essential for students in the Plumbing program of study.

1. Recognize proper applications of carbon steel piping.
2. Identify the material properties, storage, and handling requirements of carbon steel piping.
3. Identify the various techniques used in hanging and supporting carbon steel piping.
4. Properly measure, cut, groove, thread, and join carbon steel piping.
5. Identify the hazards and safety precautions associated with carbon steel piping.

K. CORRUGATED STAINLESS STEEL TUBING

Proficient plumbing professionals demonstrate knowledge and use of corrugated steel tubing. The following accountability criteria are considered essential for students in the Plumbing program of study.

1. Identify the common manufacturers of corrugated stainless-steel tubing.
2. Recognize proper and improper applications of corrugated stainless-steel tubing.
3. Identify the various techniques used in hanging and supporting corrugated stainless-steel tubing.
4. Properly measure, cut, join, and groove corrugated stainless steel tubing.
5. Identify the material properties, storage, and handling requirements of corrugated stainless-steel tubing.
6. Identify the hazards and safety precautions associated with corrugated stainless steel tubing.

L. CORROSIVE-RESISTANT WASTE PIPING

Proficient plumbing professionals demonstrate knowledge and appropriate installation of corrosive-resistant waste piping. The following accountability criteria are considered essential for students in the Plumbing program of study.

1. Discuss corrosive wastes and explain where they are found.
2. Discuss common types of materials used for corrosive-resistant waste piping.
3. Explain the methods of joining corrosive-resistant waste piping.
4. Properly measure, cut, join, and groove corrugated stainless steel tubing.

M. FIXTURES AND FAUCETS

Proficient plumbing professionals demonstrate knowledge and use of various fixtures and faucets. The following accountability criteria are considered essential for students in the Plumbing program of study.

1. Identify the basic types of materials used in the manufacture of plumbing fixtures.
2. Discuss common types of sinks, lavatories, and faucets.
3. Identify and discuss common types of bathtubs, bath-shower modules, shower stalls, and shower baths.
4. Discuss common types of toilets, urinals, and bidets.
5. Identify and describe common types of drinking fountains and water coolers.
6. Discuss common types of garbage disposals and domestic dishwashers.

N. INTRODUCTION TO DRAIN, WASTE, AND VENT (DWV) SYSTEMS

Proficient plumbing professionals demonstrate knowledge of various drain, waste, and vent systems. The following accountability criteria are considered essential for students in the Plumbing program of study.

1. Explain how waste moves from a fixture through the drain system to the environment.
2. Identify the major components of a drainage system and describe their functions.
3. Identify the different types of traps and their components, explain the importance of traps, and identify the ways that traps can lose their seals.
4. Identify the various types of drain, waste, and vent (DWV) fittings and describe their applications.
5. Identify significant code and health issues, violations, and consequences related to DWV systems.

O. INTRODUCTION TO WATER DISTRIBUTION SYSTEMS

Proficient plumbing professionals demonstrate knowledge and use of various water distribution systems. The following accountability criteria are considered essential for students in the Plumbing program of study.

1. Describe the process by which water is distributed in municipal, residential, and private water systems.
2. Identify the major components of a water distribution system, and describe the function of each component.
3. Explain the relationships between components of a water distribution system.

P. SIZING WATER SUPPLY PIPING

Proficient plumbing professionals demonstrate knowledge and appropriate installation methods of water supply systems. The following accountability criteria are considered essential for students in the Plumbing program of study.

1. Calculate pressure drops in a water supply system.
2. Size pipe for different flow rates.
3. Explain the difference between and advantages of a continuous-flow system and an intermittent-flow system.
4. Identify fixtures with high flow rates.
5. Explain the proper viscosity of liquids used in water supply installation.
6. Lay out a water supply system.
7. Calculate developed lengths of branches for a given water supply system.
8. Calculate flow rates for high flow rate fixtures.

Safety, Student Organizations, Technology Knowledge, Personal Qualities and Employability Skills, and Professional Knowledge are to be embedded in Standards A-P.

SAFETY

Professionals know the academic subject matter, including. They will use this knowledge. The following accountability criteria are considered essential for students in any program of study.

1. Review school safety policies and procedures.
2. Review classroom safety rules and procedures.
3. Review safety procedures for using equipment in the classroom.
4. Identify major causes of work-related accidents in office environments.
5. Demonstrate safety skills in an office/work environment.

STUDENT ORGANIZATIONS

Professionals know the academic subject matter, including professional development. The following accountability criteria are considered essential for students in any program of study.

1. Identify the purpose and goals of a Career and Technology Student Organization (CTSO).
2. Explain how CTSOs are integral parts of specific clusters, majors, and/or courses.
3. Explain the benefits and responsibilities of being a member of a CTSO.
4. List leadership opportunities that are available to students through participation in CTSO conferences, competitions, community service, philanthropy, and other activities.
5. Explain how participation in CTSOs can promote lifelong benefits in other professional and civic organizations.

TECHNOLOGY KNOWLEDGE

Professionals know the academic subject matter, including the ethical use of technology. The following accountability criteria are considered essential for students in any program of study.

1. Demonstrate proficiency and skills associated with the use of technologies that are common to a specific occupation.
2. Identify proper netiquette when using e-mail, social media, and other technologies for communication purposes.
3. Identify potential abuse and unethical uses of laptops, tablets, computers, and/or networks.
4. Explain the consequences of social, illegal, and unethical uses of technology (e.g., piracy; illegal downloading; cyberbullying; licensing infringement; inappropriate uses of software, hardware, and mobile devices in the work environment).
5. Discuss legal issues and the terms of use related to copyright laws, Creative Commons, fair use laws, and ethics pertaining to downloading of images, photographs, Creative Commons, documents, video, sounds, music, trademarks, and other elements for personal use.
6. Describe ethical and legal practices of safeguarding the confidentiality of business-related information.
7. Describe possible threats to a laptop, tablet, computer, and/or network and methods of avoiding attacks.

PERSONAL QUALITIES AND EMPLOYABILITY SKILLS

Professionals know the academic subject matter, including positive work practices and interpersonal skills. The following accountability criteria are considered essential for students in any program of study.

1. Demonstrate creativity and innovation.
2. Demonstrate critical thinking and problem-solving skills.
3. Demonstrate initiative and self-direction.
4. Demonstrate integrity.
5. Demonstrate work ethic.

6. Demonstrate conflict resolution skills.
7. Demonstrate listening and speaking skills.
8. Demonstrate respect for diversity.
9. Demonstrate customer service orientation.
10. Demonstrate teamwork.

PROFESSIONAL KNOWLEDGE

Proficient professionals know the academic subject matter, including positive work practices and interpersonal skills. The following accountability criteria are considered essential for students in any program of study.

1. Demonstrate global or “big picture” thinking.
2. Demonstrate career and life management skills and goal-making.
3. Demonstrate continuous learning and adaptability skills to changing job requirements.
4. Demonstrate time and resource management skills.
5. Demonstrates information literacy skills.
6. Demonstrates information security skills.
7. Demonstrates information technology skills.
8. Demonstrates knowledge and use of job-specific tools and technologies.
9. Demonstrate job-specific mathematics skills.
10. Demonstrates professionalism in the workplace.
11. Demonstrates reading and writing skills.
12. Demonstrates workplace safety.

Course Academic Alignment is found in the Instruction Hub.