Florida CTE

Architecture and Construction (2021): Building Trades and Construction Design Technology

Adopted 2021

Building Trades and Construction Design Technology (C100100)

Building Construction Assistant - Course Number: BCV 0080

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0. Demonstrate safety practices and follow disaster plans--The student will be able to: 01.0
    01. Observe and comply with all applicable company and organizational safety policies and Occupational Safety and Health Administration (OSHA) rules and regulations. 01.01
    02. Be able to demonstrate the purpose of Safety Data Sheets (SDS), formerly known as Material Safety Data Sheets (MSDS), and follow the procedures as necessary. 01.02
    03. Identify health-related problems that may result from exposure to work-related chemicals and hazardous materials, and demonstrate knowledge of the proper precautions required for handling such materials. (Refer to Safety Data Sheets.) 01.03
    04. Discuss, analyze and discuss the "Right-to-Know" law, such as with chemical or health hazards, as recorded in (29 CFR-1910.1200). 01.04
    05. Identify and demonstrate the use of safety equipment such as fall arrest systems, fire extinguishers, scaffolds and ladders. 01.05
    06. Identify and interpret follow disaster plans. 01.06
    07. Describe and demonstrate appropriate safety attitudes and behaviors in the shop and on the job in construction industry. 01.07
    08. Describe and demonstrate the appropriate safe use and maintenance of portable and stationary power equipment in the shop and on the job in the construction industry. 01.08
    09. Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments. 01.09
    10. Explain and demonstrate emergency procedures to follow in response to workplace accidents. 01.10
    11. Create a disaster and/or emergency response plan for a specific instance (earthquake, hurricane, tornado, etc.). 01.11
0. Identify and use basic hand tools--The student will be able to: 02.0
    01. Select and utilize appropriate hand tools typically used in the construction industry for specific tasks in accordance with safety guidelines and standard practice. 02.01
0. Identify power tools and describe their proper operation--The student will be able to: 03.0
    01. Select and utilize appropriate power tools and equipment for specific tasks in accordance with safety guidelines. 03.01

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0. Discuss, identify, classify and present construction components, materials, hardware and characteristics--The student will be able to: 04.0
    01. Discuss, identify and present the various components, materials and hardware used in residential construction applications. 04.01
    02. Discuss, identify and present the various components, materials and hardware used in commercial construction applications. 04.02
    03. Discuss, identify and present the various components, materials and hardware used in industrial construction applications. 04.03
    04. Discuss and present preplanning and procedural steps to accomplish various projects large and small both in the lab and on the job site with attention to building codes, standard practice and acceptable techniques. 04.04
0. Demonstrate an understanding of the construction industry and related occupations--The student will be able to: 05.0
    01. Identify and distinguish construction trade occupations and the roles and responsibilities of each craft. 05.01
    02. Identify and distinguish construction project management occupations and the roles and responsibilities of each. 05.02
    03. Identify and differentiate design and engineering occupations and the roles and responsibilities of each. 05.03
    04. Assess and discuss the relationship between the Department of Labor and the construction industry, economy and opportunity for employment. 05.04

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0. Explain the importance of employability and entrepreneurship skills--The students will be able to: 06.0
    01. Identify and demonstrate positive work behaviors needed to be employable. 06.01
    02. Develop personal career plan that includes goals, objectives and strategies. 06.02
    03. Examine and explain licensing, certification and industry credentialing requirements. 06.03
    04. Maintain a career portfolio to document knowledge, skills and experience. 06.04
    05. Evaluate and compare employment opportunities that match career goals. 06.05
    06. Identify and exhibit traits for retaining employment. 06.06
    07. Identify opportunities and research requirements for career advancement. 06.07
    08. Explain and practice the benefits and necessity of ongoing professional development. 06.08
    09. Examine and describe entrepreneurship and leadership opportunities as a career planning option. 06.09
    10. Conduct a job search and analyze the requirements of the job. 06.10
    11. Understand the consequences of poor decision making. 06.11
    12. Assess the importance of confidentiality in the workplace. 06.12
    13. Determine healthy living habits in relation to work. 06.13

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0. Demonstrate or discuss rough and finish carpentry skills--The student will be able to: 07.0
    01. Discuss the carpentry trade and explain the duties of a carpenter. 07.01
    02. Identify and use building materials, fasteners and adhesives. 07.02
    03. Use and maintain hand and power tools. 07.03
    04. Read and interpret approved plans and specifications for residential and commercial drawings. 07.04
    05. Apply linear and distance measurements, leveling, plumbing and squaring techniques. 07.05
    06. Analyze a survey and develop site layout. 07.06
    07. Construct and remove concrete forms, handle and place concrete, reinforcing materials and finish concrete. 07.07
    08. Understand the potential hazards involved in handling concrete and proper protective measures and PPE. 07.08
    09. Calculate, layout construct and install floor, wall, ceiling and roof framing. 07.09
    10. Calculate, layout and construct and install basic stair layout. 07.10
    11. Understand building science of thermal and moisture protection and mitigating measures. 07.11
    12. Calculate and install roofing applications. 07.12
    13. Install windows and interior /exterior doors and door hardware. 07.13
    14. Calculate, construct and install exterior finishing. 07.14
    15. Install drywall and apply finishing techniques. 07.15
    16. Install cabinets and built-in fabrications. 07.16
    17. Calculate and install window, door, floor and ceiling trim. 07.17
    18. Calculate, layout and construct metal stud framing. 07.18
    19. Calculate, layout and install suspended ceilings. 07.19

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0. Demonstrate or discuss masonry skills--The student will be able to: 08.0
    01. Describe and discuss orientations to the masonry trade. 08.01
    02. Identify and select basic masonry tools and equipment. 08.02
    03. Use, maintain and store masonry hand tools, power tools and equipment safely and in proper working order. 08.03
    04. Read and interpret measurements, drawings and specifications for masonry building projects. 08.04
    05. Demonstrate safe and proper procedures for set up/tear down and maintaining masonry work sites and projects. 08.05
    06. Utilize the tools and equipment used for mixing mortar. 08.06
    07. Analyze the factors that affect the consistency of mortar. 08.07
    08. Determine masonry ratios, their strengths and applications of mortar mixtures M, S, N, O and K. 08.08
    09. Mix various types of mortar, considering application and or discuss (PSI) strength. 08.09
    10. Lay out square corners using the 3-4-5 (or Pythagorean Theorem) and building instrument methods for masonry projects. 08.10
    11. Lay out and install dry bonds for masonry block corner leads projects. 08.11
    12. Lay out and build corner leads for masonry block projects. 08.12
    13. Identify and describe various masonry units and installation techniques. 08.13
    14. Implement the methods of putting up the line. 08.14
    15. Utilize pointing tools to strike mortar joints. 08.15
    16. Identify and use the various types of trowels. 08.16
    17. Mix and apply stucco to a project. 08.17
0. Demonstrate or discuss painting and decorating skills--The student will be able to: 09.0
    01. Identify, describe and use various painting tools and equipment. 09.01
    02. Properly erect an extension ladder, step ladder and a scaffold. 09.02
    03. Prepare surfaces for application of finishes. 09.03
    04. Identify and describe various painting and application techniques. 09.04
    05. Apply finishes to a project including primers, paints, stains varnishes, wall coverings and textures. 09.05
    06. Use appropriate techniques and materials for clean-up and tool and material storage. 09.06

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0. Demonstrate or discuss science knowledge and skills--The students will be able to: 10.0
    01. Explore new technology as it applies to the construction industry in terms of materials, processes and the need for continuing education. 10.01
    02. Investigate the use of communication technology and other resources to inspire design decisions. 10.02
0. Demonstrate mathematics knowledge and skills--The students will be able to: 11.0
    01. Solve job-related problems by adding, subtracting, multiplying and dividing numbers using fractions, decimals and whole numbers. 11.01
    02. Change fractions and decimals to percent. 11.02
    03. Solve job-related problems using a calculator, tape measure, or on paper, for basic computations. 11.03
    04. Read a ruler and a tape measure accurately. 11.04
    05. Compute yards, feet, inches and fractions of inches. 11.05
    06. Change hours and minutes to decimals, fractions and mixed numbers. 11.06
    07. Construct charts/tables/graphs using functions and data. 11.07
    08. Determine ratios and proportions. 11.08
    09. Solve problems for volume, weight, area, circumference and perimeter measurements for rectangles, squares and cylinders. 11.09
    10. Measure tolerance(s) on horizontal and vertical surfaces using metric (centimeters and millimeters) and english (feet, inches and fractions) units. 11.10
    11. Analyze and apply data and measurements to solve problems and interpret documents. 11.11
    12. Calculate man hours and labor costs for a specific job. 11.12
0. Explain all that the built environment encompasses--The student will be able to: 12.0
    01. Discuss the development of construction technology, its impact on the built environment and the impact of growth on the construction industry. 12.01
    02. Describe and give examples of the influences and benefits of the construction industry on health and safety, communication, transportation and the economy. 12.02
    03. Examine and compare the relationship between the built environment and the natural environment. 12.03
    04. Compare the relationship between architectural designs and/or models to understand aesthetic details. 12.04
    05. Analyze changes in architectural styles and construction practices over time relative to various environments. 12.05
    06. Discuss how technology has changed the design process throughout history. 12.06

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0. Demonstrate an understanding of the natural environment, built environment and green built environment--The student will be able to: 13.0
    01. Recognize and analyze the development of the built environment and its impacts on the natural environment such as pollution, deforestation, climate change, health and disease. 13.01
    02. Describe and give examples of how a green built environment creates growth for the construction industry, and the economy such as health and safety, transportation and natural resources. 13.02
    03. Examine and compare the relationship between a green built environment and the natural environment. 13.03
    04. Explain the purpose of the United States Green Building Council (USGBC), the Green Building Certification Institute (GBCI) and Leadership for Energy and Environmental Design (LEED) are and how they create growth for the construction industry and the economy. 13.04
    05. Discuss sustainable building design and its relationship between health, energy efficiency and money savings for government, businesses and individuals. 13.05
    06. Discuss the effects of building science on construction and energy efficiency. 13.06
    07. Discuss renewable fuels and energy. 13.07

Carpentry and Masonry Technician – Course Number: BCV 0081

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0. Research laws applicable to the construction industry--The student will be able to: 14.0
    01. Discuss and analyze the governmental law process at the federal, state and local level and its impact on the construction industry and construction education. 14.01
    02. Identify and analyze the Codes of Federal Regulations (CFR) pertaining to the construction industry. 14.02
    03. Analyze the Florida State Statues pertaining to the construction industry. 14.03
    04. Compare and contrast trade union and trade non-union workers in terms of their effect and influence on health and safety, communication, transportation and the economy. 14.04
    05. Compare and contrast employment and training with union and non-union entities in the construction industry. 14.05
    06. Examine the role of apprenticeship in the construction industry and its impact on education. 14.06
    07. Research and assess the Florida Department of Business and Professional Regulation. 14.07
    08. Research and assess the Construction Industry Licensing Board, its structure, polices and requirements. 14.08
    09. Research various construction occupations and explain the requirements for becoming licensed. 14.09
    10. Compare and contrast the roles and responsibilities of the engineers, architects/ designers and the general contractor. 14.10
    11. Compare and contrast the roles and responsibilities of the general contractor, subcontractors, specialty contractors and employees of contractors. 14.11
    12. Identify and differentiate the roles and responsibilities of building construction firms and classifications of construction projects. 14.12
    13. Understand the process of establishing a business in the construction industry. 14.13
    14. Assess the relationship between the Department of Labor and new construction projects, new permits and new business start-ups. 14.14
    15. Understand zoning and assess the need for and impact of zoning requirements on construction projects. 14.15
    16. Examine and analyze the process of applying for building permits and variances. 14.16

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0. Develop a basic understanding of construction contracts, drawings, documents and specifications and how they apply to the construction process--The student will be able to: 15.0
    01. Explain the purpose and components of contracts, drawings, documents and specifications and explain their relation to building permits. 15.01
    02. Analyze the importance of building codes and zoning regulations on the development of drawings and specifications. 15.02
    03. Identify and interpret the analogy of a full set of drawings including architectural (site plans, foundation plans, floor plans, interior/exterior elevations, sections, details, schedules, etc.), structural, plumbing, mechanical and electrical drawings. 15.03
    04. Utilize building symbols, drawing lines, abbreviations and scale in the development of blueprints. 15.04
    05. Prepare lists of materials and specifications. 15.05
    06. Use architectural and engineering scales. 15.06
    07. Demonstrate or discuss the basic use of computer-aided design software. 15.07
    08. Demonstrate or discuss the use of Computer-Aided Drafting (CAD) software to prepare project drawings. 15.08
    09. Write specifications for a project. 15.09
    10. Prepare construction documents for a project. 15.10

Electrical and Plumbing Technician – Course Number: BCV 0082

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0. Demonstrate or discuss electrical rough in skills--The student will be able to: 16.0
    01. Identify and apply electrical safety practices and procedures when working with electrical systems. (Refer to NFPA70E standards.) 16.01
    02. Explain grounding, its purpose and relation to electrical safety. 16.02
    03. Explain and describe various phases of electrical generation and the transportation and distribution of electricity to sub stations for industrial, business and residential uses (under 480 volts). 16.03
    04. Design and calculate electrical loads using ohms law to determine power, American wire gauge (AWG) and electrical equipment sizes. 16.04
    05. Apply basic electrical theory to wiring a project. 16.05
    06. Wire an air-conditioning system, heat exchanger, heat pump or electric water heater into an electrical supply and properly size wire and overcurrent protection. 16.06
    07. Design and install a branch circuit system in a project. 16.07
    08. Discuss and/or install Ground Fault Circuit Interrupter (GFCI) circuitry. 16.08
    09. Troubleshoot electrical systems, using testing and metering devices. 16.09
    10. Install a meter, distribution panel and breaker panel for a project. 16.10
    11. Identify types of wiring raceways (EMT / IMC / PVC / MC Cable / Romex / SE Cable / UF Cable). 16.11
    12. Install conduit, pipe, shielded electrical cable and electrical boxes in a project. 16.12
0. Demonstrate or discuss finish electrical skills--The student will be able to: 17.0
    01. Install electrical components relating to residential & commercial applications. 17.01
    02. Troubleshoot and inspect electrical systems. 17.02
0. Demonstrate or discuss plumbing rough in skills--The student will be able to: 18.0
    01. Identify, select and install various pipes, tubing, fittings and connectors used in the plumbing trade for a specific project. 18.01
    02. Lay out and install a water distribution (supply) system for a project. 18.02
    03. Lay out and install a Drain, Waste and Vent (DWV) system for a project. 18.03
    04. Test and inspect plumbing systems. 18.04
    05. Discuss the design and layout of a domestic solar hot water system. 18.05
0. Demonstrate or discuss finish plumbing skills--The student will be able to: 19.0
    01. Install bathroom fixtures and hardware such as lavatories, water closets, urinals, showers, bathtubs and traps. 19.01
    02. Install kitchen fixtures and hardware such as sinks, garbage disposals, faucets, dishwasher, icemaker and hot water heater tanks. 19.02

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0. Demonstrate Heating, Ventilation and Air Conditioning (HVAC) rough in skills--The student will be able to: 20.0
    01. Explain heating and cooling principles and code requirements. 20.01
    02. Perform basic calculations for heating and cooling loads. 20.02
    03. Develop an understanding of building envelope, insulation and ventilation. 20.03
    04. Select and discuss or install the components of an air conditioning system for a project including ductwork, coolant lines, compressor packages and coil packages. 20.04
    05. Identify and select refrigerants according to their properties. 20.05
0. Demonstrate finish HVAC skills--The student will be able to: 21.0
    01. Determine a refrigerant level. 21.01
    02. Install a control system for a project. 21.02
    03. Install registers for a project. 21.03
    04. Examine computer-monitoring systems associated with HVAC control systems and air-quality management. 21.04

Building Maintenance Technician – Course Number: BCV 0083

0. Design a capstone project using skills learned throughout the program--The student will be able to: 22.0
    01. Solve design and construction problems to gain new perspectives. 22.01
    02. Apply critical-thinking and problem solving skills used in design to develop solutions for real-life issues. 22.02
    03. Use and maintain tools and equipment used in the construction process. 22.03
    04. Work in a project team to develop cohesiveness, team building, respectful compromise and time-management skills 22.04
    05. Apply carpentry skills. 22.05
    06. Apply masonry skills. 22.06
    07. Apply Mechanical, Electrical and Plumbing (MEP) skills. 22.07
    08. Apply construction industry safety. 22.08
    09. Apply sustainable construction practices. 22.09
    10. Apply learned and acquired skills to address construction industry standards, methods and techniques. 22.10

Carpentry (C510300) **Introduction to Carpentry – Course Number: BCV0112**

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0. Apply shop and construction site safety skills--The student will be able to: I.01.0
    01. Maintain a clean, orderly and safe work area. I.01.01
    02. Transport, handle and store materials safely. I.01.02
    03. Operate a fire extinguisher. I.01.03
    04. Qualify in basic first-aid procedures and optionally, obtain CPR/FA/AED 2 year certification. I.01.04
    05. Know how to identify and report safety hazards and optionally, be able to fill out and report a sample Accident Report to the supervisor. I.01.05
    06. Demonstrate the inspection, proper use, inspection and care of personal protective equipment (PPE). I.01.06
    07. Describe "Right-to-Know" Law as recorded in (29 CFR-1910.1200). I.01.07
    08. Explain the purpose of the Occupational Safety and Health Administration (OSHA) and obtain an OSHA-10 Safety Certification. I.01.08
    09. Use Safety Data Sheets (SDS) to recognize health-related problems that may result from exposure to hazardous materials and chemicals. I.01.09
    10. Describe the proper procedures for handling hazardous materials. I.01.10
    11. Explain the importance of complying with the Americans with Disabilities Act (ADA) requirements. I.01.11
0. Select, use and maintain hand tools, power tools and stationary equipment--The student will be able to: I.02.0
    01. Read and demonstrate proficiency with carpenter's measuring tools. I.02.01
    02. Identify, select and safely use various hand tools. I.02.02
    03. Identify, select and safely use hand held power tools and stationary equipment. I.02.03
    04. Properly maintain hand tools, power tools and stationary equipment and learn about the maintenance of them. I.02.04
0. Apply mathematics knowledge to assist in constructing buildings, structures, and various construction and woodworking related projects--The student will be able to: I.03.0
    01. Apply geometry and algebra to solve construction related math problems. I.03.01
    02. Use arithmetic to assist in constructing buildings, structures and woodworking projects. I.03.02
    03. Use mathematics to solve distance, elevation, perimeter, area and volume problems. I.03.03

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0. Read, understand and create basic construction and shop drawings and/or sketches--The student will be able to: I.04.0
    01. Identify basic construction and shop drawings, drawing terms, components and symbols. I.04.01
    02. Interpret and apply information found on construction drawings and in specifications to assist in construction and woodworking projects. I.04.02
    03. Recognize the different types of construction drawings. I.04.03
    04. Use an architectural scale to determine and verify construction drawing dimensions. I.04.04
    05. Identify, describe and state the purpose of the parts of written specifications. I.04.05
    06. Conduct quantity takeoffs for estimating materials. I.04.06
    07. Interpret and understand scopes of work for construction guidelines. I.04.07
    08. Draw and/or sketch basic floor plans and/or shop drawings and elevations. I.04.08
0. Select and recommend appropriate building materials for building and woodworking projects--The student will be able to: I.05.0
    01. Identify the grades and species of lumber and their appropriate uses. I.05.01
    02. Identify the actual and nominal sizes of lumber. I.05.02
    03. Identify the grades of plywood and wood products and their uses. I.05.03
    04. Identify defects and blemishes that affect the durability, strength and use of lumber. I.05.04
    05. Determine how to locate and mark crowned, bowed or cupped framing lumber and how to cull it for use. I.05.05
    06. Explain the effects of temperature differences, chemical reaction and moisture content on building materials. I.05.06
    07. Explain and identity the uses of various types of engineered lumber. I.05.07
0. Select and use appropriate fasteners and hardware for specific construction and woodworking applications--The student will be able to: I.06.0
    01. Identify and use fasteners and their appropriate applications commonly used in carpentry and/or cabinetmaking. I.06.01
    02. Identify and use hardware and their appropriate applications commonly used in carpentry and/or cabinetmaking. I.06.02

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0. Set up and install basic rigging and scaffolding--The student will be able to: I.07.0
    01. Identify and use rigging equipment. I.07.01
    02. Inspect rigging equipment, following safety precautions. I.07.02
    03. Estimate size, weight and center of the load. I.07.03
    04. Use rigging methods to safely move materials and equipment. I.07.04
    05. Correctly and safely assemble, inspect and disassemble scaffolding. I.07.05
    06. Inspect and safely use various types of ladders and scaffolding. I.07.06
0. Identify ways that sustainable design and construction strategies impact the built environment (Optional)--The student will be able to: I.08.0
    01. Describe how sustainability practices impact the construction industry on the natural environment. I.08.01
    02. Describe the life cycle phases of a building and its impacts on the environment throughout the life of the building. I.08.02
    03. Recommend sustainable alternative carpentry practices as opposed to conventional carpentry practices. I.08.03
    04. Identify specific practices that can lessen adverse impacts on the environment. I.08.04
0. Explain the importance of employability and entrepreneurship skills (Optional)--The student will be able to: I.09.0
    01. Identify and demonstrate positive work behaviors needed to be employable. I.09.01
    02. Develop personal career plan that includes goals, objectives and strategies. I.09.02
    03. Examine licensing, certification and industry credentialing requirements. I.09.03
    04. Maintain an updated resume and a portfolio to document work knowledge, skills and experience. I.09.04
    05. Evaluate and compare employment opportunities that match career path goals. I.09.05
    06. Identify and exhibit traits for retaining employment. I.09.06
    07. Identify opportunities and research requirements for career advancement. I.09.07
    08. Research the benefits of ongoing professional development and education. I.09.08
    09. Examine and describe entrepreneurship opportunities as a career planning option. I.09.09

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0. Perform site-preparation and building layout activities--The student will be able to: I.10.0
    01. Identify building layout dimensions and elevations from plans and specifications using math skills. I.10.01
    02. Use a transit, a builder's level and laser level. I.10.02
    03. Erect batter boards and locate building lines. I.10.03
    04. Locate building line points on batter boards using a builder's level and measuring instruments. I.10.04
    05. Locate building lines on a site plan. I.10.05
    06. Square a building, using the 3-4-5-triangle method and the diagonal (Pythagorean Theorem) method. I.10.06
0. Understand how to layout and/or construct a building foundation--The student will be able to: I.11.0
    01. Establish building and final grade elevations. I.11.01
    02. Identify various types of footings and foundations. I.11.02
    03. Identify various footing requirements used to support different types of foundations. I.11.03
    04. Identify and select appropriate footing and foundation construction details for a specified building plan. I.11.04
    05. Install flashing, foundation anchors and connectors, and termite shields. I.11.05
    06. Understand and/or apply proper moisture management details for foundations, if required. I.11.06
    07. Layout and construct a building foundation. (Optional) I.11.07
0. Layout, cut and install framing members for a floor system (wood and/or metal)--The student will be able to: I.12.0
    01. Identify floor framing members including the subfloor. I.12.01
    02. Identify structural support components for floor framing systems (e.g. sill plates, columns, girder beams, etc.). I.12.02
    03. Identify various floor joist types, sizes and openings, including joists for a cantilevered floor. I.12.03
    04. Identify various types of bridging. I.12.04
    05. Identify various subfloor materials and fastening techniques. I.12.05
    06. Layout, cut and install framing members for a floor system. I.12.06

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0. Layout, cut and install a wall framing system (wood and/or metal)--The student will be able to: I.13.0
    01. Identify framing members used in wall and partition construction. I.13.01
    02. Lay out wall lines and partition locations on a floor. I.13.02
    03. Lay out walls for studs, doors and windows. I.13.03
    04. Identify studs, trimmers, cripples, headers, fire stops and other framing components. I.13.04
    05. Layout, cut and build up wall partition intersecting T's, corners and headers. I.13.05
    06. Identify various wall sheathing and/or diagonal bracing systems used in exterior walls. I.13.06
    07. Identify and describe various insulation materials, moisture and air barrier materials and systems. I.13.07
    08. Cut and install framing members for a wall system. I.13.08
0. Comply with current hurricane building codes--the student will be able to: I.14.0
    01. Install hurricane anchors and connectors using approved fasteners. I.14.01
    02. Install hurricane clips using approved fasteners. I.14.02
    03. Explain the purpose and importance of the codes relating to hurricanes. I.14.03
    04. Identify and/or construct braced and structural panel shear wall assemblies. I.14.04
0. Layout, cut and install a wood frame roof system--The student will be able to: I.15.0
    01. Understand the terms associated with roof framing. I.15.01
    02. Identify roof framing members used to construct various roofing types. I.15.02
    03. Calculate the lengths of rafters for various locations. I.15.03
    04. Identify the various types of trusses used in roof framing. I.15.04
    05. Use a rafter framing square, speed square and calculator to lay out a roof system. I.15.05
    06. Identify various types of sheathing used in roof construction. I.15.06
    07. Layout, cut and frame various roof types using conventional framing methods. I.15.07
    08. Understand various truss types and components, and how to correctly install them. I.15.08
    09. Estimate materials needed to frame and sheath a roof. I.15.09

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0. Frame walls using cold-formed steel (Optional)--The student will be able to: I.16.0
    01. Identify the components of a steel framing wall system. I.16.01
    02. Identify and select the tools and fasteners used in a steel framing wall system. I.16.02
    03. Identify applications for steel framing wall systems. I.16.03
    04. Demonstrate the ability to build other cold-formed steel wall framing components. I.16.04
    05. Lay out and install a steel stud structural and/or non-structural wall with openings to include bracing and blocking. I.16.05
0. Lay out, cut and rough frame a stair system--The student will be able to: I.17.0
    01. Identify various types of stair systems. I.17.01
    02. Identify the components of stair systems. I.17.02
    03. Calculate the size and number of treads and risers for a stair system. I.17.03
    04. Lay out, cut and assemble a stair system. I.17.04
0. Identify, select and install various roofing materials for building structures--The student will be able to: I.18.0
    01. Identify the materials and methods used in roofing. I.18.01
    02. Explain the safety requirements for roofing installation jobs. I.18.02
    03. Install fiberglass/asphalt shingles on various roof types. I.18.03
    04. Install roofing materials correctly in a roof valley. I.18.04
    05. Explain how to make various roof projections watertight when using fiberglass/asphalt shingles. I.18.05
    06. Properly cut and install hip and ridge caps using fiberglass/asphalt shingles. I.18.06
    07. Lay out, cut and install a cricket or saddle. I.18.07
    08. Identify and discuss techniques for installing various types of roofing systems. I.18.08
0. Identify and apply appropriate thermal boundary, moisture protection and water management systems--The student will be able to: I.19.0
    01. Identify, select and install various types of insulation material and moister/air barriers. I.19.01
    02. Calculate the required amounts of insulation and moisture/air barriers for a structure. I.19.02
    03. Identify, select, and install materials to provide an effective water management system for a structure. I.19.03
    04. Identify, discuss and/or install moisture, air, and vapor barriers. I.19.04
    05. Describe air infiltration and exfiltration control requirements. I.19.05

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0. Install windows and exterior doors--The student will be able to: I.20.0
    01. Identify various types of fixed, sliding and swinging windows including sliding, patio and French doors. I.20.01
    02. Identify various materials and techniques used to install a window. I.20.02
    03. Identify the requirements for a proper window installation. I.20.03
    04. Install a pre-hung window in accordance with manufacturer's installation instructions. I.20.04
    05. Identify the common types of exterior doors and explain how they are constructed. I.20.05
    06. Identify various materials and techniques used to install a door. I.20.06
    07. Identify the types of thresholds and door frames used with exterior doors. I.20.07
    08. Install a pre-hung exterior door. I.20.08
    09. Identify the various types of locksets used on exterior doors and explain how they are installed. I.20.09
    10. Discuss and/or install various types of locksets. I.20.10

Finish Trim Carpentry – Course Number: BCV0125

0. Install gypsum drywall--The student will be able to: I.21.0
    01. Identify the different types of drywall and their uses. I.21.01
    02. Select the type and thickness of drywall required for specific installations. I.21.02
    03. Select fasteners for drywall installation. I.21.03
    04. Perform single-layer and multi-layer drywall installations using different types of fastening systems including nails, drywall screws and adhesives. I.21.04
    05. Install drywall on wood or steel studs. I.21.05
    06. Estimate material quantities for a drywall installation. I.21.06
0. Identify and fasten wood stock and joints--The student will be able to: I.22.0
    01. Identify types of glues, fasteners and clamps and describe their applications. I.22.01
    02. Fasten stock with glue and various types of clamps. I.22.02
    03. Fasten stock and joints with appropriate fasteners such as nails, staples, screws and bolts. I.22.03
    04. Fill and finish nail and screw holes with fillers and plugs. I.22.04

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0. Install cabinets and components--The student will be able to: I.23.0
    01. Install hardware such as hinges, catches, pulls, knobs and guides on assembled cabinets. I.23.01
    02. Install fasteners. I.23.02
    03. Install drawers. I.23.03
    04. Install various types of doors including overlay, lipped and flush. I.23.04
    05. Install adjustable shelving. I.23.05
    06. Install glass panels and/or decorative metal grilles in cabinet doors. I.23.06
    07. Install specialty hardware such as wire racks and "pull-outs". I.23.07
    08. Install sliding doors and track. I.23.08
    09. Install pre-fabricated cabinets, countertops and other components. I.23.09
0. Identify, interpret and describe types of interior and exterior doors types, hardware and assembly component requirements, and installation techniques based on plans and specifications--The student will be able to: I.24.0
    01. Identify types and parts of door assemblies. I.24.01
    02. Identify various types of door jambs and frames and demonstrate the installation procedures for installing selected door jambs and frames in different types of interior and exterior partitions. I.24.02
    03. Identify different types of interior and exterior door hardware and demonstrate the installation procedures for selected types. I.24.03
    04. Identify different types of interior and exterior doors. I.24.04
    05. Read and interpret door schedules. I.24.05
    06. Install exterior and interior doors. I.24.06
0. Install interior trim and other finishes based on construction drawings, details and specifications--The student will be able to: I.25.0
    01. Produce a quantity take-off for interior trim and finish carpentry work. I.25.01
    02. Identify the different types of standard moldings and describe their uses. I.25.02
    03. Make square and miter cuts using a power miter saw. I.25.03
    04. Select and properly use fasteners to install trim. I.25.04
    05. Identify, select and install trim and other finish carpentry work for a project. I.25.05
    06. Identify, select and install various types of flooring. I.25.06

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0. Identify and install various types of interior wall and ceiling finish materials--The student will be able to: I.26.0
    01. Identify and install furring strips. I.26.01
    02. Identify and install drywall and other wall finish materials. I.26.02
    03. Identify and install finish paneling and related trim. I.26.03
    04. Identify and install various types of ceiling finish materials and systems. I.26.04
0. Layout, cut and finish a stair system--The student will be able to: I.27.0
    01. Identify the types and methods of finishing stair systems. I.27.01
    02. Identify the components of finishing a stair system. I.27.02
    03. Layout, cut and install the finish components of a stair system. I.27.03
0. Select and install exterior finishes--The student will be able to: I.28.0
    01. Select and install weather resistant barriers and flashing. I.28.01
    02. Install exterior fascia and soffit trim. I.28.02
    03. Produce a quantity takeoff for an exterior cladding system. I.28.03
    04. Identify and install various types of common wood exterior siding systems. I.28.04
    05. Install fiber-cement siding and trim. I.28.05
    06. Identify techniques for installing vinyl and metal siding. I.28.06
    07. Identify techniques for installing stucco and masonry exterior cladding systems. I.28.07
    08. Describe the types and applications of special exterior finish systems. I.28.08
    09. Install one or more types of exterior finishes commonly used in your area. I.28.09

Foundation and Form Carpentry – Course Number: BCV0123

0. Demonstrate building site layout to excavate for footings and foundations, and optionally, trenching for utilities--The student will be able to: F.29.0
    01. Identify the different types, bearing capacities and classifications of soils. F.29.01
    02. Identify ways to increase soil density. F.29.02
    03. Identify strategies and equipment needed to compact loose fill soil for building foundations. F.29.03
    04. Explain the safety considerations for digging trenches and deep excavations. F.29.04

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0. Erect, plumb and brace simple concrete forms with reinforcement--The student will be able to: F.30.0
    01. Identify the properties of cement. F.30.01
    02. Describe the composition of concrete. F.30.02
    03. Estimate volumes of concrete. F.30.03
    04. Identify types of concrete reinforcement materials and describe their uses. F.30.04
    05. Identify various types of footings and foundations. F.30.05
    06. Identify the parts of various types of concrete forms. F.30.06
    07. Explain the safety procedures associated with the construction and use of concrete forms. F.30.07
    08. Construct and brace a simple concrete form with reinforcement. F.30.08
0. Explain or identify various foundation forms--The student will be able to: F.31.0
    01. Identify types of foundations. F.31.01
    02. Explain the method for installing pier forms for a foundation. F.31.02
    03. Explain how to strip a form for reuse. F.31.03
    04. Explain edge forms for a floor with or without foundation walls and for a stoop. F.31.04
    05. Explain various types of curb and gutter forms. F.31.05
    06. Identify various types of form systems used to construct elevated concrete slabs, horizontal beams and vertical columns. F.31.06
    07. Discuss the different types and uses of flying forms for decks and shear walls. F.31.07
    08. Understand the consequences of concrete pressure on forms. F.31.08
    09. Identify form work components (e.g. snap ties, wedges, pigs feet, whalers, and stiff-backs, etc.). F.31.09

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0. Demonstrate an understanding of vertical concrete formwork--The student will be able to: F.32.0
    01. Explain safety procedures associated with using concrete wall forms. F.32.01
    02. Identify the differences in construction and uses of various types of vertical concrete wall forms. F.32.02
    03. Identify vertical form components. F.32.03
    04. Discuss how to, and/or plumb and brace vertical wall forms. F.32.04
    05. Recognize various types of manufactured forms. F.32.05
    06. Discuss how to, and/or plumb and brace a column form. F.32.06
    07. Discuss how to, and/or plumb and brace a stair form. F.32.07
    08. Identify and explain types of cranes. F.32.08
    09. Construct a small vertical form with reinforcement. (Optional) F.32.09
0. Demonstrate an understanding of constructing horizontal formwork--The student will be able to: F.33.0
    01. Identify the different classes of slabs on grade and flatwork. F.33.01
    02. Identify the safety hazards associated with elevated deck formwork. F.33.02
    03. Identify the different types of elevated decks. F.33.03
    04. Discuss the different types of flying or slip form systems. F.33.04
    05. Describe how to install, plumb, brace and level different types of handset deck form systems. F.33.05
    06. Describe the installation of edge forms, block outs, embedments and construction joints. F.33.06
    07. Identify control, expansion and construction joints. F.33.07
    08. Describe templates, keyways, bulkheads and embedments. F.33.08
    09. Describe the proper installation of vapor barriers under slabs on grade. F.33.09
    10. Establish finish grade and fill requirements. F.33.10

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0. Explain and demonstrate how to place reinforcing bars in walls, columns, beams, girders, joists and slabs--The student will be able to: F.34.0
    01. Describe the applications of reinforcing bars, the uses of reinforced structural concrete and the basic processes involved in placing reinforcing bars. F.34.01
    02. Recognize and identify the bar bends standardized by the American Concrete Institution (ACI). F.34.02
    03. Read and interpret bar lists and describe the information found on a bar list. F.34.03
    04. List the types of ties used in securing reinforcing bars. F.34.04
    05. Demonstrate the proper use of common ties for reinforcing bars. F.34.05
    06. Describe methods by which reinforcing bars may be cut and bent in the field. F.34.06
    07. Use the tools and equipment needed for installing reinforcing bars. F.34.07
    08. Safely use selected tools and equipment to cut, bend and install reinforcing materials. F.34.08
    09. Explain the necessity of concrete cover in placing reinforcing bars. F.34.09
    10. Identify lapped splices. F.34.10
    11. Install reinforcing bars in concrete wall, beam, girder and slab forms. F.34.11
0. Discuss the transport and placement of concrete--The student will be able to: F.35.0
    01. List various types of equipment used to transport and place concrete. F.35.01
    02. Describe the factors that contribute to the quality of concrete placement. F.35.02
    03. Explain the importance of control and expansion joints in slabs on grade. F.35.03
    04. Demonstrate the correct methods for placing and consolidating concrete into forms. F.35.04
    05. Use a screed to strike off and level concrete to the proper grade in a form. F.35.05
    06. Use tools for placing, floating and finishing concrete. F.35.06
    07. Explain when conditions permit the concrete finishing operation to start. F.35.07
    08. Name the factors that affect the curing of concrete and describe the methods used to achieve proper curing. F.35.08
    09. Care for and safely use hand and power tools used when working with concrete. F.35.09
    10. Place concrete in a horizontal form, screed, edge and trowel finish. F.35.10

0. Apply basic drafting skills--The student will be able to: D.01.0
    01. Use drafting equipment, measuring scales and drafting instruments. D.01.01
    02. Identify the various drafting media and techniques. D.01.02
    03. Use various freehand and other architectural lettering techniques including cursive and block. D.01.03
    04. Prepare title blocks and other drafting formats. D.01.04
    05. Demonstrate the use of the Alphabet of Lines. D.01.05
    06. Prepare axonometric, oblique and multi-view freehand sketches. D.01.06
    07. Prepare charts, graphs and diagrams. D.01.07
    08. Apply geometric construction techniques. D.01.08
0. Demonstrate algebra mathematics knowledge and skills related to drafting--The student will be able to: D.02.0
    01. Demonstrate knowledge of arithmetic operations. D.02.01
    02. Solve arithmetic problems. D.02.02
    03. Solve algebra problems. D.02.03
    04. Solve geometry problems. D.02.04
    05. Apply multiple discipline calculations. D.02.05
    06. Construct charts, tables and graphs using functions and data. D.02.06
0. Prepare multi-view drawings--The student will be able to: D.03.0
    01. Prepare multi-view scaled drawings. D.03.01
    02. Select proper drawing scale, views and layout. D.03.02
    03. Prepare drawings containing horizontal and vertical surfaces. D.03.03
    04. Prepare drawings containing circles and/or arcs. D.03.04
    05. Prepare drawings incorporating removed details and conventional breaks. D.03.05
0. Prepare sectional views--The student will be able to: D.04.0
    01. Prepare drawings containing full sections and half sections. D.04.01
    02. Prepare drawings containing offset sections. D.04.02
    03. Prepare drawings containing revolved sections. D.04.03
    04. Prepare drawings containing removed sections and broken-out sections. D.04.04
    05. Prepare a sectional assembly drawing applying material symbols. D.04.05
0. Prepare auxiliary drawings--The student will be able to: D.05.0
    01. Prepare drawings containing primary auxiliary views. D.05.01
    02. Prepare drawings containing auxiliary views that include curved lines. D.05.02

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0. Apply basic dimensioning--The student will be able to: D.06.0
    01. Prepare drawings containing linear, angular and circular standard dimensions. D.06.01
    02. Prepare drawings using metric dimensions. D.06.02
    03. Prepare drawings using general and local notes. D.06.03
    04. Apply basic tolerance techniques and tolerance dimensioning. D.06.04
    05. Understand the differences between dimensioning architectural, civil and mechanical drawings. D.06.05
0. Prepare pictorial drawings--The student will be able to: D.07.0
    01. Prepare isometric and oblique pictorial drawings. D.07.01
    02. Prepare one-point and two-point perspectives. D.07.02
0. Prepare surface developments--The student will be able to: D.08.0
    01. Prepare developments of a prism, a cylinder, a cone and a pyramid. D.08.01
    02. Prepare developments of a transition piece. D.08.02
    03. Prepare drawing involving intersecting pieces. D.08.03
0. Perform basic Computer-Aided Drafting (CAD) functions--The student will be able to: D.09.0
    01. Perform drawing set up. D.09.01
    02. Construct geometric figures of lines, splines, circles and arcs. D.09.02
    03. Create and edit text using appropriate style and size to annotate drawings. D.09.03
    04. Use and control accuracy enhancement tools for entity positioning methods such as snap and XYZ. D.09.04
    05. Utilize editing commands. D.09.05
    06. Control entity properties by level or layer, color and line style or type. D.09.06
    07. Use viewing commands to perform zooming and panning. D.09.07
    08. Plot or print drawings on media using layout and scale. D.09.08
    09. Apply standard dimensioning rules. D.09.09
0. Prepare physical three-dimensional (3-D) model from a two-dimensional (2-D) drawing--The student will be able to: D.10.0
    01. Create a primitive physical 3-D model from a 2-D design containing linear and angular dimensions. D.10.01
    02. Create a physical primitive 3-D model from a 2-D design containing circular dimensions. D.10.02

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0. Prepare basic architectural drawings--The student will be able to: D.11.0
    01. Understand architectural terminology. D.11.01
    02. Read and interpret architectural drawings. D.11.02
    03. Prepare a plot/site plan. D.11.03
    04. Prepare a floor plan. D.11.04
    05. Prepare a roof plan. D.11.05
    06. Prepare exterior elevations. D.11.06
    07. Prepare a typical wall section. D.11.07
0. Demonstrate geometry and mathematics knowledge and skills related to drafting--The student will be able to: D.12.0
    01. Solve right-angle trigonometric problems. D.12.01
    02. Analyze and apply data and measurements to solve problems and interpret documents. D.12.02
0. Demonstrate mathematics knowledge and skills with respect to market and industry applications of drafting--The student will be able to: D.13.0
    01. Demonstrate an understanding of federal, state and local taxes and their computation. D.13.01
    02. Solve problems for volume, weight, area, circumference and perimeter measurements for rectangles, squares and cylinders. D.13.02
    03. Measure tolerances on horizontal and vertical surfaces using millimeters, centimeters, feet and inches. D.13.03
    04. Determine the correct purchase price, to include sales tax, for a materials list containing a minimum of six items. D.13.04
0. Apply tolerance dimensioning--The student will be able to: D.14.0
    01. Apply tolerance dimensioning in inches and feet. D.14.01
    02. Dimension tolerance using millimeters and centimeters. D.14.02
0. Demonstrate an understanding of basic civil drawings--The student will be able to: D.15.0
    01. Understand civil drawing terminology. D.15.01
    02. Read and interpret civil drawings. D.15.02
    03. Prepare a civil plan with topography and profile drawing. D.15.03
0. Demonstrate basic electrical/electronic literacy--The student will be able to: D.16.0
    01. Identify electrical/electronic symbols. D.16.01
    02. Prepare schematic/block diagrams and/or electric plans. D.16.02

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0. Perform advanced CAD functions--The student will be able to: D.17.0
    01. Identify, create, store and use standard part symbols and libraries. D.17.01
    02. Understand how to minimize file size. D.17.02
    03. Use query commands to interrogate database for entity characteristics, distance, area and status. D.17.03
0. Prepare a basic digital 3-D model from a 2-D drawing--The student will be able to: D.18.0
    01. Create a basic digital 3-D model from a 2-D design containing linear and angular dimensions. D.18.01
    02. Create a basic digital 3-D model from a 2-D design containing circular dimensions. D.18.02
0. Explain the importance of employability and entrepreneurship skills--The student will be able to: D.19.0
    01. Identify and demonstrate positive work behaviors needed to be employable. D.19.01
    02. Develop a personal career plan that includes goals, objectives and strategies. D.19.02
    03. Prepare a resume. D.19.03
    04. Examine licensing, certification and industry credentialing requirements. D.19.04
    05. Maintain a career portfolio to document knowledge, skills and experience. D.19.05
    06. Evaluate and compare employment opportunities that match career goals. D.19.06
    07. Identify and exhibit traits for retaining employment. D.19.07
    08. Identify opportunities and research requirements for career advancement. D.19.08
    09. Research the benefits of ongoing professional development. D.19.09
    10. Examine and describe entrepreneurship opportunities as a career planning option. D.19.10
    11. Demonstrate knowledge of the "Right-To-Understand" law as recorded in (29 CFR-1910.1200). D.19.11

Drafting Detailer 1 – Course Number: TDR0775

0. Prepare computer-aided 3-D architectural drawings--The student will be able to: D.20.0
    01. Draw a floor plan. D.20.01
    02. Prepare isometric exterior views. D.20.02
    03. Prepare perspective exterior views. D.20.03

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0. Prepare architectural multi-level residential drawings--The student will be able to: D.21.0
    01. Prepare a first floor plan. D.21.01
    02. Prepare a second floor plan. D.21.02
    03. Prepare a basic roof framing layout drawing. D.21.03
    04. Prepare a two-story elevation drawing. D.21.04
    05. Prepare a second floor framing plan. D.21.05
    06. Create a stair drawings and details. D.21.06
0. Prepare a basic site/plot plan drawing--The student will be able to: D.22.0
    01. Layout a residential site/plot plan. D.22.01
    02. Indicate site/plot size, orientation and limits. D.22.02
    03. Layout a public street, sidewalk and public utility lines. D.22.03
    04. Write a site/plot legal description. D.22.04
    05. Dimension a building location. D.22.05
    06. Layout and label specialty features (patio, deck, pool, gazebo, etc.). D.22.06
    07. Locate easements and setbacks. D.22.07
0. Prepare a basic landscape plan drawing--The student will be able to: D.23.0
    01. Layout landscape features. D.23.01
    02. Develop a schedule of plants and shrubs. D.23.02
    03. Develop a list of landscape symbols. D.23.03
0. Convert a basic architectural 3-D model to a mechanically created prototype--The student will be able to: D.24.0
    01. Use a digital 3-D model design, containing linear and angular features, to 3-D print a basic prototype. D.24.01
    02. Use a digital 3-D model design, containing circular features, to 3-D print a basic prototype. D.24.02

Drafting Detailer 2 – Course Number: TDR0776

0. Prepare advanced computer-aided mechanical working drawings--The student will be able to: D.25.0
    01. Prepare dimensioned multi-view drawings applying CAD techniques. D.25.01
0. Convert a computer-aided 3-D model to a rapid prototype of a mechanical device--The student will be able to: D.26.0
    01. Prepare computer-aided 3-D mechanical model. D.26.01
    02. Use a digital 3-D model, containing linear and angular features, to 3-D print a prototype of a mechanical device. D.26.02
    03. Use a digital 3-D model, containing circular dimensions, to 3-D print a prototype of a mechanical device. D.26.03

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0. Prepare a typical wall section--The student will be able to: D.27.0
    01. Prepare a two-story residential wall section. D.27.01
    02. Apply notes and dimensions to a residential wall section. D.27.02
0. Prepare a basic foundation plan drawing--The student will be able to: D.28.0
    01. Prepare a foundation plan drawing for a residence. D.28.01
    02. Prepare foundation detail drawings. D.28.02
0. Prepare a basic electrical plan drawing--The student will be able to: D.29.0
    01. Prepare an electrical plan for a residence. D.29.01
    02. Prepare an electrical symbols legend for an electrical plan. D.29.02
0. Prepare a basic Heating, Ventilation and Air-Conditioning (HVAC) plan drawing--The student will be able to: D.30.0
    01. Prepare an HVAC plan for a residence. D.30.01
    02. Prepare an HVAC symbols legend for an HVAC plan. D.30.02
0. Prepare a basic plumbing plan drawing--The student will be able to: D.31.0
    01. Prepare a plumbing plan for a residence. D.31.01
    02. Prepare a plumbing symbols legend for a plumbing plan. D.31.02
0. Prepare a digital scale 3-D model from a 2-D drawing--The student will be able to: D.32.0
    01. Create a digital scale 3-D model from a 2-D design containing linear and angular features. D.32.01
    02. Create a digital scale 3-D model from a 2-D design containing circular features. D.32.02

Architectural Drafter – Course Number: TDR0570

0. Prepare architectural drawings for a commercial building--The student will be able to: D.33.0
    01. Interpret commercial catalogs, specifications, technical tables, codes and ordinances. D.33.01
    02. Prepare a commercial site plan. D.33.02
    03. Prepare a floor plan with dimensions. D.33.03
    04. Prepare a foundation plan with dimensions and a footing schedule. D.33.04
    05. Prepare a roof plan to include a drainage plan and a roof framing plan. D.33.05
    06. Prepare elevation drawings. D.33.06
    07. Prepare building section drawings. D.33.07
    08. Prepare door and window schedules. D.33.08

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0. Prepare basic building utility drawings for a commercial building--The student will be able to: D.34.0
    01. Prepare an electrical plan. D.34.01
    02. Prepare a riser diagram. D.34.02
    03. Prepare a plumbing plan. D.34.03
    04. Prepare an HVAC plan. D.34.04
0. Prepare presentation drawings for a commercial building--The student will be able to: D.35.0
    01. Produce color pictorial drawings. D.35.01
    02. Prepare dynamic presentation zoom views or a walk-thru. D.35.02
    03. Create a drawing portfolio. D.35.03
0. Integrate drawing sets--The student will be able to: D.36.0
    01. Compile a full drawing set to describe a complete building. D.36.01
0. Convert computer-aided 3-D or building information models to rapid prototypes of a building design or building components--The student will be able to: D.37.0
    01. Use a digital 3-D model containing a parametric component to 3-D print a prototype of a building design. D.37.01
0. Engage in project planning activities to expedite the completion of architectural projects--The student will be able to: D.38.0
    01. Understand what it takes to schedule and plan for architectural project tasks. D.38.01
    02. Understand how to network with stakeholders to manage budgets, resources and deadlines. D.38.02
    03. Produce project deliverables per negotiated obligations. D.38.03

Civil Drafter – Course Number: TDR0874

0. Prepare computer-aided map details--The student will be able to: D.39.0
    01. Prepare a map using bearings. D.39.01
    02. Prepare a map using coordinates. D.39.02
    03. Convert a map into metric dimensions. D.39.03
0. Understand surveying and mapping procedures--The student will be able to: D.40.0
    01. Analyze basic mapping specifications. D.40.01
    02. Interpret aerial photogrammetry. D.40.02
    03. Identify horizontal measures. D.40.03
    04. Identify leveling procedures. D.40.04
    05. Interpret angular measurements. D.40.05
    06. Interpret legal descriptions. D.40.06

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0. Prepare advanced map drawings--The student will be able to: D.41.0
    01. Prepare a traverse drawing. D.41.01
    02. Prepare a street layout drawing. D.41.02
    03. Prepare an advanced map drawing. D.41.03
    04. Prepare a highway drawing. D.41.04
    05. Prepare a topographic drawing. D.41.05
0. Prepare advanced civil drawings--The student will be able to: D.42.0
    01. Prepare a drainage drawing. D.42.01
    02. Prepare a plat drawing. D.42.02
    03. Prepare an advanced plan and profile drawing. D.42.03
    04. Prepare a utility drawing. D.42.04
0. Engage in project planning activities to expedite the completion of civil drafting projects--The student will be able to: D.43.0
    01. Understand what it takes to schedule and plan for civil project tasks. D.43.01
    02. Understand how to network with stakeholders to manage budgets, resources and deadlines. D.43.02
    03. Produce project deliverables per phasing and negotiated obligations. D.43.03

Mechanical Drafter – Course Number: TDR0777

0. Prepare advanced mechanical drawings--The student will be able to: D.44.0
    01. Analyze problems using the descriptive geometry method of projection. D.44.01
    02. Identify the various manufacturing methods. D.44.02
    03. Use precision dimensioning to include Geometric Dimensioning and Tolerancing (GDT) for fits and finishing. D.44.03
    04. Make engineering changes on drawings. D.44.04
    05. Prepare fastener drawings. D.44.05
    06. Prepare a cam drawing with dimensions. D.44.06
    07. Prepare a gear drawing with dimensions. D.44.07
    08. Prepare a spring drawing with dimensions. D.44.08

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0. Prepare production drawings using 3-D CAD techniques--The student will be able to: D.45.0
    01. Make a pattern shop detail drawing. D.45.01
    02. Make a casting drawing. D.45.02
    03. Make a forging detail drawing. D.45.03
    04. Make a machining detail drawing. D.45.04
    05. Make a 3D stamping drawing. D.45.05
    06. Make a 3D welding drawing. D.45.06
    07. Prepare an installation drawing. D.45.07
    08. Prepare a Bill of Materials (BOM). D.45.08
0. Prepare pneumatic/hydraulic drawings--The student will be able to: D.46.0
    01. Prepare a piping drawing. D.46.01
    02. Prepare a pictorial piping drawing. D.46.02
    03. Prepare a sectional drawing. D.46.03
    04. Prepare a diagram. D.46.04
0. Prepare tool drawings using 3-D CAD techniques--The student will be able to: D.47.0
    01. Prepare a 3D jig and fixture drawing. D.47.01
    02. Prepare a 3D cutting die drawing. D.47.02
    03. Prepare a 3D forming die drawing. D.47.03
0. Engage in project planning activities to expedite the completion of mechanical drafting projects--The student will be able to: D.48.0
    01. Understand what it takes to schedule and plan mechanical project tasks. D.48.01
    02. Understand how to network with stakeholders to manage budgets, resources and deadlines. D.48.02
    03. Produce project deliverables per phasing and negotiated obligations. D.48.03

Structural Drafter – Course Number: TDR0875

0. Prepare structural details--The student will be able to: D.49.0
    01. Interpret structural manuals and technical tables. D.49.01
    02. Draw structural connections. D.49.02

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0. Prepare structural steel drawings--The student will be able to: D.50.0
    01. Interpret codes and specifications. D.50.01
    02. Use the Timber Construction Manual and other technical data. D.50.02
    03. Understand reactions and stresses. D.50.03
    04. Interpret shear and moment diagrams. D.50.04
    05. Detail bolted connections. D.50.05
    06. Detail welded connections. D.50.06
    07. Prepare erection plans and schedules. D.50.07
    08. Prepare an advance bill for ordering materials. D.50.08
0. Prepare reinforced concrete drawings--The student will be able to: D.51.0
    01. Interpret codes and specifications. D.51.01
    02. Interpret engineering drawings. D.51.02
    03. Prepare beam and column drawings and schedules. D.51.03
    04. Prepare footing and foundation drawings. D.51.04
    05. Prepare floor and roof detail drawings. D.51.05
    06. Prepare special structure detail drawings. D.51.06
    07. Prepare a bar list and schedule. D.51.07
0. Prepare structural wood drawings--The student will be able to: D.52.0
    01. Interpret codes and specifications. D.52.01
    02. Prepare fastening and connection details. D.52.02
    03. Prepare framing plans. D.52.03
0. Prepare advanced 3-D computer-aided drawings--The student will be able to: D.53.0
    01. Produce structural (steel, wood and reinforced concrete) 3-D drawings. D.53.01

Electricity (I460312) **Electrician Helper – Course Number: BCV0603**

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0. Explain the importance of health, safety, environmental stewardship and related regulatory compliance--The student will be able to: E.01.0
    01. Understand the role and purpose of the Occupational Safety and Health Administration (OSHA) rules and regulations. E.01.01
    02. Clean the work area and maintain it in a safe condition. E.01.02
    03. Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments. E.01.03
    04. Identify and operate workplace safety electrical devices. E.01.04
    05. Identify health related problems that may result from exposure to work related chemicals and hazardous materials, and know the proper precautions required for handling such materials. E.01.05
    06. Explain emergency procedures to follow in response to workplace accidents. E.01.06
    07. Create a disaster and/or emergency response plan for specific incidences. E.01.07
    08. Explain the importance of CPR (CardioPulmonary Resuscitation) and first aid. E.01.08
    09. Describe "Right-to-Understand" Law as recorded in (29 CFR.1910.1200). E.01.09
0. Identify, use and maintain the tools and accessories used in the electrical industry--The student will be able to: E.02.0
    01. Identify and select tools, equipment and materials to complete a job. E.02.01
    02. Drill holes in metal, wood and concrete for electrical installations. E.02.02
    03. Determine the layout of electrical devices, complying with local, state and national electric code regulations. E.02.03
    04. Install the following, complying with the appropriate local, state or national electric codes: E.02.04
        a. Conductors and cable. E.02.04.A
        b. Standard outlets and switch boxes. E.02.04.B
        c. Cord connections on equipment. E.02.04.C
        d. Cords, switches, receptacles and dimmers, including a single-pole switched lighting circuit, a three-way switched lighting circuit and a four-way combination circuit. E.02.04.D

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0. Demonstrate an understanding of basic Direct Current (DC) electrical circuit skills--The student will be able to: E.03.0
    01. Define the following terms: voltage, current, resistance and power. E.03.01
    02. Measure voltage, current and resistance using industry standard electrical measuring devices. E.03.02
    03. Analyze and explain series, parallel, and series parallel (combination) circuits. E.03.03
    04. Draw each type of circuit and calculate the circuit values. E.03.04
    05. Explain and apply Ohm's Law. E.03.05
    06. Compute conductance and resistance of conductors. E.03.06
0. Apply mathematics knowledge and skills to electricity--The student will be able to: E.04.0
    01. Demonstrate knowledge of arithmetic operations. E.04.01
    02. Analyze and apply data and measurements to solve problems and interpret documents. E.04.02
    03. Construct charts, tables and graphs using functions and data. E.04.03
0. Demonstrate an understanding of basic electricity--The student will be able to: E.05.0
    01. Relate electricity to the nature of matter. E.05.01
    02. Describe various ways that electricity is produced. E.05.02
    03. Explain the magnetic properties of circuits and devices. E.05.03
    04. Explain the principles of electromagnetism. E.05.04
0. Read and interpret basic electric codes--The student will be able to: E.06.0
    01. Describe the importance of following the local, state and national electric codes. E.06.01
    02. Read and interpret basic electric codes, wiring plans and specifications. E.06.02
    03. Identify licensure requirements for electrical occupations. E.06.03
    04. Demonstrate knowledge of National Fire Protection Association (NFPA) 70E and how it relates to job safety. E.06.04
0. Apply further mathematics knowledge and skills to electricity--The student will be able to: E.07.0
    01. Demonstrate and solve basic algebraic formulas related to electricity. E.07.01
    02. Solve basic trigonometric functions related to electrical theory. E.07.02
    03. Explain basic Alternating Current (AC) theory and solve related mathematical problems using appropriate test equipment. E.07.03
    04. Solve math related problems from measurements on training aids. E.07.04

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0. Demonstrate further understanding of electricity--The student will be able to: E.08.0
    01. Explain how voltage is produced by chemical, mechanical, thermal, photoelectric and piezo electric means. E.08.01
0. Demonstrate analytical and trouble shooting skills related to electrical principles--The student will be able to: E.09.0
    01. Identify conditions and resolutions to overcurrent and ground fault conditions in electrical circuits. E.09.01
    02. Discuss the dangers, conditions and resolutions to short circuit and arc fault conditions in electrical circuits. E.09.02

Residential Electrician – Course Number: BCV0640

0. Demonstrate proficiency in electrical math problems and skills--The student will be able to: E.10.0
    01. Calculate wiring costs. E.10.01
    02. Calculate voltage drop. E.10.02
    03. Determine ampacity correction factors. E.10.03
    04. Calculate conduit fill. E.10.04
    05. Calculate box fill. E.10.05
    06. Calculate range loads. E.10.06
0. Demonstrate an understanding of Alternating Current (AC) circuit skills--The student will be able to: E.11.0
    01. Identify the physical and electrical characteristics of capacitors and inductors. E.11.01
    02. Demonstrate proficiency in measuring, testing and connecting a transformer. E.11.02
    03. Analyze and apply the principles of transformers to AC circuits. E.11.03
    04. Identify the properties of an AC signal. (optional) E.11.04
    05. Identify AC sources. E.11.05

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0. Explain the importance of employability and entrepreneurship skills--The student will be able to: E.12.0
    01. Identify and demonstrate positive work behaviors needed to be employable. E.12.01
    02. Develop personal career plan that includes goals, objectives and strategies. E.12.02
    03. Examine licensing, certification and industry credentialing requirements. E.12.03
    04. Maintain a career portfolio to document knowledge, skills and experience. E.12.04
    05. Evaluate and compare employment opportunities that match career goals. E.12.05
    06. Identify and exhibit traits for retaining employment. E.12.06
    07. Identify opportunities and describe requirements for career advancement. E.12.07
    08. Describe the benefits of ongoing professional development. E.12.08
    09. Examine and describe entrepreneurship opportunities as a career planning option. E.12.09
0. Install residential wiring--The student will be able to: E.13.0
    01. Identify residential wiring requirements and specifications in accordance with a wiring plan. E.13.01
    02. Identify electrical symbols in construction documents. E.13.02
    03. Draw a residential wiring plan, using electrical wiring symbols. E.13.03
    04. Identify and install a recessed lighting fixture, a fluorescent lighting fixture and a surface lighting fixture according to the specifications, complying with the appropriate local, state and national electric codes. E.13.04
    05. Identify, install and wire a duplex receptacle outlet circuit, a split circuit duplex receptacle outlet circuit, and a special purpose receptacle outlet circuit, a Ground Fault Circuit Interrupter (GFCI) receptacle or circuit, and an Arc Fault Circuit Interrupter (AFCI) receptacle or circuit, according to the specifications, complying with the appropriate local, state and national electric codes. E.13.05

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0. Install residential wiring systems--The student will be able to: E.14.0
    01. Install and wire a low voltage signal system. E.14.01
    02. Install conduit systems. E.14.02
    03. Provide power for Heating, Ventilation and Air Conditioning (HVAC) equipment. E.14.03
    04. Install the following, complying with the appropriate local, state and national electric codes: E.14.04
        a. Service entrance main panel. E.14.04.A
        b. Service entrance meter base. E.14.04.B
        c. Alarm systems and smoke detectors. E.14.04.C
    05. Demonstrate knowledge of the requirements for the installation of a swimming pool electrical system. E.14.05
    06. Connect single-phase and three-phase transformers. E.14.06
    07. Troubleshoot residential electric circuits. E.14.07

Commercial Electrician – Course Number: BCV0652

0. Demonstrate proficiency in commercial wiring--The student will be able to: E.15.0
    01. Read and interpret a commercial wiring plan and specifications. E.15.01
    02. Draw a commercial electrical wiring plan. E.15.02
    03. Select tools, equipment and materials to complete a job. E.15.03
    04. Install or identify the following according to the plan and specifications, complying with appropriate electric codes: E.15.04
        a. Wire mold. E.15.04.A
        b. Conduit, duct and raceway systems. E.15.04.B
        c. Conductors in a conduit. E.15.04.C
    05. Describe the difference between a residential and a commercial lighting circuit. E.15.05
    06. Describe poly-(three)-phase circuits. E.15.06
    07. Install a simple poly-(three)-phase circuit. E.15.07
    08. Construct control circuits from schematics. E.15.08
    09. Describe high voltage (over 1000 volts) wiring requirements. E.15.09
    10. Demonstrate a general knowledge of hazardous locations and wiring methods. E.15.10
    11. Explain a commercial three-phase receptacle circuit and an emergency lighting system. E.15.11
    12. Explain commercial service entrance requirements. E.15.12

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0. Demonstrate specialized electrical skills--The student will be able to: E.16.0
    01. Demonstrate an understanding of solid state control devices such as Variable Frequency Drives (VFD's), electronic ballast, electronic motor starters, motion sensors, etc. E.16.01
    02. Demonstrate an understanding of data cable installation according to the plans and specifications. E.16.02
    03. Demonstrate an understanding of the basic concepts of grounding and bonding. E.16.03

Heating, Ventilation, Air-Conditioning/Refrigeration (HVAC/R) (C400400)

Introduction to HVAC/R – Course Number: ACR0000

0. Demonstrate the importance of health, safety and environmental management systems in organizations and their importance to organizational performance and regulatory compliance--The student will be able to: HVAC.01.0
    01. Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments. HVAC.01.01
    02. Explain the reasons for regular safety meetings and for company safety policies. HVAC.01.02
    03. Explain the need for employee-background checks and medical examinations. HVAC.01.03
    04. Identify appropriate fire extinguishers and other such safety devices. HVAC.01.04
    05. Identify and follow emergency and rescue procedures. HVAC.01.05
    06. Identify and use safe-handling practices as they relate to hazardous and volatile fluids, compounds and gases. HVAC.01.06
    07. Demonstrate Occupational Safety and Health Administration (OSHA) 10, Environmental Protection Agency (EPA) practices, Department of Transportation (DOT) hazardous materials safety requirements, lock-out and tag out, and electrical safety. HVAC.01.07
    08. Select and wear proper protective clothing and equipment. HVAC.01.08
    09. Describe the purpose and requirements of local, state and federal heating, air-conditioning and refrigeration codes and standards as well as the manufacturer's installation instructions. HVAC.01.09
    10. Identify and use OSHA practices when working with heating, air-conditioning and refrigeration systems and equipment. HVAC.01.10
    11. Explain emergency procedures to follow in response to workplace accidents. HVAC.01.11
    12. Understand a disaster and/or emergency response plan. HVAC.01.12

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0. Explain the importance of employability and entrepreneurship skills--The student will be able to: HVAC.02.0
    01. Identify and demonstrate positive work behaviors needed to be employable. HVAC.02.01
    02. Develop personal career plan that includes goals, objectives and strategies. HVAC.02.02
    03. Create and maintain a career portfolio to document knowledge, skills and experience. HVAC.02.03
0. Identify, use and maintain the tools and tool accessories used in the heating, air-conditioning and refrigeration industry--The student will be able to: HVAC.03.0
    01. Follow safety precautions when using hand and power tools. HVAC.03.01
    02. Identify and use basic hand tools and tool accessories; power tools (electric and mechanical); pipe and tube-working tools; and specialized tools of the trade. HVAC.03.02
    03. Apply appropriate care and maintenance procedures for tools and tool accessories, following the directions in the tool-equipment manufacturer's manual. HVAC.03.03
0. Demonstrate mathematics knowledge and skills--The student will be able to: HVAC.04.0
    01. Demonstrate knowledge of arithmetic operations. HVAC.04.01
    02. Analyze and apply data and measurements to solve problems and interpret documents. HVAC.04.02
0. Read construction documents--The student will be able to: HVAC.05.0
    01. Recognize and identify basic construction drawing terms, components and symbols. HVAC.05.01
    02. Relate information on construction drawings to actual locations on the print. HVAC.05.02
    03. Recognize different classifications of construction drawings. HVAC.05.03
    04. Interpret and use drawing dimensions. HVAC.05.04

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0. Explain the properties of matter and heat behavior--The student will be able to: HVAC.06.0
    01. Describe and explain freezing point, critical temperature and absolute zero. HVAC.06.01
    02. Explain the gas laws (Dalton, Boyle and Charles) used when dealing with air and its properties. HVAC.06.02
    03. Describe matter, heat and heat transfer. HVAC.06.03
    04. Differentiate between heat and temperature. HVAC.06.04
    05. Explain and distinguish among the characteristics of the three states of matter. HVAC.06.05
    06. Explain the relationship between temperature and humidity. HVAC.06.06
    07. Differentiate between latent heat and sensible heat. HVAC.06.07
0. Describe the history and concepts of heating, air-conditioning and refrigeration--The student will be able to: HVAC.07.0
    01. Explain the basic principles of heating, ventilation and air-conditioning. HVAC.07.01
    02. Identify the refrigeration cycle. HVAC.07.02
    03. Identify and explain the four major refrigeration components. HVAC.07.03
    04. Identify and explain the characteristics of a compression-cycle refrigerant system. HVAC.07.04
    05. Differentiate between air-conditioning and refrigeration. HVAC.07.05
    06. Differentiate between split systems, mini-splits and package systems. HVAC.07.06
    07. Describe the benefits of conditioned air and indoor air quality. HVAC.07.07
    08. Identify various professional organizations, associations and societies and explain their purposes. HVAC.07.08
0. Demonstrate a practical knowledge of basic electricity and of the electrical components of heating, air-conditioning and refrigeration equipment--The student will be able to: HVAC.08.0
    01. Explain the principles of electricity. HVAC.08.01
    02. Explain single- and three-phase power distribution. HVAC.08.02
    03. Define and explain watts, ohms, volts and amps. HVAC.08.03
    04. Identify and explain electrical measuring tools and devices. HVAC.08.04
    05. Explain the standards for and ways to measure watts, resistance, voltage and amperage, using appropriate instruments or devices. HVAC.08.05

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0. Demonstrate knowledge of electrical wiring in air-conditioning and refrigeration--The student will be able to: HVAC.09.0
    01. Identify and explain appropriate electrical wiring symbols. HVAC.09.01
    02. Draw and explain a wiring schematic diagram for a control system. HVAC.09.02
    03. Create a wiring schematic for an air conditioner an electric furnace, a heat pump, an oil furnace (optional) and a gas furnace. HVAC.09.03
0. Troubleshoot heating, air-conditioning and refrigeration electrical control systems and their components--The student will be able to: HVAC.10.0
    01. Identify and explain the operations of electrical control systems and their components (zone damper motors, duel fuel lock out controls, outdoor thermostats/low ambient controls, defrost controls/timers and auxiliary heating controls, contactors, relays, circuit boards, motors, solenoids, and thermostats.). HVAC.10.01
    02. Troubleshoot protection devices, such as fuses and breakers. HVAC.10.02
    03. Identify, install and troubleshoot controls for heating, air-conditioning and refrigeration systems. HVAC.10.03
    04. Explain the operation of different types of electromechanical communicating, humidity control, and Wi-Fi and programmable operating thermostats. HVAC.10.04
    05. Troubleshoot operational problems for different types of electromechanical communicating, humidity control, and Wi-Fi operating thermostats. HVAC.10.05
0. Select and test electrical generation and distribution components for commercial heating and air conditioning systems--The student will be able to: HVAC.11.0
    01. Determine wire sizes and voltage drops. HVAC.11.01
    02. Describe the operation of various types of transformers. HVAC.11.02

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0. Analyze fluids, pressures, refrigerants and related codes--The student will be able to: HVAC.12.0
    01. Identify and explain general safety issues and EPA rules and regulations regarding the handling of refrigerants. HVAC.12.01
    02. Define and explain pressure, fluid and temperature. HVAC.12.02
    03. Explain the standards for and ways to measure and calculate absolute and gauge pressures. HVAC.12.03
    04. Identify and explain the classifications, properties and uses of different refrigerants based on chemical composition. HVAC.12.04
    05. Explain how fluids react and flow in a closed versus an open environment or vessel. HVAC.12.05
    06. Define and identify "color coding" of refrigerant cylinders. HVAC.12.06
    07. Explain the proper methods of transferring, storing and recovering refrigerants. HVAC.12.07
    08. Explain the effects of an improper refrigerant and contaminants in a system. HVAC.12.08
    09. Identify the refrigerants in common use and state the types of applications in which each is used. HVAC.12.09
    10. Describe how azeotropes and near-azeotropes differ from each other and from so-called pure refrigerants. HVAC.12.10
    11. Compare and interpret a P-T chart for pure refrigerants, azeotrope, and near-azeotrope refrigerants and explain the difference between bubble point and dew point. HVAC.12.11
    12. Demonstrate refrigerant leak detecting methods. HVAC.12.12
    13. Identify the different types of oils used in refrigeration systems and explain their relationships to the various refrigerants. HVAC.12.13
    14. Explain how to add and remove oil from a system. HVAC.12.14
    15. Describe how to test oil and acid for contamination. HVAC.12.15

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0. Evaluate heating, air-conditioning and refrigeration system components and accessories--The student will be able to: HVAC.13.0

    01. Explain the types, operation, use and requirements of HVAC.13.01

    . Compressors (such as reciprocating, rotary, screw, scroll and inverter) HVAC.13.01.A.

    . Condensers and evaporators (such as evaporative condensers, evaporative coils, shell and tube, tube within a tube and fin and tube) HVAC.13.01.B.

    . Metering devices (such as adjusting automatic and thermostatic expansion valves, fixed orifices, stepper motor electronic expansion valve (EEV), solenoid EEV and other devices available on the local market) HVAC.13.01.C.

    02. Identify the location and explain the uses of refrigerant flow accessories. HVAC.13.02

    03. Identify the location and explain the uses of heating, air-conditioning and refrigeration-system accessories (such as receivers, dryers/filers, solenoid valves, heat exchangers, accumulators, suction filter, oil separators, evaporator pressure-regulating valve, crankcase pressure-regulating valves, hot gas bypass valves and check valves). HVAC.13.03

0. Fabricate and service the piping, tubing and fittings used in the heating, air-conditioning and refrigeration industry--The student will be able to: HVAC.14.0

    01. Identify and explain the purpose of the piping, tubing and fittings used in the heating, air-conditioning and refrigeration industry. HVAC.14.01

    02. Bend tubing, using tube benders. HVAC.14.02

    03. Connect tubing using flared fittings, pressed fittings and compression fittings. HVAC.14.03

    04. Connect tubing, using a swaged-joint connection. HVAC.14.04

    05. Identify and use various types of torches. HVAC.14.05

    06. Identify, select and use appropriate brazing alloys, materials and skills. HVAC.14.06

    07. Explain the purposes and procedures for protecting piping materials and fabrication, such as valves, fittings and products from heat. HVAC.14.07

    08. Braze tubing while purging dry nitrogen. HVAC.14.08

    09. Silver-braze brass, steels and copper. HVAC.14.09

    10. Demonstrate an understanding of the procedures for installing pipe and tubing insulation. HVAC.14.10

    11. Explain the procedures required for installing heating, air-conditioning, refrigerant and ventilation accessories. HVAC.14.11

    12. Fabricate and leak-test the piping, tubing and fittings used in the heating, air-conditioning and refrigeration industry. HVAC.14.12

    13. Demonstrate proper safety measures when fabricating and servicing piping, tubing and fittings. HVAC.14.13

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0. Maintain, test and troubleshoot electrical motors and their components for commercial heating and air-conditioning systems--The student will be able to: HVAC.15.0
    01. Explain how alternating current is developed and draw a sine wave. HVAC.15.01
    02. Identify single-phase and three-phase wiring arrangements. HVAC.15.02
    03. Explain how phase shift occurs in inductors and capacitors. HVAC.15.03
    04. Describe the types of capacitors and their applications. HVAC.15.04
    05. Explain the operation of single-phase and three-phase induction motors. HVAC.15.05
    06. Identify and explain the operations and applications of various types of electrical motors and their components as used in heating and air-conditioning systems. HVAC.15.06
    07. Maintain, test and troubleshoot various types of electrical motors and their components as used in heating and air-conditioning systems. HVAC.15.07
    08. Demonstrate the proper use of motor testing equipment. HVAC.15.08
    09. Reverse the rotation of a motor. HVAC.15.09

HVAC/R Service Practices – Course Number: ACR0012

0. Utilize mechanical components of heating air-conditioning and refrigeration systems —The student will be able to: HVACR.01.0
    01. Evaluate metering-device performance. HVACR.01.01
    02. Explain the methods of compression, lubrication and compressor modulation. HVACR.01.02
    03. Analyze the operating condition of a compressor. HVACR.01.03
    04. Test, troubleshoot and correct the causes of mechanical problems in a heating, air-conditioning and refrigeration system. HVACR.01.04
    05. Evaluate system performance. HVACR.01.05
0. Operate solid-state electronics as used in heating, air-conditioning and refrigeration systems--The student will be able to: HVACR.02.0
    01. Explain the basic principles and functions of Direct Digital Control (DDC). HVACR.02.01
    02. Explain basic solid-state circuits and boards. HVACR.02.02
    03. Identify, test and replace circuits and boards. HVACR.02.03
    04. Explain codes and standards and safety requirements for working with the electrical components used in heating, air conditioning and refrigeration. HVACR.02.04

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0. Utilize and operate mechanical refrigeration servicing and testing equipment--The student will be able to: HVACR.03.0
    01. Identify the effects of superheat and sub-cooling on a system. HVACR.03.01
    02. Identify and explain the functions of servicing and testing equipment (such as vacuum pumps, micron gauges, EPA-approved equipment, leak detectors and charging systems). HVACR.03.02
    03. Operate a refrigerant recovery system. HVACR.03.03
    04. Apply specific safety and recovery practices for refrigerants used in the industry. HVACR.03.04
    05. Apply specific safety practices as they relate to handling and storing cylinders and materials. HVACR.03.05
    06. Explain the standards for and ways to measure, test, maintain and evacuate a mechanical heating, air-conditioning and refrigeration system. HVACR.03.06
    07. Evacuate the refrigerant system with various vacuum methods. HVACR.03.07
    08. Demonstrate compliance with Environmental Protection Agency (EPA) rules and regulations and, if possible, take the EPA test. HVACR.03.08
    09. Charge various air-conditioning and mechanical refrigeration systems by various methods. HVACR.03.09
    10. Demonstrate the effects of superheat and sub-cooling on a system utilizing test equipment (such as thermometers and gages). HVACR.03.10
0. Assist in the installation of a residential heating and air-conditioning system and determine start-up procedures--The student will be able to: HVACR.04.0
    01. Read and comply with dispatch orders. HVACR.04.01
    02. Explain codes and ordinances. HVACR.04.02
    03. Assist in the installation of a heating and air-conditioning system to the manufacturer's installation and operation specifications, using a practical knowledge of duct fabrication methods. HVACR.04.03
    04. Determine which charging method is appropriate for a given type of system in a residential air-conditioning unit and adjust superheat and/or sub-cooling. HVACR.04.04
    05. Determine the temperature split/ difference across the evaporator. HVACR.04.05
    06. Determine the temperature split/ difference across the condenser. HVACR.04.06
    07. Explain the electrical and mechanical operations of the basic heat pump. HVACR.04.07
    08. Write a service report. HVACR.04.08
    09. Apply good customer-relations skills. HVACR.04.09

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0. Conduct start-up and check-out procedures for mechanical heating and air-conditioning systems--The student will be able to: HVACR.05.0
    01. Identify and explain the following heat-pump systems: air-to-air, water-to-air, water-to-water, air-to-ground (geothermal), open-loop and closed-loop. HVACR.05.01
    02. Determine the start-up and checkout procedures recommended by different manufacturers. HVACR.05.02
    03. Determine the temperature split/ difference across the outdoor coil on a heat pump. HVACR.05.03
    04. Determine the temperature split/ difference across the indoor coil on a heat pump. HVACR.05.04
    05. Apply good customer-relations skills. HVACR.05.05
0. Use combustion-type heating servicing and testing equipment--The student will be able to: HVACR.06.0
    01. Explain combustion theory and the safety precautions for using combustion-type-heating servicing and testing equipment. HVACR.06.01
    02. Identify and explain the various types of combustion-type heating servicing and testing equipment (such as draft gauge, U-tube manometer, sling psychrometer, millivolt meter and oil-furnace testing equipment). HVACR.06.02
    03. Use the servicing and testing equipment. HVACR.06.03
    04. Test, analyze and troubleshoot combustion-type-heating systems. HVACR.06.04
0. Troubleshoot combustion gas valves and regulators as used in heating, air-conditioning, refrigeration and ventilation systems--The student will be able to: HVACR.07.0
    01. Identify and discuss the safety and regulation issues and concerns. HVACR.07.01
    02. Explain the operations of various types of gas valves and regulators (such as low-voltage, line-voltage, pneumatic (optional), solenoid and gas and pressure regulators). HVACR.07.02
    03. Identify various types of gas valves and regulators. HVACR.07.03
    04. Determine the application of gas valves and regulators. HVACR.07.04
    05. Troubleshoot gas valves and regulators. HVACR.07.05

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0. Understand the design of heating and cooling systems--The student will be able to: HVACR.08.0
    01. Identify and describe the steps in the system design process. HVACR.08.01
    02. Use construction drawings or an actual job site to obtain information needed to complete heating and cooling load estimates. HVACR.08.02
    03. Identify the factors that affect heat gains and losses to a building and describe how these factors influence the design process. HVACR.08.03
    04. Complete a load estimate to determine the heating and/or cooling load of a building. HVACR.08.04
    05. State the principles that affect the selection of equipment to satisfy the calculated heating and/or cooling load. HVACR.08.05
    06. Select heating and/or cooling equipment using manufacturers' product data. HVACR.08.06
    07. Identify the various types of duct systems and explain why and where each type is used. HVACR.08.07
    08. Demonstrate the effect of fittings and transitions on duct system design. HVACR.08.08
    09. Use a friction loss chart and duct sizing table to size duct. HVACR.08.09
    10. Install insulation and vapor barriers used in duct systems. HVACR.08.10
    11. Select and install refrigerant and condensate piping following proper design principles. HVACR.08.11
    12. Describe airflow and pressures in a basic forced-air distribution system. HVACR.08.12
    13. Explain the differences between propeller and centrifugal fans and blowers. HVACR.08.13
    14. Identify the various types of duct systems and explain why and where each type is used. HVACR.08.14
    15. Demonstrate or explain the installation of metal, fiberboard and flexible duct. HVACR.08.15
    16. Demonstrate or explain the installation of fittings and transitions used in duct systems. HVACR.08.16
    17. Identify and explain the operations of electrical control systems and their components (zone damper motors). HVACR.08.17
    18. Demonstrate or explain the use and installation of dampers used in duct systems. HVACR.08.18
    19. Demonstrate or explain the use and installation of insulation and vapor barriers used in duct systems. HVACR.08.19
    20. Identify instruments used to make measurements in air systems and explain the use of each instrument. HVACR.08.20

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21. Make basic temperature, air pressure and velocity measurements in an air distribution system. HVACR.08.21

0. Make career plans--The student will be able to: HVACR.09.0

01. Evaluate and compare employment opportunities that match career goals. HVACR.09.01

02. Identify and exhibit traits for retaining employment. HVACR.09.02

03. Identify opportunities and research requirements for career advancement. HVACR.09.03

04. Research the benefits of ongoing professional development. HVACR.09.04

05. Examine licensing, certification and industry credentialing requirements. HVACR.09.05

HVAC/R Intermediate Service Practices – Course Number: ACR0013

0. Select appropriate commercial compressors--The student will be able to: HVACR.25.0

01. Compare commercial-compressor requirements with those for residential and light commercial heating & air-conditioning systems. HVACR.25.01

02. Discuss appropriate commercial compressors for cooling requirements. HVACR.25.02

03. Describe the mechanical operation for each type of compressor. HVACR.25.03

04. Explain compressor lubrication methods. HVACR.25.04

05. Explain methods used to control compressor capacity. HVACR.25.05

06. Describe how compressor protection devices operate. HVACR.25.06

07. Perform the common procedures used when field servicing open and semi-hermetic compressors. HVACR.25.07

0. Test and adjust commercial evaporative condensers--The student will be able to: HVACR.26.0

01. Determine the proper air and fluid flow for commercial evaporative condensers. HVACR.26.01

02. Test and adjust the airflow for proper temperature difference. HVACR.26.02

03. Test and adjust the water flow for proper GPM and temperature difference. HVACR.26.03

04. Check for proper water treatment. HVACR.26.04

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0. Maintain, test and troubleshoot commercial evaporators--The student will be able to: HVACR.27.0
    01. Determine the operational requirements for evaporators used in commercial heating and air-conditioning applications. HVACR.27.01
    02. Discuss appropriate evaporators for commercial heating and air-conditioning systems HVACR.27.02
    03. Maintain, test and adjust commercial heating and air-conditioning accessories. HVACR.27.03
    04. Select the heating and air-conditioning accessories appropriate for various commercial applications. HVACR.27.04
0. Identify basic principles of heating, air conditioning, refrigeration and ventilation piping sizing--The student will be able to: HVACR.28.0
    01. Identify and explain various types of heating, air-conditioning and refrigeration piping. HVACR.28.01
    02. Identify basic principles of sizing various heating, air conditioning, refrigeration and ventilation for various tasks. HVACR.28.02
    03. Explain pressure and temperature drops. HVACR.28.03
0. Maintain, troubleshoot and repair commercial heating systems--The student will be able to: HVACR.29.0
    01. Identify the components of various commercial heating systems. HVACR.29.01
    02. Explain the operational principles of various commercial heating systems. HVACR.29.02
    03. Test and analyze heating air-distribution systems. HVACR.29.03
    04. Maintain, troubleshoot and repair various commercial heating systems. HVACR.29.04
0. Discuss new technologies--The student will be able to: HVACR.30.0
    01. Follow safety precautions. HVACR.30.01
    02. Describe new technologies in heating, air-conditioning and refrigeration installation, including variable-speed motors, heat-pipe systems, desiccant systems and gas-driven heating systems. HVACR.30.02
    03. Describe multi-ports and variable refrigerant volume (VRV)/variable refrigerant flow (VRF) systems. HVACR.30.03
    04. Explain how to lay out, construct and troubleshoot comfort systems. HVACR.30.04
    05. Test and analyze systems. HVACR.30.05
    06. Test and analyze heat-recovery systems and variable refrigerant volume (VRV)/variable refrigerant flow (VRF). HVACR.30.06

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0. Interpret, use and modify construction drawings and specifications--The student will be able to: HVACR.31.0
    01. Read mechanical plans within a set of construction drawings explain their relationship. HVACR.31.01
    02. Compare mechanical plans with the actual installation of duct and pipe runs, fittings and sections. HVACR.31.02
    03. Interpret specification documents and apply them to the plans. HVACR.31.03
    04. Interpret shop drawings and apply them to the plans and specifications. HVACR.31.04
    05. Develop a field set of as-built drawings. HVACR.31.05
    06. Identify the steps required for transferring design information to component production. HVACR.31.06
    07. List and classify materials most commonly used in HVAC systems. HVACR.31.07
0. Troubleshoot and repair commercial heating and air-conditioning systems--The student will be able to: HVACR.32.0
    01. Keep a record of the installation, maintenance and repair of commercial heating and air-conditioning systems. HVACR.32.01
    02. Apply local and national codes and safety practices. HVACR.32.02
    03. Lay out a commercial heating and air-conditioning system. HVACR.32.03
    04. Lay out a typical split commercial air-conditioning system. HVACR.32.04
    05. Lay out a typical split commercial heating system. HVACR.32.05
    06. Maintain, test, analyze and repair various types of commercial heating and air-conditioning systems. HVACR.32.06
    07. Maintain, troubleshoot and repair water-cooled condensers. HVACR.32.07

HVAC/R Advanced Service Practices (formerly Air-Conditioning, Refrigeration & Heating Technician') – Course Number: ACR0044

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0. Develop an understanding of hydronic systems--The student will be able to: HVACR.33.0
    01. Explain the terms and concepts used when working with hot-water heating systems. HVACR.33.01
    02. Identify the major components of hot-water heating systems. HVACR.33.02
    03. Explain the purpose of each component of hot-water heating systems. HVACR.33.03
    04. Describe the safety precautions used when working with hot water systems. HVACR.33.04
    05. Identify the common piping configurations used with hot water heating systems. HVACR.33.05
    06. Explain the principles involved and describe the procedures used in balancing hydronic systems. HVACR.33.06
    07. Select, calibrate and properly use the tools and instruments needed to balance hydronic systems. HVACR.33.07
    08. Read the pressure across a water system circulating pump. HVACR.33.08
0. Determine the properties of air--The student will be able to: HVACR.34.0
    01. Explain the principles of psychrometrics. HVACR.34.01
    02. Identify and explain the components and uses of a psychrometric meter. HVACR.34.02
    03. Identify indoor-air-quality concerns as related to psychrometrics. HVACR.34.03
    04. Determine the properties of air, using a psychrometric chart. HVACR.34.04
    05. Follow safety precautions. HVACR.34.05
    06. Identify and explain the different types and benefits of air-filtration systems, products for improving indoor-air quality. HVACR.34.06
    07. Fabricate, operate, maintain and troubleshoot air-filtration systems, air-handling systems and ventilation systems. HVACR.34.07
0. Use a pressure enthalpy chart to diagram refrigerant cycles--The student will be able to: HVACR.35.0
    01. Identify all components of the pressure enthalpy chart. HVACR.35.01
    02. Define enthalpy and entropy. HVACR.35.02
0. Explain the standards for and ways to measure indoor-air quality--The student will be able to: HVACR.36.0
    01. Identify and explain the codes and standards regarding indoor-air quality. HVACR.36.01
    02. Select and use indoor-air-quality measuring devices. HVACR.36.02
    03. Explain the standards for and ways to measure indoor-air quality using various methods. HVACR.36.03

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0. (Optional) Identify and understand pneumatic control systems for commercial heating and air-conditioning applications--The student will be able to: HVACR.37.0
    01. Identify pneumatic control systems and explain the transition to electro/pneumatic systems. HVACR.37.01
    02. Understand the functions of direct acting and reverse acting controls of pneumatic control systems. HVACR.37.02
0. Develop an understanding of chilled systems--The student will be able to: HVACR.38.0
    01. Explain the terms and concepts used when working with chilled-water cooling systems. HVACR.38.01
    02. Identify the major components of chilled-water cooling and dual-temperature water systems. HVACR.38.02
    03. Explain the purpose of each component of chilled-water cooling and dual-temperature water systems. HVACR.38.03
    04. Describe the safety precautions used when working with chilled-water systems. HVACR.38.04
    05. Explain the differences between reciprocating, rotary screw, scroll and centrifugal chillers. HVACR.38.05
0. (Optional) Maintain and repair thermal storage systems--The student will be able to: HVACR.39.0
    01. Apply appropriate codes, standards and safety practices. HVACR.39.01
    02. Describe the benefits and limitations of each type. HVACR.39.02
    03. Explain the operational principles of a thermal storage system. HVACR.39.03
    04. Identify and explain various types of thermal storage systems. HVACR.39.04
    05. Troubleshoot and test various types of thermal storage systems. HVACR.39.05

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0. Understand and explain the calculation of commercial heating and air-conditioning loads--The student will be able to: HVACR.40.0
    01. Explain conduction as a heat-load source. HVACR.40.01
    02. Describe the implications of conducting and the resistance values for different types of construction materials. HVACR.40.02
    03. Interpret heat-transfer tables and define values U, K, C and R. HVACR.40.03
    04. Locate the total heat-transfer value of any surface. HVACR.40.04
    05. Explain infiltration and exfiltration/ventilation as a heat-load source. HVACR.40.05
    06. Explain a product heat-load source. HVACR.40.06
    07. Explain miscellaneous loads (people, motors and equipment) as heat-load sources. HVACR.40.07
    08. Explain the purpose of vapor barriers. HVACR.40.08
    09. Interpret tables of specific heat values as applied to commercial heating and air-conditioning systems. HVACR.40.09
    10. Understand the importance of system design and load calculation process of heating and cooling systems. HVACR.40.10
    11. Understand and explain the methods of installing air-movement systems. HVACR.40.11
0. Balance an air distribution system--The student will be able to: HVACR.41.0
    01. Explain the fan and pump laws. HVACR.41.01
    02. Use a psychrometric chart to evaluate air properties and changes in air properties. HVACR.41.02
    03. Explain the principles involved in the balancing of air and water distribution systems. HVACR.41.03
    04. Define common terms used by manufacturers when describing grilles, registers and diffusers. HVACR.41.04
    05. Identify and use the tools and instruments needed to balance air distribution systems. HVACR.41.05
    06. Change the speed of an air distribution system supply fan. HVACR.41.06
0. Select energy conservation equipment--The student will be able to: HVACR.42.0
    01. Identify and explain the operation of energy conservation equipment. HVACR.42.01
    02. Operate selected energy conservation equipment. HVACR.42.02
0. Analyze building management systems--The student will be able to: HVACR.43.0
    01. Identify the major components of a building management system and describe how they fit together. HVACR.43.01
    02. Explain a basic direct digital controller. HVACR.43.02

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0. (Optional) Recommend alternative heating and cooling systems for various case studies--The student will be able to: HVACR.44.0
    01. Describe alternative technologies for heating such as in-floor, direct-fired makeup unit (DFMU), solar, air turnover, corn or wood pellet burners, waste oil/multi-fuel and fireplace inserts. HVACR.44.01
    02. Describe alternative technologies for heating and cooling such as ductless systems, computer rooms, chilled beams and multi-zone. HVACR.44.02

HVAC/R Advanced Commercial and Industrial Service Practices (formerly 'Refrigeration Mechanic') – Course Number: ACR0045

0. Demonstrate knowledge of retail refrigeration systems--The student will be able to: HVACR.45.0
    01. Describe the mechanical refrigeration cycle as it applies to retail refrigeration systems. HVACR.45.01
    02. Explain the differences in refrigerants and applications in low-, medium- and high-temperature refrigeration systems. HVACR.45.02
    03. Identify and describe the primary refrigeration cycle components used in retail refrigeration systems. HVACR.45.03
    04. Identify and describe the supporting components and accessories used in retail refrigeration systems. HVACR.45.04
    05. Describe the various methods of defrost used in retail refrigeration systems. HVACR.45.05
    06. Identify and describe the applications for the various types of retail refrigeration systems. HVACR.45.06
    07. Describe the control system components used in retail refrigeration systems. HVACR.45.07
    08. Explain the operating sequence of a retail refrigeration system. HVACR.45.08
    09. Interpret wiring diagrams and troubleshooting charts to isolate malfunctions in retail refrigeration systems. HVACR.45.09

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0. Demonstrate knowledge of commercial and industrial refrigeration systems--The student will be able to: HVACR.46.0
    01. Identify different types of refrigerated coolers and display cases and describe each one's common application. HVACR.46.01
    02. Compare the basic components used in commercial/industrial refrigeration systems with those used in retail refrigeration systems. HVACR.46.02
    03. Identify single, multiple and satellite compressor systems; describe the applications, installation considerations and advantages and disadvantages of each type. HVACR.46.03
    04. Identify packaged condensing units and unit coolers; describe their applications, operation and installation considerations. HVACR.46.04
    05. Identify two-stage and inverter compressors and explain their operation and applications. HVACR.46.05
    06. Identify the various accessories used in commercial refrigeration systems and explain why each is used and where it should be installed in the system. HVACR.46.06
    07. Identify the various refrigeration control devices and explain the purpose of each type and how it works. HVACR.46.07
0. Demonstrate a working knowledge of electrical generation and distribution components for commercial heating and air conditioning systems--The student will be able to: HVACR.47.0
    01. Calculate loads and design and lay out a commercial refrigeration system. HVACR.47.01
    02. Identify and explain commercial refrigeration-pressure-regulation devices, controls and components. HVACR.47.02
    03. Test and troubleshoot refrigerant-pressure-regulating devices, controls and components. HVACR.47.03
    04. Apply local and national codes and mechanical safety practices. HVACR.47.04
0. Demonstrate a working knowledge of refrigeration-system vibration and insulation--The student will be able to: HVACR.48.0
    01. Describe the applications of vibration eliminators. HVACR.48.01
    02. Identify and select the correct insulation for commercial application. HVACR.48.02

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0. Apply commercial refrigeration pipe sizing and troubleshooting procedures--The student will be able to: HVACR.49.0

    01. Determine the capacities of refrigerant lines, including the amounts they will hold, equivalent lengths of fittings and the total effective length for various pipelines. HVACR.49.01

    02. Identify and apply industry-approved installation procedures. HVACR.49.02

    03. Troubleshoot refrigeration-pipe-sizing problems. HVACR.49.03

    a. Explain the use of traps in suction-line risers. HVACR.49.03.A

    b. Explain pressure drop. HVACR.49.03.B

    c. Calculate pressure drop in liquid-line risers. HVACR.49.03.C

    d. Size double risers, hot-gas lines and liquid lines from condenser to receiver. HVACR.49.03.D

0. Use refrigeration-systems skills in commercial applications--The student will be able to: HVACR.50.0

    01. Identify and apply the safety practices used with commercial refrigeration systems. HVACR.50.01

    02. Apply refrigeration-systems skills to commercial refrigeration systems. HVACR.50.02

    a. Perform dehydration, evacuation and recovery procedures. HVACR.50.02.A

    b. Interpret blueprints and mechanical drawings. HVACR.50.02.B

    c. Service and charge a refrigeration system. HVACR.50.02.C

    d. Test, analyze and replace compressors. HVACR.50.02.D

    e. Retrofit alternative refrigerants and oils. HVACR.50.02.E

0. Demonstrate a working knowledge of refrigerated storage systems--The student will be able to: HVACR.51.0

    01. Identify and differentiate among various types of cases, such as service cases and self-service cases. HVACR.51.01

    02. Explain the operation of air-screen freezers, glass-door freezers, coffin cases and walk-in coolers. HVACR.51.02

    03. Differentiate among medium-temperature, low-temperature and ultralow-temperature systems. HVACR.51.03

    04. Explain various defrost methods. HVACR.51.04

    05. Maintain, test and troubleshoot defrost components. HVACR.51.05

    06. Identify and explain the components of various refrigerated storage systems. HVACR.51.06

    07. Maintain, test and troubleshoot various refrigerated storage system components. HVACR.51.07

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0. Diagnose, maintain and repair ice-making systems--The student will be able to: HVACR.52.0
    01. Identify and explain various types and operations of ice-making systems. HVACR.52.01
    02. Maintain, test, troubleshoot and repair various types of ice-making systems, following the manufacturers' recommendations. HVACR.52.02
    03. Identify and explain the different types of water-treatment methods and systems. HVACR.52.03
    04. Analyze water to identify water problems and the proper treatments. HVACR.52.04
    05. Install, service and repair ice machines and specialty refrigeration systems. HVACR.52.05
0. Use refrigeration electrical-system skills in commercial applications--The student will be able to: HVACR.53.0
    01. Apply electrical safety practices for commercial refrigeration systems. HVACR.53.01
    02. Apply refrigeration electrical-system skills to commercial refrigeration systems: HVACR.53.02
    a. Interpret symbols of electrical components and diagrams. HVACR.53.02.A
    b. Interpret schematics and diagrams. HVACR.53.02.B
    c. Apply electrical theory and calculations. HVACR.53.02.C
    d. Explain the principles of designing electrical systems. HVACR.53.02.D
    e. Test and troubleshoot single- and three-phase motors and variable speed electronic commutated motors (ECM). HVACR.53.02.E
    03. Test the solid-state components used in commercial refrigeration systems. HVACR.53.03
    04. Troubleshoot and diagnose the electrical circuits used in commercial refrigeration systems. HVACR.53.04
    05. Test and troubleshoot the thermostatic controls used in commercial refrigeration systems. HVACR.53.05
0. Maintain and troubleshoot commercial refrigeration systems--The student will be able to: HVACR.54.0
    01. Follow appropriate safety precautions for commercial refrigeration systems. HVACR.54.01
    02. Identify and explain the operations of various types of commercial refrigeration systems and applications, such as single, multiplex and cascade systems. HVACR.54.02
    03. Maintain and troubleshoot various types of commercial refrigeration systems. HVACR.54.03

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Plumbing (C500500)

Plumber Helper – Course Number: BCV0508

0. Describe career and training opportunities in the pipe trade industry--The student will be able to: 01.0
    01. Obtain information on current and future job opportunities in the pipe trade industry and discuss its trends. 01.01
    02. Describe career ladders (entry, intermediate and technical level careers) in each of the pipe trade industry programs and preparation requirements. 01.02
    03. Describe advanced training opportunities, including apprenticeship programs in each of the pipe trade industry programs. 01.03
0. Demonstrate a basic knowledge of the pipe trade industry--The student will be able to: 02.0
    01. Discuss the history of pipe trades. 02.01
    02. Identify pipes, fittings, materials and equipment related to the pipe trades. 02.02
    03. Identify fixtures and appliances for plumbing, fire sprinkler fitting, pipe fitting and gas fitting jobs. 02.03
    04. Define the terms used in the pipe trade industry. 02.04
0. Identify the use and care of basic tools in the pipe trade industry--The student will be able to: 03.0
    01. Identify and use the basic tools, equipment and materials of the pipe trade industry. 03.01
    02. Demonstrate the procedures/techniques for the selection, use, care and storage of tools and equipment. 03.02
    03. Compare the various tools used for plumbing and pipe fitting. 03.03
    04. Identify tools and equipment and the safety hazards associated with them. 03.04

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0. Demonstrate the importance of health, safety and environmental management systems in organizations and their importance to organizational performance and regulatory compliance--The student will be able to: 04.0
    01. Explain the importance of following safety precautions when working in the pipe trade industry. 04.01
    02. Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments. 04.02
    03. Observe safety precautions. 04.03
    04. Identify safe working practices and safe working conditions in the pipe trade industry. 04.04
    05. Explain emergency procedures to follow in response to workplace accidents. 04.05
    06. Demonstrate Cardiopulmonary Resuscitation (CPR) techniques. (Optional) 04.06
    07. Demonstrate an understanding of when and how to use first aid. 04.07
    08. Describe "Right-to-Know" Law as recorded in (29 CFR-1910.1200). 04.08
    09. Identify health related problems that may result from exposure to work related chemicals and hazardous materials, and describe the proper precautions for handling such materials. 04.09
    10. Discuss environmental concerns related to hazardous waste, chemical waste and biological waste disposal. 04.10
0. Demonstrate basic mathematics knowledge and skills--The students will be able to: 05.0
    01. Solve problems for volume, weight, area, circumference and perimeter measurements for rectangles, squares and cylinders, manually and Optionally, with the use of a calculator. 05.01
    02. Measure tolerances on horizontal and vertical surfaces using feet and inches, fractions of inches, and Optionally, using millimeters and centimeters. 05.02
    03. Analyze and apply data and measurements to solve problems and interpret documents. 05.03
    04. Solve pipe trade related basic math problems, such as piping offsets, head pressure, Pounds per Square Inch (PSI), pressure loss, slope, flow, etc. and Optionally, using metric conversion. 05.04
    05. Perform plumbing math calculations by adding, subtracting, multiplying and dividing, manually and Optionally, with the use of a calculator. 05.05

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0. Demonstrate science knowledge and skills--The student will be able to: 06.0
    01. Describe the effect of temperature and pressure changes, chemical reaction and moisture content on various plumbing systems. 06.01
    02. Explain pressure measurement in terms of PSI, inches of mercury and Kilopascal (KPA). 06.02
    03. Explain how to use alternating current meters and instruments in the pipe trades. 06.03
0. Read and interpret construction documents--The student will be able to: 07.0
    01. Read and interpret measuring devices. 07.01
    02. Draw and interpret basic isometric sketches, and Optionally, advanced isometric sketches. 07.02
    03. Identify the basic symbols used in the pipe trades. 07.03
    04. Read and interpret manufacturers' schematics and specifications. 07.04
    05. Interpret roof drains, leaders and drainage systems. 07.05
0. Read and interpret current pipe trade codes--The student will be able to: 08.0
    01. Describe the importance of following the local, state and national codes for plumbing, gas fitting and/or pipe fitting. 08.01
    02. Read and interpret current standards and codes for plumbing, gas fitting and/or pipe fitting, including the Florida Plumbing Code and the Florida Fuel Gas Code. 08.02
    03. Read and interpret basic building codes in the pipe trade industry and demonstrate knowledge of key codes and definitions regarding: drain, waste, vent sizing, water heaters, wet venting, stack venting, bathroom groups, maximum distance from p-trap to vent, etc. 08.03

Residential Plumber - Course Number: BCV0540

0. Demonstrate knowledge of basic plumbing skills--The student will be able to: 09.0
    01. Explain the basic theory and principles of plumbing. 09.01
    02. Identify: 09.02
        a. Pipe and fitting 09.02.A
        b. Pipe joining methods 09.02.B
        c. Plumbing fixtures, appliances, materials and equipment 09.02.C
        d. Valves by type, size, materials and application 09.02.D

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0. Cut and join pipes--The student will be able to: 10.0
    01. Join different types of pipes (including PVC, galvanized, steel, plastic, copper and cast iron pipes) according to plumbing codes and specifications using various methods including brazing (brazing Optional), clamping, compression, threading, flange, flaring, gasket-joint, gluing and soldering. 10.01
    02. Measure, mark and cut different types of pipes using various methods. 10.02
    03. Thread a steel pipe by hand and with a power driven vise stand or a pipe threading machine. 10.03
    04. Demonstrate proficiency in using the tools, following safety practices and procedures. 10.04
0. Demonstrate knowledge of plumbing codes--The student will be able to: 11.0
    01. Describe and explain the purpose of plumbing codes. 11.01
    02. Apply the basic theory and principles of plumbing in relation to the codes. 11.02
    03. Read and locate information in the Florida Plumbing Code. 11.03
    04. Define and explain the terms used in the plumbing codes. 11.04
    05. Explain why the code may supersede the manufacturer's specifications. 11.05
0. Read and interpret construction documents and specifications--The student will be able to: 12.0
    01. Recognize and identify plumbing symbols. 12.01
    02. Identify basic plumbing systems from the blueprint. 12.02
    03. From the blueprints and specifications, identify the plumbing fixtures and materials required for the plumbing job. 12.03
    04. Relate the blueprint to all applicable (local, state and federal) plumbing codes. 12.04
    05. Cross reference all working drawings to determine the location and elevation of the piping system and duct work. 12.05
    06. Demonstrate trade related computer skills for blueprints and specifications. 12.06
0. Layout and coordinate a job--The student will be able to: 13.0
    01. Identify specifications. 13.01
    02. Make a list of materials required to lay out a job. 13.02
    03. Determine the work aids required and the sequence of installations, according to building plans, specifications and working drawings. 13.03

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0. Layout and install, or Optionally discuss and simulate, the installation of the first rough (underground)--The student will be able to: 14.0

    01. Layout and install or Optionally, discuss and simulate the layout of an underground plumbing system. Establish a starting point according to codes and specifications. Explain the importance of coordinating with other crafts. 14.01

    02. Layout and install or Optionally, discuss and simulate the installation of the building drain, waste, vent, storm drainage and water heating and circulating systems. 14.02

    03. Layout and install or Optionally, discuss and simulate the installation of distribution systems. 14.03

    04. Layout and install or Optionally, discuss and simulate the installation of a temporary water service with backflow prevention. 14.04

    05. Layout and install or Optionally, discuss and simulate the testing and inspection of the first rough. 14.05

0. Layout and install, or Optionally discuss and simulate, the installation of the second rough (first floor & above)--The student will be able to: 15.0

    01. Layout and install or Optionally, discuss and simulate the installation and layout of a job for the first floor and above according to codes and specifications. Explain the importance of coordinating with other crafts. 15.01

    02. Layout and install or Optionally, discuss and simulate the cutting of openings in walls and floors to accommodate the pipe and fittings. 15.02

    03. Layout and install or Optionally, discuss and simulate the installation of hangers and supports. 15.03

    04. Layout and install or Optionally, discuss and simulate the installation of the building drain, waste vent, storm drainage; and water heating and circulating systems. 15.04

    05. Layout and install or Optionally, discuss and simulate the installation of distribution systems. 15.05

    06. Layout and install or Optionally, discuss and simulate the testing and inspection of the second rough. 15.06

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0. Layout and install or Optionally, discuss and simulate trim out plumbing--The student will be able to: 16.0
    01. Layout and install or Optionally, discuss and simulate how to distribute and place fixtures, appliances and equipment, including safety devices and control. 16.01
    02. Layout and install or Optionally, discuss and simulate how to trim out and install job-site fixtures, appliances and equipment including closet flanges, supply stops on water pipes, lavatory, water closets, showers, kitchen sinks, garbage disposal, ice makers, dishwashers and water heaters. 16.02
    03. Layout and install or Optionally, discuss and simulate how to install backflow assemblies as required by the local jurisdiction and code. 16.03
    04. Layout and install or Optionally, discuss and simulate how to test and inspect the final installation. 16.04
0. Explain the importance of employability and entrepreneurship skills--The students will be able to: 17.0
    01. Identify and demonstrate positive work behaviors needed to be employable. 17.01
    02. Develop personal career plan that includes goals, objectives and strategies. 17.02
    03. Examine licensing, certification and industry credentialing requirements. 17.03
    04. Maintain a career portfolio to document knowledge, skills and experience. 17.04
    05. Evaluate and compare employment opportunities that match career goals. 17.05
    06. Identify and exhibit traits for retaining employment. 17.06
    07. Demonstrate an understanding of how to calculate basic operating costs for a fictitious small plumbing business, as well as deriving a profitable labor rate for that business. 17.07
    08. Identify opportunities and research requirements for career advancement. 17.08
    09. Research the benefits of ongoing professional development. 17.09
    10. Examine and describe entrepreneurship opportunities as a career planning option. 17.10

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0. Discuss and simulate the installation of water heating and circulating systems--The student will be able to: 18.0
    01. Explain the basic theory of domestic water heating. 18.01
    02. Discuss and simulate how to design, size and layout a system. 18.02
    03. Discuss and identify the equipment and materials needed for the job in accordance with job specifications and plumbing codes. 18.03
    04. Discuss and simulate how to test and inspect the system. 18.04
0. Discuss and simulate the installation of interceptors and separators--The student will be able to: 19.0
    01. Identify various types of interceptors and separators. 19.01
    02. Explain the theory and function of various interceptors and separators. 19.02
    03. Discuss and simulate how to install and maintain lint and grease traps, gas and oil separators, and sand and sediment interceptors. 19.03
0. Discuss and simulate the installation of a storm drainage system--The student will be able to: 20.0
    01. Explain the theory of roof drains, leaders and the storm drainage system. 20.01
    02. Size and layout a storm drainage system on a plan. 20.02
    03. Identify the materials needed to install a storm drainage system in accordance with job specifications and plumbing codes. 20.03
    04. Discuss and simulate how to layout a job on site according to job specifications and plumbing codes. Explain the importance of coordinating with other trades. 20.04
    05. Discuss and simulate how to test and inspect the systems. 20.05
0. Explain the principles of backflow and cross connection control--The student will be able to: 21.0
    01. Define backflow and cross connection control. 21.01
    02. Describe the importance of backflow and cross connection control to the health of the public. 21.02
    03. Identify the proper devices and assemblies for individual applications. 21.03
    04. Explain the "degree of hazard" principle and how it relates to the installation of devices and assemblies. 21.04

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0. Explain the process of installing a medical gas system (Optional)--The student will be able to: 22.0
    01. Explain the procedures for: 22.01
        a. Installing a medical gas system in a health care facility according to applicable plumbing codes. 22.01.A
        b. Connecting medical equipment, safety devices and controls. 22.01.B
        c. Testing and inspecting medical gas systems to make sure there is no cross connection and the system is pure. 22.01.C
0. Explain how Liquid Propane Gas (LPG) and natural gas systems work--The student will be able to: 23.0
    01. Identify materials approved for the installation of LPG and natural gas systems. 23.01
    02. Explain how to size and lay out a job on site according to plumbing codes and manufacturer's specifications. 23.02
    03. Install distribution systems, including equipment, safety devices and controls. 23.03
    04. Test and inspect the systems. 23.04
0. Repair, service and maintain plumbing systems--The student will be able to: 24.0
    01. Troubleshoot and diagnose plumbing systems. 24.01
    02. Repair and replace water service and sanitary lines. 24.02
    03. Repair and replace water closets, ball cocks, flush valves, floats, lift rods, ball stoppers and trip levers. 24.03
    04. Repair leaks in traps and faucets. 24.04
    05. Repair and replace sink strainers. 24.05
    06. Repair and replace water heaters. 24.06
    07. Replace and repair fixture water supply pipes. 24.07
    08. Reseal water closets to flanges. 24.08
    09. Test and inspect repaired systems. 24.09
    10. Clear obstructions from kitchen sink, water closet, bathtub, lavatory and sewer lines, using chemicals and tools. 24.10
0. Demonstrate how to connect residential plumbing to a municipal sewer lateral (Optional)--The student will be able to: 25.0
    01. Describe who is allowed (according to municipal codes) to tap into a sewer line. 25.01
    02. Excavate from the building drain to a sewer lateral. 25.02
    03. Connect the house drain to the sewer main. 25.03
    04. Test and inspect the system. 25.04

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0. Apply plumbing applications to swimming pools and spas (Optional)--The student will be able to: 26.0
    01. Describe and explain the various types of piping materials and methods of installation. 26.01
    02. Select pumps based on swimming pool volume and pump specifications. 26.02
    03. Determine type of filtration system based on volume and use. 26.03
    04. Describe and explain how to install water heating and circulating systems for swimming pools, hot tubs and spas. 26.04
0. Identify solar systems and their components (Optional)--The student will be able to: 27.0
    01. Identify components specific to an active direct solar system. (e.g. collectors, tanks, pumps, controllers, sensors, isolation and drain valves, pressure and temperature relief valves, air vents, piping, insulation, flashing, etc.). This would apply to the components relevant to each specific type of system. 27.01
    02. Identify components specific to an active indirect solar system. 27.02
    03. Identify components specific to a passive direct solar system. 27.03
    04. Identify components specific to a passive indirect solar system. 27.04
    05. Identify components specific to a swimming pool heating solar system. 27.05
0. Adapt a solar system design (Optional)--The student will be able to: 28.0
    01. Determine active direct system components' location and system layout and configuration. 28.01
    02. Determine active indirect system components' location and system layout and configuration. 28.02
    03. Determine passive direct system components' location and system layout. 28.03
    04. Determine passive indirect system components' location and system layout and configuration. 28.04
    05. Determine solar pool system components' location and system layout and configuration. 28.05
    06. Determine installation sequence to optimize use of time and materials. 28.06
    07. Explain and discuss how to inspect all provided system components for damage prior to installation. 28.07

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0. Conduct a solar site assessment (Optional)--The student will be able to: 29.0
    01. Determine the required installation area, orientation and tilt for proposed collector installation. 29.01
    02. Establish whether there is suitable installation area with unobstructed solar access for installing collector. 29.02
    03. Determine the extent of current and future shading for any proposed collector location using typical sun path calculators or similar methods. 29.03
    04. Determine suitable location for installing all subsystem components (all valves and ancillary equipment required for complete system installation). 29.04
    05. Verify that system to be installed is appropriate for the building and climate. 29.05
    06. Verify with the homeowner the proposed location of the collector and other major components. 29.06
0. Maintain and troubleshoot a solar thermal system (Optional)--The student will be able to: 30.0
    01. Demonstrate proficiency in using tools and materials required for maintenance and troubleshooting. 30.01
    02. Interpret installation manual, wiring diagrams, drawings and other specifications to plan maintenance or repair work. 30.02
    03. Determine evaluation points for system monitoring, maintenance and troubleshooting (i.e., sensor calibration, heat exchanger fluid integrity, pump operation). 30.03
    04. Identify cause of problems based on evaluation results. 30.04
    05. Determine what repairs or system modifications are needed to restore the system to its baseline operating conditions. 30.05
    06. Perform or explain how to perform any identified repairs or modifications to restore system to manufacturer's or operator's satisfaction. 30.06

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0. Discuss the installation of solar collectors (Optional)--The student will be able to: 31.0
    01. Identify specific manufacturer's mounting design and materials. 31.01
    02. Identify different collector mounting methods suitable for roof types or other installation areas. 31.02
    03. Identify different system (in the case of ICS and thermosiphon systems, due to extra weight and components) mounting methods suitable for roof type. 31.03
    04. Identify locations for roof/wall, foundation penetrations and structural attachments. 31.04
    05. Determine multi-collector piping strategy. 31.05
    06. Discuss and simulate the installation of a collector mounting device to installation area. 31.06
    07. Explain how to lift collectors to installation area Psychomotor. 31.07
    08. Describe and simulate how to attach mounting bracket and struts (if required) to collector. 31.08
    09. Describe and simulate how to secure collector to collector mounting device. 31.09
    10. Describe and simulate how to connect collector to piping. 31.10