

Florida Department of Education  
Curriculum Framework

**Program Title:** Computer-Aided Drawing and Modeling  
**Program Type:** Career Preparatory  
**Career Cluster:** Architecture and Construction

**Career Certificate Program**

Program Number	C100300
CIP Number	0615130205
Grade Level	30,31
Standard Length	1200 Hours
Teacher Certification	Refer to the <b><u>Program Structure</u></b> section.
CTSO	SkillsUSA
SOC Codes (all applicable)	17-3011 – Architectural and Civil Drafters 17-3013 – Mechanical Drafters 17-3019 – Drafters, All Other
CTE Program Resources	<a href="http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml">http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml</a>
Basic Skills Level	Mathematics: 10 Language: 9 Reading: 9

**Purpose**

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Architecture and Construction career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Architecture and Construction career cluster.

The content includes but is not limited to the use of software to convert the engineering or architectural designs into technical drawings. Students can specialize in architectural, civil, or mechanical drafting and use technical drawings to help design everything from microchips to skyscrapers.

**Additional Information** relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

**Program Structure**

This program is a planned sequence of instruction consisting of three occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44(3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	TDR0301	CAD & Modeling I		450 hours	17-3011
B	TDR0302	CAD & Modeling II		450 hours	17-3011
C	TDR0303 <b>-OR-</b>	1) Building Information Modeling CAD Technician <b>-OR-</b>		BLDG CONSTR @7 7G DRAFTING @7 7G TECH DRAFT 7G TECH CONSTR @7 7G	300 hours
	TDR0306 <b>-OR-</b>	2) Civil/Geographic Information Systems CAD Tech. <b>-OR-</b>	17-3019		
	TDR0305	3) Mechanical CAD Technician	17-3013		

## **Common Career Technical Core – Career Ready Practices**

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

## **Standards**

After successfully completing this program, the student will be able to perform the following:

### **CAD & Modeling I**

- 01.0 Apply basic computer-aided drawing (CAD) skills
- 02.0 Demonstrate mathematics knowledge and skills.
- 03.0 Prepare multi-view drawings.
- 04.0 Prepare auxiliary drawings.
- 05.0 Apply basic dimensioning.
- 06.0 Prepare pictorial drawings.
- 07.0 Prepare surface developments.
- 08.0 Prepare basic computer-aided architectural drawings.
- 09.0 Demonstrate basic electrical/electronic literacy.
- 10.0 Perform basic computer-aided drawing functions.
- 11.0 Explain the importance of employability and entrepreneurship skills.
- 12.0 Prepare basic computer-aided two dimensional architectural drawings.
- 13.0 Prepare basic computer-aided two dimensional architectural multi-level drawings for a residential project.
- 14.0 Prepare a basic two dimensional plot plan drawing for a residential project.
- 15.0 Prepare a basic two dimensional landscape plan drawing for a residential project.
- 16.0 Prepare computer-aided mechanical working drawings.
- 17.0 Prepare computer-aided three dimensional mechanical drawings.
- 18.0 Prepare a typical two dimensional wall section for a residence.
- 19.0 Prepare a basic foundation plan drawing for a residential project.
- 20.0 Prepare a basic electrical plan drawing for a residential structure.
- 21.0 Prepare a basic heating, ventilation and air-conditioning (HVAC) plan drawing for a residential structure.
- 22.0 Prepare a basic two dimensional and isometric plumbing plan drawing for a residential structure.
- 23.0 Demonstrate mathematics knowledge and skills.

### **CAD & Modeling II**

- 24.0 Prepare computer-aided 3D architectural drawings using building information modeling (BIM) tools.
- 25.0 Prepare advanced computer-aided 3D architectural multi-level drawings for a residential BIM project.
- 26.0 Prepare an advanced three dimensional site plan drawing.
- 27.0 Prepare an advanced landscape plan drawing.
- 28.0 Prepare an advanced wall section using building information modeling.
- 29.0 Prepare an advanced drawing of a foundation plan for a residential BIM project.
- 30.0 Prepare an advanced drawing of an electrical plan for a residential BIM project.
- 31.0 Prepare an advanced drawing of a heating, ventilation & air-conditioning (HVAC) plan for a residential BIM project.
- 32.0 Prepare an advanced drawing of a plumbing plan for a residential BIM project.

### **Building Information Modeling CAD Technician**

- 33.0 Prepare computer-aided 3D architectural commercial drawings using building information modeling tools.
- 34.0 Prepare an advanced drawing of the foundation and footing plan for a commercial BIM project.
- 35.0 Prepare advanced electrical plans for a commercial BIM project.
- 36.0 Prepare three dimensional presentation drawings for a commercial BIM project.
- 37.0 Prepare structural details for a commercial BIM project.
- 38.0 Prepare structural steel drawings for a commercial BIM project.
- 39.0 Prepare reinforced concrete drawings for a commercial BIM project.
- 40.0 Prepare structural wood drawings for a commercial BIM project.
- 41.0 Prepare advanced three-dimensional computer-aided drawings for a commercial building.
- 42.0 Prepare advanced heating, ventilation and air-conditioning (HVAC) plans for a commercial BIM project.
- 43.0 Prepare advanced plumbing plan drawings for a commercial BIM project.

### **Civil Geographic Information Systems CAD Technician**

- 44.0 Demonstrate understanding of basic civil drawings.
- 45.0 Prepare computer-aided map details.
- 46.0 Understand surveying and mapping procedures.
- 47.0 Prepare advanced map drawings.
- 48.0 Prepare advanced civil drawings.
- 49.0 Demonstrate an understanding of geographic coordinate systems.
- 50.0 Perform map creation activities.
- 51.0 Perform Geographic Information System (GIS) data file creation activities.
- 52.0 Perform GIS data file manipulation activities.
- 53.0 Perform GIS spatial analysis activities.
- 54.0 Perform database operations.
- 55.0 Engage in project planning activities to expedite the completion of civil mapping projects.

### **Mechanical CAD Technician**

- 56.0 Prepare advanced mechanical drawings.
- 57.0 Prepare production drawings using 3D CAD techniques.
- 58.0 Prepare tool drawings using 3D CAD techniques.
- 59.0 Engage in project planning activities to expedite the completion of mechanical drafting projects.
- 60.0 Prepare advanced modeling analysis using Finite Element Method (FEM) techniques.

Florida Department of Education  
Student Performance Standards

Program Title: Computer-Aided Drawing and Modeling  
Career Certificate Program Number: C100300

<b>Course Number: TDR0301</b>	
<b>Occupational Completion Point: A</b>	
<b>CAD &amp; Modeling I – 450 Hours – SOC Code: 17-3011</b>	
01.0	Apply basic Computer-Aided Drawing (CAD) skills--The student will be able to:
01.01	Identify the responsibilities of beginning and experienced CAD technicians.
01.02	Use engineering design equipment, measuring scales and drawing instruments.
01.03	Distinguish between scale types and notations.
01.04	Use various lettering techniques text styles and fonts.
01.05	Identify sheet sizes and title block information.
01.06	Prepare title blocks and other design formats.
01.07	Demonstrate the use of the line weights, associated with various disciplines.
01.08	Prepare axonometric, oblique, isometric and multi-view sketches.
01.09	Prepare multi-view drawings.
01.10	Select proper plot drawing scale, views and layout.
01.11	Apply geometric construction techniques.
01.12	Relate math, writing, drawing, leadership, and communication skills in CAD technician careers.
02.0	Demonstrate mathematics knowledge and skills--The student will be able to:
02.01	Analyze and apply data and measurements to solve problems and interpret documents.
02.02	Analyze drawings using the software features, X-Y coordinates, area, distance, perimeter, etc.

02.03	Perform basic arithmetic functions using fractions and decimals.
02.04	Accurately and efficiently convert between fractions and decimals.
02.05	Use the decimal/fraction equivalent chart.
02.06	Use the appropriate mathematical process to solve geometry problems specific to each industry.
02.07	Apply multiple discipline calculations.
02.08	Perform basic quantity takeoffs from architectural or engineering drawings or sketches.
02.09	Measure tolerance(s) on horizontal and vertical surfaces using millimeters, centimeters, feet and inches.
02.10	Explain the decimal number system.
02.11	Explain integer numbers, fractional numbers, and real numbers.
02.12	Describe the binary number system.
02.13	Convert decimal numbers to binary and vice versa.
02.14	Perform binary math operations, such as add, subtract, multiply, and divide.
02.15	Explain binary algebra.
02.16	Explain the hexadecimal and octal number systems.
02.17	Convert binary numbers to hexadecimal or octal numbers and vice versa.
02.18	Explain the binary coded decimal number system and its use.
02.19	Convert decimal numbers to binary coded decimals.
02.20	Explain the Gray code number system and its use.
02.21	Explain the ASCII and EBCDIC alphanumeric codes.
03.0	Prepare multi-view drawings--The student will be able to:
03.01	Explain the principles of orthographic projection.
03.02	Describe how measurements are transferred from view to view.

03.03	Identify and explain projection planes and how they relate to multi-view drawings.
03.04	Determine the necessary views to completely describe an object in a multi-view drawing.
03.05	Prepare multi-view scaled drawings using orthographic projection.
03.06	Prepare drawings using general and local notes.
03.07	Select proper plot drawing scale, views and layout.
04.0	Prepare auxiliary drawings--The student will be able to:
04.01	Explain the projection procedures for the creation of auxiliary views.
04.02	Explain why an auxiliary view is constructed perpendicular to an angular surface.
04.03	Prepare drawings containing primary auxiliary views.
04.04	Prepare drawings containing auxiliary views that include curved lines.
05.0	Apply basic dimensioning--The student will be able to:
05.01	Explain why dimensions and notes are needed on drawings.
05.02	Identify, explain, and accurately use the two systems of linear measurement to dimension drawings.
05.03	Prepare drawings containing linear, angular and circular standard dimensions.
05.04	Dimension cylinders, holes, arcs, and angles.
05.05	Apply the general rules for dimensioning inch and/or metric drawings.
05.06	Explain the methods used in the conversion to metric dimensioning from conventional inch dimensioning.
05.07	Prepare drawings using metric dimensions.
05.08	Understand and demonstrate tolerance dimensioning.
05.09	Describe the basic principles of geometric dimensioning and tolerancing.
05.10	Explain how dimensions are generated in computer-aided drafting.
06.0	Prepare pictorial drawings--The student will be able to:



06.01	Define pictorial drawings.
06.02	Identify and compare isometric and oblique pictorial drawings.
06.03	Understand the geometric layout of an isometric view.
06.04	Use snap setting, function keys and crosshairs rotate an isometric plane orientation to assist drawing objects in isometric angles.
06.05	Illustrate one-point and two-point perspectives.
06.06	Produce a pictorial drawing of a mechanical device in a separate viewport describing an orthogonal projection drawing.
06.07	Explain how CAD and Modeling have impacted the creation of pictorial drawings.
07.0	Prepare surface developments--The student will be able to:
07.01	Define pattern development.
07.02	Describe the parallel line and radial line development methods.
07.03	Explain what a wired edge, hem, and seam are and why they are used.
07.04	Determine the bend allowance to properly dimension a flat pattern drawing in precision sheet metal work.
07.05	Construct developments of a prism, a cylinder, a cone and a pyramid.
07.06	Create developments of a transition piece.
07.07	Produce assembly drawing involving intersecting pieces.
08.0	Prepare basic computer-aided architectural drawings--The student will be able to:
08.01	Explain the importance of architectural plans.
08.02	List the types of information required when building a home.
08.03	Identify the types of plans in a set of architectural drawings.
08.04	Produce a site plan using the computer.
08.05	Produce a floor plan using the computer.
08.06	Design a roof plan using the computer.

08.07	Create a 2D drawing indicating the elevations for the project.
08.08	Illustrate a typical wall section and identify individual components.
09.0	Demonstrate basic electrical/electronic literacy--The student will be able to:
09.01	Differentiate a basic understanding of electrical and electronics drafting.
09.02	Explain why electrical and electronics drafting is diagrammatic in nature.
09.03	List the rules for creating accurate block, flow, single-line electronic and Process Instrumentation Derivative (PID) diagrams.
09.04	Draw a block diagram, flow diagram, single line diagram.
09.05	Identify electrical/electronic symbols per ANSI Y32.2, <i>Electrical and Electronics Diagrams</i> (used for ANSI Y32.14).
09.06	Identify electrical/electronic symbols per ANSI Y-32.14, <i>Logic Diagrams, Graphic Symbols</i>
09.07	Prepare schematic/block diagrams and/or electrical plans.
09.08	List and describe the common types of diagrams used in the industry.
09.09	Describe the use of CAD in electrical and electronics drafting.
09.10	Identify the electrical symbols for various pushbuttons and switches.
09.11	Describe the operation of proximity, Hall Effect, RADAR, LIDAR, and ultrasonic sensors.
09.12	Describe the history, development and use of Programmable Logic Controllers (PLC).
09.13	Name the common indicators used in PLC systems.
09.14	Explain the purpose of using indicators in a PLC system.
09.15	Explain the difference between a power relay and a control relay.
09.16	Describe the operation of a relay and a solenoid.
09.17	Name the two major types of motor control devices.
09.18	Name two types of overload relays.
10.0	Perform basic computer-aided drawing functions--The student will be able to:

10.01	Explain the value of planning your work and systems management procedures.
10.02	Identify title blocks, revision history blocks, parts lists, bills of materials and schedules using attributes and dynamic blocks.
10.03	Prepare drawing set up using templates, layouts and title blocks, external referenced backgrounds and x-referenced title blocks.
10.04	Construct geometric figures of lines, splines, circles and arcs, polylines, multiline, donuts and ellipses.
10.05	Develop and use text styles and edit text and size to annotate drawings.
10.06	Differentiate between .SHX and .TTF font extensions.
10.07	Use and control accuracy enhancement tools for entity positioning methods such as 2D and 3Dsnap and XYZ.
10.08	Identify, create, store and use standard part symbols and libraries, files for tool palettes.
10.09	Create attribute definitions.
10.10	Create blocks that contain attributes.
10.11	Insert blocks with attributes into a drawing.
10.12	Edit attribute values in existing blocks.
10.13	Edit single and multiple attribute references.
10.14	Display attribute values in fields.
10.15	Create and modify table styles.
10.16	Insert tables into a drawing.
10.17	Edit tables.
10.18	Differentiate between data extraction and object linking.
10.19	Use existing data entered in an electronic spreadsheet or Comma-Separated Value (CSV) file to create or update CAD tables.
10.20	Use data extraction procedure to reuse data from an existing CAD drawing content to create a table.
10.21	Understand how extracted data objects or linked data in the tabular format is changed and data is written back to the original file.
10.22	Utilize editing commands.

10.23	Control entity properties by layer, color and line type.
10.24	Use viewing commands to perform zooming and panning.
10.25	Create saved page setups for plotting to different plotters and sizes of paper.
10.26	Select Browse for Plot File dialog box to create Drawing Web Format or .PDF drawing output files.
10.27	Create a border information block to populate an external referenced title block including multiline attribute for sheet titles.
10.28	Differentiate between attached or overlay processes with external references.
10.29	Explain the function of the VISRETAIN variable as it relates to external reference a layering scheme.
10.30	Create a drawing with external references and two viewports of different scales.
10.31	Explain how to switch between viewports.
10.32	Define dimscale and associated scale settings associated with individual viewports.
10.33	Apply standard dimensioning rules per discipline.
11.0	Explain the importance of employability and entrepreneurship skills--The student will be able to:
11.01	Identify and demonstrate positive work behaviors needed to be employable.
11.02	Develop personal career plan that includes goals, objectives and strategies.
11.03	Examine licensing, certification and industry credentialing requirements.
11.04	Maintain a career portfolio to document knowledge, skills and experience.
11.05	Evaluate and compare employment opportunities that match career goals.
11.06	Identify and exhibit traits for retaining employment.
11.07	Identify opportunities and research requirements for career advancement.
11.08	Research the benefits of ongoing professional development.
11.09	Examine and describe entrepreneurship opportunities as a career planning option.
11.10	Demonstrate knowledge of the "Right-To-Know Law" as recorded in (29 CFR-1910.1200).

12.0	Prepare basic computer-aided two dimensional architectural drawings--The student will be able to:
12.01	List the information required on a typical floor plan.
12.02	Create and dimension a 2D floor plan.
12.03	Determine diametric interior and exterior elevation and section views.
12.04	Establish perspective exterior views.
13.0	Prepare basic computer-aided two dimensional architectural multi-level drawings for a residential project--The student will be able to:
13.01	Produce a 2D first floor plan.
13.02	Produce a 2D second floor plan.
13.03	Design basic roof framing layout drawing.
13.04	Create four exterior elevations using the computer using different viewports with varied scale configurations.
13.05	Construct a second floor framing plan.
14.0	Prepare a basic two dimensional plot plan drawing for a residential project--The student will be able to:
14.01	Layout a 2D residential plot.
14.02	Indicate plot size and limits.
14.03	Indicate plot orientation.
14.04	Layout a public street and sidewalk.
14.05	Locate building setback lines and public utility easements.
14.06	Write a plot legal description.
14.07	Dimension a building location.
14.08	Layout and label specialty features (patio / pool / gazebo).
15.0	Prepare a basic two dimensional landscape plan drawing for a residential project--The student will be able to:
15.01	Develop a list of landscape symbols.

15.02	Layout landscape features.
15.03	Develop a schedule of plants/shrubs.
16.0	Prepare computer-aided mechanical working drawings--The student will be able to:
16.01	Produce dimensioned multi-view drawings applying CAD techniques.
16.02	Name the six Two Dimensional (2D) views possible in orthographic projection.
16.03	Create construction lines using the XLINE and RAY commands as a drawing aid to align the objects in each view.
17.0	Prepare computer-aided three dimensional mechanical drawings--The student will be able to:
17.01	Describe three differences between parametric modeling and traditional 2D computer-aided drafting techniques.
17.02	Describe how the parametric modeling approach conforms to the design philosophy of "shape before size."
17.03	Use design intent as evidenced using parametric modeling, geometric and dimensional constraints, relational parametric equations.
17.04	Describe how parametric modeling updates entire systems by changing one parameter of complex designs.
17.05	Discuss the principles behind solid and surface modeling techniques.
17.06	Discuss techniques for creating accurate 3D model features.
17.07	Discuss detailed uses of 3D coordinates, user coordinate systems, and viewports.
17.08	Use various techniques for editing 3D objects.
17.09	Follow guidelines for using text in 3D drawings.
17.10	Select CAD software tools available for creating drawing views.
17.11	Identify methods for assigning materials, creating lights, and setting up scenes for rendering.
17.12	Describe animation tools and techniques used in CAD software.
17.13	Demonstrate understanding in sharing coordinates between 3D models, acquiring and reacquiring shared coordinates.
18.0	Prepare a typical two dimensional wall section for a residence--The student will be able to:
18.01	Produce a two-story residential wall section.

18.02	Apply notes and dimensions to residential wall section.
19.0	Prepare a basic foundation plan drawing for a residential project--The student will be able to:
19.01	Produce a foundation plan drawing for a residence.
19.02	Generate foundation detail drawings.
20.0	Prepare a basic electrical plan drawing for a residential structure--The student will be able to:
20.01	Design an electrical plan for a residence.
20.02	Apply electrical symbols legend to electrical plan.
20.03	Create the one-line and corresponding riser diagram for a residence.
20.04	Distinguish the difference between panel and feeder schedules used in architectural plans.
21.0	Prepare a basic heating, ventilation and air-conditioning (HVAC) plan drawing for a residential structure--The student will be able to:
21.01	List features included on a residential climate control plan.
21.02	Estimate the ductwork for a typical forced-air system.
21.03	Compute an appropriate heating or cooling unit for a given structure.
21.04	Categorize HVAC symbols and legend for a HVAC plan.
21.05	Produce a HVAC plan for a residence.
21.06	Explain types of HVAC schedules used in residential and commercial architecture plans.
22.0	Prepare a basic two dimensional and isometric plumbing plan drawing for a residential structure--The student will be able to:
22.01	Explain the purpose of a residential plumbing system.
22.02	Identify the elements contained in a residential water supply system.
22.03	Identify the elements in a water and waste removal system.
22.04	Explain the layout of a private sewage disposal system.
22.05	Develop a plumbing plan for a residence.

22.06	Create plumbing symbols and legend for a plumbing plan.
22.07	Create single-line plumbing isometric riser diagrams indicating domestic water and waste venting of overhead runs.
22.08	Discuss considerations related to healthy architectural design and construction.
22.09	Explain considerations related to hazardous waste disposal and storage.
23.0	Demonstrate mathematics knowledge and skills--The student will be able to:
23.01	Analyze and apply data and measurements to solve problems and interpret documents.
23.02	Create formulas in table cells to perform calculations.
23.03	Generate expressions with common operators used for mathematical expressions.
23.04	Calculate sum, average or count of a range of cells in a tabular format.

**Course Number: TDR0302**  
**Occupational Completion Point: B**  
**CAD & Modeling II – 450 Hours – SOC Code: 17-3011**

24.0	Prepare computer-aided 3D architectural drawings using building information modeling (BIM) tools--The student will be able to:
24.01	Explain the concept of building information modeling (BIM).
24.02	Explain the difference between sustainability and green building.
24.03	List seven major sustainable design concepts and explain how they apply to residential design.
24.04	Create a floor plan.
24.05	Generate isometric, diametric, interior and exterior views.
24.06	Select perspective exterior views.
25.0	Prepare advanced computer-aided 3D architectural multi-level drawings for a residential BIM project --The student will be able to:
25.01	Produce a first floor plan from the residential BIM model.
25.02	Produce a second floor plan from the project model.



25.03	Produce two-story interior and exterior elevation drawings by positioning markers appropriately.
26.0	Prepare an advanced three dimensional site plan drawing--The student will be able to:
26.01	Layout an advanced 3D residential site plan using topographical elevation data.
26.02	Indicate plot size and limits.
26.03	Indicate plot orientation.
26.04	Dimension building location.
26.05	Identify national certification programs including Leadership in Energy & Environmental Design (LEED) Green Building ratings.
27.0	Prepare an advanced landscape plan drawing--The student will be able to:
27.01	Categorize a list of landscape symbols using attributes.
27.02	Layout advanced landscape features in a site plan.
27.03	Develop a schedule of plants/shrubs in tabular format.
28.0	Prepare an advanced wall section using building information modeling--The student will be able to:
28.01	Produce an advanced two-story residential wall section through section marker positioning on the floor plan.
28.02	Apply notes and dimensions to an advanced residential wall section.
29.0	Prepare an advanced drawing of a foundation plan for a residential BIM project--The student will be able to:
29.01	Produce an advanced foundation plan drawing for a residence.
29.02	Create advanced foundation detail drawings.
30.0	Prepare an advanced drawing of an electrical plan for a residential BIM project--The student will be able to:
30.01	Design an advanced electrical plan for a residence.
30.02	Apply electrical symbols and legend for an advanced electrical plan.
31.0	Prepare advanced drawing of a heating, ventilation & air-conditioning (HVAC) plan for residential BIM project.--The student will be able to:
31.01	Categorize HVAC symbols and legend for an advanced HVAC plan.

31.02	Produce an advanced HVAC plan for a residence.
32.0	Prepare an advanced drawing of a plumbing plan for a residential BIM project--The student will be able to:
32.01	Categorize plumbing symbols and legend for an advanced plumbing plan.
32.02	Produce an advanced plumbing plan for a residence.

**NOTE: Students may choose one of the following courses for the completion of OCP C: TDR0303, TDR0305 or TDR0306  
OCP C - OPTION 1:**

**Course Number: TDR0303  
Occupational Completion Point: C – Option 1  
Building Information Modeling CAD Technician – 300 Hours – SOC Code: 17-3011**

33.0	Prepare computer-aided 3D architectural commercial drawings using building information modeling tools--The student will be able to:
33.01	Explain the principles of building information modeling (BIM).
33.02	Describe the characteristics of a BIM model.
33.03	List and describe major BIM processes used in a building project.
33.04	Explain the common tools and processes used in parametric modeling.
33.05	Describe common processes used to coordinate models between different engineering disciplines.
33.06	Explain applications for a BIM model in facility management.
33.07	Explain the common tools and processes used in parametric modeling.
33.08	Interpret catalogs, specifications, technical tables, codes and ordinances for commercial buildings.
33.09	Draw floor plans for a commercial building.
33.10	Draw diametric interior and exterior elevations for a commercial building.
33.11	Draw perspective exterior views for a commercial building.
33.12	Apply notes and dimensions to wall section for a commercial building.
34.0	Prepare an advanced drawing of the foundation and footing plan for a commercial BIM project--The student will be able to:

34.01	Produce an advanced dimensioned foundation and footing plan drawing for a commercial building.
34.02	Create advanced foundation detail drawings for a commercial building.
35.0	Prepare advanced electrical plans for a commercial BIM project--The student will be able to:
35.01	Produce advanced electrical plans for a multi-story commercial building.
35.02	Apply electrical symbols legend to advanced electrical plans.
36.0	Prepare three dimensional presentation drawings for a commercial BIM project--The student will be able to:
36.01	Produce color pictorial drawings for a commercial building.
36.02	Generate dynamic presentation views or walk-throughs.
36.03	Create a drawing portfolio of a commercial BIM project.
37.0	Prepare structural details for a commercial BIM project--The student will be able to:
37.01	Interpret structural manuals and technical tables.
37.02	Draw structural connections.
37.03	Create a graphical column schedule for a commercial BIM project.
38.0	Prepare structural steel drawings for a commercial BIM project--The student will be able to:
38.01	Interpret codes and American Institute of Steel Construction (AISC) specifications.
38.02	Use the Manual of Steel Construction and other technical data.
38.03	Explain the product fabrication processes for structural steel.
38.04	Calculate reactions and stresses.
38.05	Perform weight calculations for structural steel.
38.06	Interpret shear and moment diagrams.
38.07	Explain the application of bolted, welded, riveted, split-ring, and shear-plate in heavy construction.
38.08	Detail bolted connections.

38.09	Detail welded connections.
38.10	Detail complete structural steel baseplate, framed and seated connections.
38.11	Produce erection plans and schedules.
38.12	Determine an advanced bill for ordering materials.
38.13	Interpret common welding symbols.
38.14	Produce properly constructed structural steel framing plans according to engineering specifications.
39.0	Prepare reinforced concrete drawings for a commercial BIM project--The student will be able to:
39.01	Identify four basic types of framing plans in precast concrete framing plans.
39.02	Interpret codes and specifications per current American Concrete Institute (ACI) standards.
39.03	Interpret engineering drawings and shop drawings for a set of precast concrete structural working drawings.
39.04	Identify product schedules found in framing plans.
39.05	Define precast concrete sections.
39.06	Create an annotated example of a typical section cutting symbol.
39.07	Identify the rules for assigning mark numbers.
39.08	Produce precast concrete full, partial, and offset sections in precast concrete working drawings.
39.09	Create column detail drawings.
39.10	Produce footing and foundation drawings for a commercial building.
39.11	Create floor and roof detail drawings for a commercial building.
39.12	Create special structure detail drawings for a commercial building.
39.13	Determine a reinforcing bar list and schedule.
39.14	Define poured-in-place concrete construction.
39.15	Define engineering drawings and placing drawings as used in poured-in-place concrete drafting.

39.16	Identify common abbreviations and symbols used in poured-in-place drawings.
39.17	Assign and interpret mark numbers for structural concrete members.
39.18	Produce engineering and placing drawings for poured-in-place concrete foundations.
39.19	Produce engineering and placing drawings for poured-in-place concrete wall systems, components and concrete columns
39.20	List the four basic categories of poured-in-place concrete walls and identify methods for each category.
39.21	Perform cubic yard calculations for concrete.
40.0	Prepare structural wood drawings for a commercial BIM project--The student will be able to:
40.01	Identify the four most common materials used in the construction of residential and commercial building.
40.02	Identify qualities that make these materials environmentally friendly.
40.03	Cite the four common framing systems used with wood construction.
40.04	Interpret codes and specifications.
40.05	Create fastening and connection details.
40.06	Produce framing plans.
40.07	Perform board feet calculations for structural wood.
41.0	Prepare advanced three-dimensional computer-aided drawings for a commercial BIM project--The student will be able to:
41.01	Produce advanced 3D CAD drawings for a commercial building.
42.0	Prepare advanced heating, ventilation and air-conditioning (HVAC) plans for a commercial BIM project--The student will be able to:
42.01	Explain the purpose and function of HVAC systems.
42.02	Produce advanced HVAC drawings for a commercial building including plans, schedules and details.
42.03	Construct a HVAC symbols legend for a HVAC plan.
42.04	Create sheet metal pattern developments and intersections.
42.05	Calculate and apply bend allowances to sheet metal components.

42.06	Reconstruct and completely dimension precision sheet metal fabrication drawings.
43.0	Prepare advanced plumbing plan drawings for a commercial BIM project--The student will be able to:
43.01	Interpret the different kinds of pipe and their uses.
43.02	Interpret the methods of pipe connections and particular applications.
43.03	Identify pipe fittings and valves.
43.04	Produce dimensioned, single-line and double-line piping drawings using pipe fittings and valves.
43.05	Translate piping riser diagrams and spool drawings using piping plans and elevations.
43.06	Produce advanced plumbing plans for a commercial building.
43.07	Classify a plumbing symbols legend for commercial plumbing plan.

**NOTE: Students may choose one of the following courses for the completion of OCP C: TDR0303, TDR0305 or TDR0306**

**OCP C - OPTION 2:**

**Course Number: TDR0306**

**Occupational Completion Point: C – Option 2**

**Civil/Geographic Information Systems CAD Technician – 300 Hours – SOC Code: 17-3019**

44.0	Demonstrate understanding of basic civil drawings--The student will be able to:
44.01	Describe how sustainable sites/landscaping offer innovation in the application of resources needed to create the built environment.
44.02	Understand civil terminology.
44.03	Read and interpret civil drawings.
44.04	Prepare civil plans with topography and profile drawing.
45.0	Prepare computer-aided map details--The student will be able to:
45.01	Produce a map using bearings.
45.02	Produce a map using coordinates.
45.03	Convert map into metric dimensions.

46.0	Understand surveying and mapping procedures--The student will be able to:
46.01	Analyze basic mapping specifications.
46.02	Interpret aerial photogrammetry.
46.03	Identify horizontal measures.
46.04	Identify leveling procedures.
46.05	Interpret angular measurements and quantify results in addition and subtraction of bearings and azimuths in boundary surveys.
46.06	Interpret legal descriptions.
47.0	Prepare advanced map drawings--The student will be able to:
47.01	Compile traverse drawings.
47.02	Produce street layout drawings using alignments.
47.03	Create advanced map drawings.
47.04	Construct highway drawings featuring intersections.
47.05	Generate topographic drawings.
48.0	Prepare advanced civil drawings--The student will be able to:
48.01	Devise drainage drawings designed for storm water run-off.
48.02	Produce plat drawings indicating building setback lines and public utility easements.
48.03	Generate advanced plan and profile drawings.
48.04	Create utility drawings.
49.0	Demonstrate an understanding of geographic coordinate systems--The student will be able to:
49.01	Differentiate between different models for the shape of the earth.
49.02	Describe the characteristics of a global coordinate system.
49.03	Describe the characteristics of geographic datum.

49.04	Compare and contrast different map projections.
49.05	Detail the characteristic of the Cartesian coordinate system.
49.06	Detail the Universal Transverse Mercator (UTM), universal polar stereographic (UPS) and State Plane coordinate systems.
49.07	Find and organize geographic data and other content for mapping projects.
49.08	Share GIS maps and analysis results so they are easily accessible to desktop, web, and mobile device users.
49.09	Accurately display features on Geographic Information System (GIS) maps and access information about them.
49.10	Plan cartographic projects.
50.0	Perform map creation activities--The student will be able to:
50.01	Create and share GIS maps.
50.02	Set the appropriate geographic coordinate system for maps in the GIS application.
50.03	Add geographic data layers to a GIS application.
50.04	Manipulate data files that do not align correctly.
50.05	Symbolize each layer appropriately.
50.06	Label map features as needed.
50.07	Add map components such as legends, titles, scale bars, north arrows.
50.08	Publish the complete map in paper and electronic formats.
51.0	Perform GIS data file creation activities--The student will be able to:
51.01	Subset existing GIS data files to create new files.
51.02	Combine existing, adjacent GIS data files together to create new files.
51.03	Collect coordinate information using a Global Positioning System (GPS) receiver in the correct geographical coordinate system.
51.04	Create new GIS data files using coordinate information.
51.05	Register aerial photographs or satellite images to a specific geographical coordinate system.



51.06	Create new GIS data files by digitizing on top of registered images.
52.0	Perform GIS data file manipulation activities--The student will be able to:
52.01	Create, delete and move GIS files between folders and computers.
52.02	Import metadata into GIS files.
52.03	Set coordinate system information for a GIS file.
52.04	Reproject GIS files to different coordinate systems.
52.05	Rectifying / rubber-sheeting arbitrary coordinate systems into defined coordinate systems.
52.06	Create appropriate geodatabase structures to organize data for efficient storage, display, and editing.
52.07	Add and delete fields in a GIS database.
52.08	Manipulate values of fields within a GIS database.
52.09	Choose appropriate data, methods, and tools to plan, execute, and document a given analysis project.
53.0	Perform GIS spatial analysis activities--The student will be able to:
53.01	Generalize maps by merging adjacent areas if they contain the same or similar attributes.
53.02	Overlay GIS files that cover the same area to create new files.
53.03	Create buffers around map features.
53.04	Manipulate Digital Elevation Models (DEM's) to create slope, aspect, view shed and hill shade layers.
53.05	Create density maps from point features.
53.06	Interpolate point features to create continuous surfaces.
53.07	Generate spatial statistics on GIS files.
53.08	Interpret spatial analysis to answer questions and create new information.
53.09	Add rules and behaviors to ensure the spatial and attribute integrity of geographic data.
54.0	Perform database operations--The student will be able to:

54.01	Build a relational database.
54.02	Query, display and format data.
54.03	Save, retrieve and run queries.
54.04	Build and format reports.
54.05	Group and summarize data.
54.06	Insert, update, automatically generate and delete data.
54.07	Control transaction processing.
54.08	Create, confirm, modify and remove tables to store data.
54.09	Apply business rules to ensure data integrity.
54.10	Restrict user access to tables.
54.11	Improve query performance.
54.12	Develop programs using Structured Query Language (SQL).
54.13	Insert and manipulate data with SQL.
54.14	Choose appropriate data to support cartographic needs.
55.0	Engage in project planning activities to expedite the completion of civil drafting projects--The student will be able to:
55.01	Understand requirements to schedule and plan for civil project tasks including mitigation as a result of impact on the environment.
55.02	Understand the processes to network with stakeholders to manage budgets, resources, and deadlines.
55.03	Produce project deliverables per phasing and negotiated obligations.

**NOTE: Students may choose one of the following courses for the completion of OCP C: TDR0303, TDR0305 or TDR0306**

**OCP C - OPTION 3:**

**Course Number: TDR0305**

**Occupational Completion Point: C – Option 3**

**Mechanical CAD Technician – 300 Hours – SOC Code: 17-3013**

56.0	Prepare advanced mechanical drawings--The student will be able to:
56.01	Create extruded solid models.
56.02	Understand the basic parametric modeling procedure.
56.03	Create 2D sketches.
56.04	Indicate the Engineering Change Orders (ECO's) procedure used in mechanical drawing revision documentation.
56.05	Make engineering changes on drawings.
56.06	Create and edit parametric dimensions.
56.07	Understand constructive solid geometry concepts.
56.08	Create a binary tree.
56.09	Understand the basic boolean operations.
56.10	Understand the importance of the Order of Features.
56.11	Understand the concept and usage of the Base, Origin, Root, Note (BORN) technique.
56.12	Understand the importance of Parent/Child Relations in features.
56.13	Create drawing layouts from solid models.
56.14	Identify the various manufacturing methods.
56.15	Use precision dimensioning to include Geometric Dimensioning and Tolerancing (GDT) for fits and finishing.
56.16	Construct fastener drawings.
56.17	Generate a cam drawing with dimensions.
56.18	Identify diagrams that explain the shape and size of cams.
56.19	Explain terminology related to cams.
56.20	Understand the meaning and draw a cam displacement drawing.
56.21	Identify three types of gears with the individual representations and specifications.

56.22	Create a gear drawing with dimensions.
56.23	Create a Geneva Cam assembly with housing and produce a 3D print or animation of the working mechanism.
56.24	Produce a spring drawing with dimensions.
57.0	Prepare production drawings using 3D CAD techniques--The student will be able to:
57.01	Generate pattern shop detail drawings.
57.02	Reconstruct casting drawings.
57.03	Make forging detail drawings.
57.04	Generate machining detail drawings.
57.05	Create 3D stamping drawings.
57.06	Make 3D welding drawings.
57.07	Construct installation drawings.
57.08	Generate a Bill of Materials (BOM) using attributes and tabular format within a drawing.
57.09	Export tables to an external database or an electronic spreadsheet.
58.0	Prepare tool drawings using 3D CAD techniques--The student will be able to:
58.01	Produce 3D jig and fixture drawings.
58.02	Create 3D cutting die drawings.
58.03	Design 3D forming die drawings.
59.0	Engage in project planning activities to expedite the completion of mechanical drafting projects--The student will be able to:
59.01	Understand what it takes to schedule and plan mechanical project tasks.
59.02	Define Just-In-Time communication and explain how it optimizes factory and plant operations.
59.03	Define Supervisory Control and Data Acquisition (SCADA) and state the functional tasks involved with automation systems.
59.04	Identify industrial electrical symbols for various pushbuttons, switches, relays and indicators.

59.05	Describe the types of temperature sensors used in industrial settings.
59.06	Explain the difference between a power relay and a control relay.
59.07	Name the common indicators used in Programmable Logic Controller (PLC) systems.
59.08	Explain the purpose of using indicators in a PLC system.
59.09	Describe the operations of a relay and solenoid.
59.10	Indicate the sequence of operation of a given application.
59.11	Name the two major types of motor control devices.
59.12	Name two types of overload relays.
59.13	Use symbols to represent different types of input and output devices.
59.14	Create relay logic diagrams using the standard relay logic rules.
59.15	Create relay logic circuits for process and industrial control problems.
59.16	List the rules for creating a PLC ladder logic diagram.
59.17	Convert a relay logic diagram to a PLC ladder logic diagram.
59.18	Use the force instruction for troubleshooting.
59.19	Describe combinational and sequential logic gate circuits.
59.20	Create PLC ladder logic programs for NOT, AND, OR, NAND, NOR, XOR, and XNOR logic gates.
59.21	Create Boolean expressions and logic gate circuits from truth tables.
59.22	Simplify Boolean expressions.
59.23	Convert Boolean expressions to PLC ladder logic diagrams.
59.24	Convert PLC ladder logic diagrams to logic gate circuits and Boolean expressions.
59.25	Use timer and counter instructions to create PLC ladder logic diagrams.
59.26	Program the add, subtract, multiply and divide instructions into the PLC ladder logic diagram.

59.27	Explain the meaning of PLC indicator lights.
59.28	Use forced instructions to check PLC input and output ports.
59.29	Name the common devices used in a PLC network.
59.30	Describe the three main elements of a PLC network.
59.31	Explain the relationship between programs, tasks, and routines.
59.32	PLC programming to achieve PLC control of various industries.
59.33	Understand how to network with stakeholders to manage budgets, resources and deadlines.
59.34	Produce project deliverables per phasing and negotiated obligations.
60.0	Prepare advanced modeling analysis using Finite Element Method (FEM) techniques--The student will be able to:
60.01	Define the Finite Element Method (FEM).
60.02	Describe FEM through variational formulation, a discretization strategy, solution algorithm(s) and post-processing procedures.
60.03	Understand the difference between dynamics and statics process in mathematical terms needed to solve simulations.
60.04	Explain how stresses are calculated using linear static analysis based on the finite element method.
60.05	Understand general theory of Finite Element Analysis (FEA).
60.06	Identify the general procedures that are necessary to carry out an analysis.
60.07	Quantify the accuracy (or inaccuracy) of the analysis with reasonable success.
60.08	Perform comprehensive evaluation and checking when interpreting results.
60.09	Understand the overall physics and engineering of the problem to be solved, and the loads and boundary conditions to apply.
60.10	Identify the relevant material properties and the different reactions to boundary conditions of the model.
60.11	Use the appropriate material type for linear analyses, including isotropic material, orthotropic & anisotropic element shell definitions.
60.12	Clarify what the problem is, what is being modeled and formulate a systematic plan of analysis.
60.13	Understand requirements of any particular design intent and the circumstance(s) as to which form(s) of analysis is required to solve.

60.14	Consider manufacturing and operating environments of a product and how the factors might impinge on the performance.
60.15	Understand how a product reacts to various physical effects and which analysis is utilized given specific parameters.
60.16	Know relationships between elements, element nodes and how interpolation is based on all possible support and load scenarios.
60.17	Understand how each node is described by a number of parameters depending on the analysis type and the element used.
60.18	Understand in structural analysis how the response of a node is described by the degrees of freedom for each occurrence.
60.19	Perform a typical Linear Stress Analysis systematic description of components of FEM programs.
60.20	Integrate the resultant components to facilitate problem solving the workflow for a FEA process model.
60.21	Create 3-dimensional model geometry.
60.22	Assign physical material properties.
60.23	Create a mesh of the model.
60.24	Apply loads and constraints.
60.25	Run the simulation.
60.26	Generate a report and review results.
60.27	Describe how results of FEA can be presented in various forms including x-y plots and contour plots.
60.28	Determine if design changes are required to reduce the chance of failure, improve performance, or optimize for cost; use the results.
60.29	Examine licensing, certification and industry credentialing requirements, specifically Professional Simulation Engineer certification.
60.30	Present basic information that is necessary for the safe use of finite element analysis.
60.31	Understand the qualification of assumption is the key to the successful use of finite element analysis in any product design.

## **Additional Information**

### **Laboratory Activities**

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

### **Special Notes**

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student. Access MyCareerShines by visiting: [www.mycareershines.org](http://www.mycareershines.org).

### **Career and Technical Student Organization (CTSO)**

SkillsUSA is the intercurricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

### **Cooperative Training – OJT**

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

### **Basic Skills (if applicable)**

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 10, Language 10, and Reading 10. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement



(Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

### **Accommodations**

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

### **Additional Resources**

For additional information regarding articulation agreements, Bright Futures Scholarships, Fine Arts/Practical Arts Credit and Equivalent Mathematics and Equally Rigorous Science Courses please refer to: <http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml>