

## **Computer Aided Drafting and Design**

### Associate of Applied Science

The Computer Aided Drafting (CAD) program prepares students to enter the workforce as a skilled CAD technician for who are equipped with a solid foundation for drafting positions in manufacturing, engineering, and other areas requiring production-ready drawings and 3-dimensional or 3D printed models. Students will learn to prepare 2D and 3D projects for fabrication using the latest releases of multiple CAD software. In addition, students will acquire skills in subject matter of design principles, industry standards, fabrication materials, manufacturing applications, tolerance methods and analysis, problem-solving techniques and general organizational skills.

Career opportunities include drafting and engineering technician, project technician, design technician, draftsperson, and certified document technician. These career options play a critical role in product planning and the design of assembly parts and products which are to be fabricated and produced. With additional equipping and/or education, additional career options include mechanical engineer, commercial or industrial designer, civil engineer, product designer, and project designer.

Degree opportunities are:

**CAD Mechanical** Emphasis- this emphasis students are trained to be CAD technicians in manufacturing, engineering, fabrication, and other areas requiring production-ready drawings and solid 3-dimensional models. Assisting with the design of residential and commercial buildings in an architectural or construction office. Subject matter such as design principles, technical drawing, print reading, product documentation, and fabrication materials and methods are included.

Learning outcomes: Upon completion of the program Computer Aided Drafting program Mechanical emphasis, students should be able to:

- Develop and produce a technical engineering assembly drawing applying current industry standards for manufacturing.
- Analyze part function and relationship to each other including tolerance of parts for assemblies while calculating and applying mating part conditions for a guaranteed assembly fit.
- Develop and produce rapid prototypes using additive manufacturing technology and appropriate 3D printing material.

**CAD Robotics and Automation** Emphasis - this emphasis students are prepared for entry level careers as a CAD technician in the robotics and automation field. Graduates become qualifies to work in electronic automation and in control systems environments. Students in this program are trained on the principles behind robotic and automation technology while focusing on principles of robotics, design, programming, operation of robotic systems, and robotics system maintenance topics such as programmable logic controllers, sensors and transducers, and fundamentals of DC/AC

Learning outcomes: Upon completion of the program Computer Aided Drafting program Robotics & Automation emphasis, students should be able to:

- Interpret and produce industrial 2D working drawings and 3D models based on industry standards.
- Use the SolidWorks software package to create advanced models, parts, assemblies, and related documents (e.g., bill of materials, parts lists).
- Produce parts and assemblies using additive manufacturing with 3D printing.
- Construct, test, and troubleshoot electronic and digital circuits.
- Solder electronic components on circuit boards.

- Program, maintain, and troubleshoot robotic system.
- Explain the architecture, hardware, programming languages, and input and output capabilities of microcontrollers.
- Program a microcontroller to execute code.
- Construct, test, and evaluate basic industrial control systems in robotic and automation technology.

**CAD HVAC Emphasis-** this emphasis students are prepared for entry level careers as a CAD technician in the heating, air conditioning and refrigeration field. This field of work involves different trade disciplines in residential and commercial heating, ventilation, air conditioning, and refrigeration. This includes drafting technician positions in mechanical, electrical, and heating systems while learning basic refrigeration, fundamentals of gas heating, and electricity for HVAC systems for both residences, and large facilities.

Learning outcomes: Upon completion of the program Computer Aided Drafting program HVAC emphasis, students should be able to:

- Interpret and produce industrial 2D working drawings and 3D models based on industry standards.
- Use the SolidWorks software package to create advanced models, parts, assemblies, and related documents (e.g., bill of materials, parts lists).
- Explain basic theory and components of refrigeration systems.
- Calculate current, voltage, and power in AC and DC circuits.
- Apply computations of circuit analysis and troubleshooting with basic test equipment.
- Discuss basics of gas heating systems, operation of gas valves and burners, to include gas pipe system design.
- Apply basic code requirements for heating systems.
- Examine the operation of hot water heating systems, to include installation, maintenance and repair.

Interested students should schedule appointments with CAD program advisor prior to enrolling. Students may address and complete prerequisite requirements with the beginning program courses. Students not meeting a course prerequisite must have prior permission in order to enroll in the course.

**General Education Courses**

CIS 118	Introduction to PC Applications	3
	or	
CSC 105	Computer Literacy	(3)
COM 225	Organizational Communication	3
ENG 131	Technical Writing I or higher	3
MAT 107	Career Math or higher	3
	Three (3) additional credit hours from list below	<u>3</u>
		15

**Three (3) additional credit hours**

BUS 115	Introduction to Business	3
COM 125	Interpersonal Communication	3
PSY 100	Psychology of Workplace Relationships	3

**Additional Required Courses (all emphasis areas)**

CAD 100	Print Reading for CAD	3
CAD 101	Computer Aided Drafting I	3
CAD 102	Computer Aided Drafting II	3
CAD 153	Introduction to Pro Engineer/Basics	3
CAD 255	SolidWorks/Mechanical	3
EGT 103	Applied Dimension & Tolerance	3
EGT 210	Mechanical Design III	<u>3</u>
		21

## Emphasis Areas

### Mechanical Emphasis

EGT 205	Geometric Dimensioning & Tolerance	3
MAC 100	Machine Shop Safety	1
MAC 101	Introduction to Machine Shop	3
CAD 262	3D Printing	3
MTE 130	Metrology	3
MTE 247	Strengths of Materials	3
Electives	Choose nine (9) hours from technical electives list	<u>9</u>
		25
<b>Total Hours for Mechanical Degree Emphasis</b>		<b>61</b>

### Robotics & Automation Emphasis

ELT 106	Fundamentals of DC/AC	4
ELT 146	Digital Devices in Computers	3
ELT 165	Electronic Assembly	3
ELT 252	Motors & Controls	3
ELT 258	Programmable Logic Controllers	3
ELT 262	Intro to Microcontrollers	3
ELT 267	Intro to Robotics	1
ELT 268	Robotics Technologies	3
Elective	Choose 3 (three) hours from technical electives list	<u>3</u>
		26
<b>Total Hours for Electronics Degree Emphasis</b>		<b>62</b>

### HVAC Emphasis

HVA 102	Basic Refrigeration	4
HVA 105	Electricity for HVAC/R	4
HVA 110	Fundamentals of Gas Heating	4
HVA 111	Piping Skills for HVAC/R	4
HVA 247	Hot Water Heating Systems	4
Electives	Choose <b>six (6)</b> hours from technical electives list	<u>6</u>
		26
<b>Total Hours for HVAC Degree Emphasis</b>		<b>62</b>

### Technical Electives

CAD 253	Advanced Creo	3
CAD 240	Inventor I/Autodesk	3
CAD 259	Advanced SolidWorks	3
CAD 262	3D Printing	3
CAD 266	Advanced 3D Printing	3
CAD 280	Internship	3
MAC 205	Introduction to CNC Milling Operations	3
MAC 206	CNC Milling Operations II	3
MAC 240	CAD/CAM 2D	3
MAC 241	CAD/CAM 2D Lab	3

## Certificates

### Advanced CAD Technical Skills

#### Advanced CAD Technical Skills Certificate

The Advanced CAD Technical Skills Certificate is designed for students to learn a variety of techniques and skills associated with print reading for computer aided drafting. Students will learn about linetype identification and the use of lineweights, file management, industry standards in dimensioning and how to read working drawings. Additionally, students will learn basic computer aided drafting skills using AutoCAD software, 2D CAD skills. Students will develop skills in industrial dimensioning techniques and apply the ASME Y14.5 standards, and the production of industrial working drawings and working models based on ASME standards.

Upon completion of the Advanced CAD Technical Skills Certificate, students should be able to:

- Produce 2D printed/plotted drawings with AutoCAD software.
- Interpret working drawings for various industries.
- Produce industrial working drawings and models based on industry standards.
- Reverse engineer assemblies to create working drawings in 2D plan and 3D models.

CAD 100 Print Reading for Computer Aided Drafting	3
CAD 101 Computer Aided Drafting I	3
CAD 102 Computer Aided Drafting II	3
EGT 103 Technical Drafting III	3
EGT 210 Mechanical Design III	<u>3</u>
<b>Total Credit Hours</b>	<b>15</b>

### Advanced SolidWorks Skills Certificate

The Advanced SolidWorks Skills one-semester certificate is for individuals who are working in the field or individuals in a related field wishing to obtain SolidWorks skills beyond the entry level and with prior knowledge of Mechanical Drafting. Drafting technicians who wish to update their skills, should select this certificate to gain those skills required in industry. Advanced applications of the 3D parametric software include management of design data, advanced assembly, analysis of model creations, documentation of bill of materials and parts lists, rendering, animation, and dynamic simulation and testing a model assembly.

Upon completion of the Advanced SolidWorks Skills Certificate, students should be able to:

- Use the SolidWorks software package to create advanced models, parts, assemblies, and related documents (e.g. bill of materials, parts lists)
- Construct, modify, and manage complex parts in 3D space as well as to produce 2D drawings from the 3D models.

CAD 255 SolidWorks Mechanical	3
CAD 259 Advanced SolidWorks	<u>3</u>
<b>Total Credit Hours</b>	<b>6</b>

### Basic CAD Skills

The Basic CAD Skills Certificate is designed for students to learn a variety of techniques and skills associated with print reading for computer aided drafting. Students will learn about linetype identification and the use of lineweights, file management, industry standards in dimensioning and how to read working drawings. Additionally, students will learn basic computer aided drafting skills using AutoCAD software, 2D CAD skills.

Upon completion of the Basic CAD Skills Certificate, students should be able to:

- Produce 2D printed/plotted drawings with AutoCAD software.
- Interpret working drawings for various industries.

CAD 100 Print Reading for Computer Aided Drafting	3
CAD 101 Computer Aided Drafting I	3
CAD 102 Computer Aided Drafting II	<u>3</u>
<b>Total Credit Hours</b>	<b>9</b>

### **CAD–Quality Assurance**

The CAD – Quality Assurance Certificate is designed for students to learn a variety of techniques and skills associated with print reading for computer aided drafting. Students will learn about linetype identification and the use of lineweights, file management, industry standards in dimensioning and how to read working drawings. Additionally, students learn how to interpret and apply geometric dimensioning and tolerancing in machining or drafting per the ASME Y14.5 specification. Students learn how to examine and interpret the generation of working drawings, and about the team effort amongst design, drafting, manufacturing, and quality control.

Upon completion of the CAD-Quality Assurance Certificate, students should be able to:

- Apply geometric dimensioning and tolerancing (GDT) in machining/drafting.
- Interpret working drawings for various industries.
- Use common measuring instruments (e.g., Vernier, micrometer) found in manufacturing environments.

CAD 100 Print Reading for Computer Aided Drafting	3
EGT 205 Geometric Dimension & Tolerance	3
MAT107 Career Math or higher	3
MTE 130 Metrology	<u>3</u>
<b>Total Credit Hours</b>	<b>12</b>

### **CAD Skills for Interiors**

The CAD Skills for Interiors Certificate is designed for students to learn 2D AutoCAD software as well as 3D SketchUp software to develop their computer aided drafting and interior design skills, to enhance their design process, and ability to portray design concepts creating rendered interior spaces. Students learn a variety of techniques and skills associated with interior building systems and assemblies, construction documents and details, and codes applicable to interior architecture. In addition, students are introduced to methods of communicating interior design plans, elements, and ideas in 3D, through perspective drawing construction and quick sketch techniques, and practice rendering and illustration skills.

Upon completion of the CAD Skills for Interiors Certificate, students should be able to:

- Design interior projects to include floor plans, dimensions, elevations, sections, details, lighting, special features and finishes.
- Create 2D design plans and 3D visualization models and presentations for interior design applications using AutoCAD and SketchUp software.
- Produce construction documents using Autodesk AutoCAD software.
- Apply various software modification techniques to produce drawings with enhanced lighting, materials, and finishes.
- Develop digital presentation skills such as lighting, accessories, and reflectivity using various drafting software.

CAD 105 AutoCAD for Interiors	4
IND 112 Graphic Communication	4
IND 211 Interior Construction	<u>4</u>
<b>Total Credit Hours</b>	<b>12</b>

### **Modeling Design**

The Modeling Design Certificate is designed for students to learn a variety of techniques and skills associated with print reading for computer aided drafting. Students learn to use Creo software to construct, modify, and manage complex parts in 3D space, as well as how to produce 2D drawings from 3D models. The focus is on advanced part creation, drawing manipulation, and documentation. Additionally, students build confidence in 3D thinking and progresses to three-dimensional parameters. Students learn how to use the 3D parametric software SolidWorks and Creo to focus on management of design data, advanced assembly, rendering, animation and dynamic simulation and testing a model assembly. Additionally, students learn how to create advanced 3D solid models using 3D printing and 3D scanning technology.

Upon completion of the Modeling Design Certificate, students should be able to:

- Produce 2D drawings from 3D solid models.

- Use the SolidWorks and Creo software packages to create advanced models, parts, assemblies, and related documents (e.g., bill of materials, parts lists).
- Produce parts and assemblies using additive manufacturing/3D printing.

CAD 153 Introduction to Pro Engineer/Basics	3
CAD 253 Advanced Creo	3
CAD 255 SolidWorks/Mechanical	3
CAD 259 Advanced SolidWorks	3
CAD 262 3D Printing	3
CAD 266 Advanced 3D Printing	<u>3</u>
<b>Total Credit Hours</b>	<b>18</b>

### Professional CAD- Architecture

The Professional CAD - Architecture Certificate is designed for students to learn a variety of techniques and skills associated with print reading for computer aided drafting. Students learn about architectural drawing theory and light frame construction techniques and produce a professional set of construction drawings of residential and commercial structures. Additionally, students acquire 2D architectural computer aided drafting skills using AutoCAD software, as well as learning to use Autodesk Revit Architecture software to create floorplans, elevations, 3D models, topographic site plans, and presentation techniques.

Upon completion of the Professional CAD - Architecture Certificate, students should be able to:

- Produce construction documents (e.g., topographic site plans, elevations, 3D models, templates, and presentations) using Autodesk Revit Architecture software.
- Produce professional sets of construction drawings for residential and commercial structures.

AEC 102 Residential Construction Drawing	4
AEC 104 Architectural Theory	4
CAD 104 CAD Architecture	4
CAD 224 Revit Architecture	3
CAD 227 Advanced Revit Architecture	<u>3</u>
<b>Total Credit Hours</b>	<b>18</b>

### Professional CAD- Interior Design

The Professional CAD - Interior Design certificate is designed for students to learn advanced techniques using 2D AutoCAD and 3D Autodesk Revit software to enhance their computer aided drafting and interior design skills and increase their ability to portray design advanced concepts through the rendered interior spaces. Emphasis is placed on producing photorealistic 3-dimensional (3D) renderings and models that are specific to interior building elements and spaces through advanced modeling techniques such as advanced lighting, materials, and rendering techniques.

Upon completion of the Professional CAD - Interior Design Certificate, students should be able to:

- Design innovative interior projects to include floor plans, dimensions, elevations, sections, details, specification sheets, lighting, special features and finishes.
- Produce construction documents (e.g., floor plans, elevations, sections, details, 3D models, templates, and presentations) using Autodesk Revit Architecture software.
- Create 3D visualization models and presentations for interior design applications using advanced Autodesk Revit software.
- Apply materials, lighting, and cameras to generate walk-through presentations.
- Produce presentation quality renderings of 3D interior design and spaces.

CAD 105 AutoCAD for Interiors	4
IND 112 Graphic Communication	4
IND 211 Interior Construction	4
CAD 230 Revit for Interiors	3
CAD 234 Advanced Revit for Interiors	<u>3</u>
<b>Total Credit Hours</b>	<b>18</b>

### Professional CAD- Mechanical

The Professional CAD - Mechanical Certificate is designed for students to learn a variety of techniques and skills associated with print reading for computer aided drafting. Students will learn about linetype identification and the use of lineweights, file management, industry standards in dimensioning and how to read working drawings. Additionally, students will learn basic computer aided drafting skills using AutoCAD software, 2D CAD skills, and how to use SolidWorks and Creo 3D software. Students build confidence in 3D thinking and progresses to three-dimensional parameters. Students will develop skills in industrial dimensioning techniques and apply the ASME Y14.5 standards, and the production of industrial working drawings and working models based on ASME standards.

Upon completion of the Professional CAD – Mechanical Certificate, students should be able to:

- Produce 2D and 3D printed/plotted drawings with AutoCAD software.
- Interpret working drawings for various industries.
- Produce industrial 2D working drawings and 3D models based on industry standards.
- Produce 2D drawings from 3D models.

CAD 100	Print Reading for Computer Aided Drafting	3
CAD 101	Computer Aided Drafting I	3
CAD 102	Computer Aided Drafting II	3
CAD 153	Introduction to Creo Basics	3
CAD 255	Solid Works/Mechanical	3
EGT 103	Technical Drafting III	3
EGT 210	Mechanical Design III	3
MAT 107	Career Math	3
Electives	Choose six (6) hours from technical electives list	<u>6</u>
<b>Total Credit Hours</b>		<b>30</b>

### Revit Skills

The Revit Skills certificate is designed for students who are in industry and with prior knowledge of Interior Design and Architecture. Students will polish their 3D architectural computer aided drafting skills using Autodesk Revit software to create floorplans, elevations, 3D models, topographic site plans, and presentation techniques.

Upon completion of the Revit Skills Certificate, students should be able to:

- Produce construction documents (e.g., topographic site plans, elevations, 3D models, templates, and presentations) using Autodesk Revit Architecture software.
- Create 3D visualization models and presentations for interior design applications using advanced Autodesk Revit software

CAD 224	Revit Architecture	3
CAD 227	Advanced Revit Architecture	<u>3</u>
<b>Total Credit Hours</b>		<b>6</b>

### Professional CAD- Robotics

The Professional CAD Robotics certificate is designed for students to learn a variety of techniques and skills associated with basic computer aided drafting skills using AutoCAD software, 2D CAD skills and progress to three-dimensional parameters using the 3D parametric software SolidWorks to focus on management of design data, advanced assembly, rendering, animation and dynamic simulation and testing a model assembly and leading to creating an advanced 3D solid model using 3D printing software. Additionally, students learn skills needed to program a robot in a higher-level language to perform various tasks, including the building and interfacing of sensor circuits to include write and debug code, program the microcontroller, acquire and analyze sensor data, and use that data to control actuators. Other focus includes the robotic work envelopes, programming, troubleshooting, and maintenance.

Upon completion of the Professional CAD Robotics Certificate, students should be able to:

- Produce 2D printed/plotted drawings with AutoCAD software.
- Interpret and produce industrial 2D working drawings and 3D models based on industry standards.

- Use the SolidWorks software package to create advanced models, parts, assemblies, and related documents (e.g., bill of materials, parts lists).
- Produce parts and assemblies using additive manufacturing with 3D printing.
- Construct, test, and troubleshoot electronic and digital circuits.
- Solder electronic components on circuit boards.
- Program, maintain, and troubleshoot robotic system.
- Explain the architecture, hardware, programming languages, and input and output capabilities of microcontrollers.
- Program a microcontroller to execute code.

CAD 100	Print Reading for Computer Aided Drafting	3
CAD 101	Computer Aided Drafting I	3
CAD 102	Computer Aided Drafting II	3
CAD 255	SolidWorks/Mechanical	3
CAD 259	Advanced SolidWorks	3
CAD 262	3D Printing	3
ELT 106	Fundamentals of DC/AC	4
ELT 146	Digital Devices in Computers	3
ELT 165	Electronic Assembly	3
ELT 262	Microcontrollers	3
ELT 267	Intro to Robotics	1
ELT 268	Robotics Technologies	<u>3</u>
<b>Total Credit Hours</b>		<b>35</b>