

Advanced Manufacturing Technology Mechatronics

GENERAL INFORMATION

Everett Community College offers a number of pathways toward technical careers, using stackable certificates and degrees. The first level, for students seeking entry into the technical world would be the **Manufacturing Pre-Employment Certificate**, a credential that would allow one to work in entry-level manufacturing. The next level up would be to take classes leading to a **Skills-Oriented Certificate**. And for those seeking a higher level of education, and the job skills and responsibilities that go with it, EvCC offers skills oriented **ATA Degrees**. This Advanced Manufacturing Technology curriculum guide describes all three levels in the Technical Design discipline. This program also provides a flexible framework for the incorporation of credit from prior learning in industry or government. An early conference with one of the designated advisors is strongly suggested for success.

THE PROGRAM

The Advanced Manufacturing Technology – Mechatronics Program is part of a cluster of programs. Five **Associate in Technical Arts degrees** and nine **certificates in Advanced Manufacturing Technology** are offered, and may be pursued on a full-time or part-time basis at Everett Community College (EvCC).

ATA degree Programs:

- **Advanced Manufacturing Tech – Precision Machining***
 - **Advanced Manufacturing Tech – Technical Design (CAD)***
 - **Advanced Manufacturing Tech – Composites***
 - **Advanced Manufacturing Tech - Welding and Fabrication***
 - **Advanced Manufacturing Tech--Mechatronics**
- * Described in a separate guide.**

Certificate Programs :

- **Manufacturing Pre-Employment Precision Machining ***
 - **Engineering Technology (CAD) ***
 - **CATIA 3D Experience ***
 - **Composites ***
 - **Welding and Fabrication ***
 - **Mechatronics (19 credits)**
 - **Introduction to Composites ***
 - **Introduction to Robotics**
- * Described in a separate guide.**

The program outcomes for students pursuing the degree will prepare them to perform the following tasks:

- Understand and explain the principal operations of the mechatronics subsystems in a complex system.
- Understand how these subsystems work together.
- Recognize potential or impending malfunctions, and contact expert assistance in order to keep the production line functioning, and to prevent production loss.
- Perform routine, preventative maintenance; localize and identify causes and sources of malfunctions where possible.
- Read and understand the technical documents, reports and outlines specific to systems and subsystems; be able to consult with experts; and be able to document malfunctions.
- Work effectively as a team member and coordinate the activities with upstream and downstream operations.
- Understand and implement safety regulations required for operation of the system.

CREDIT FOR PRIOR LEARNING

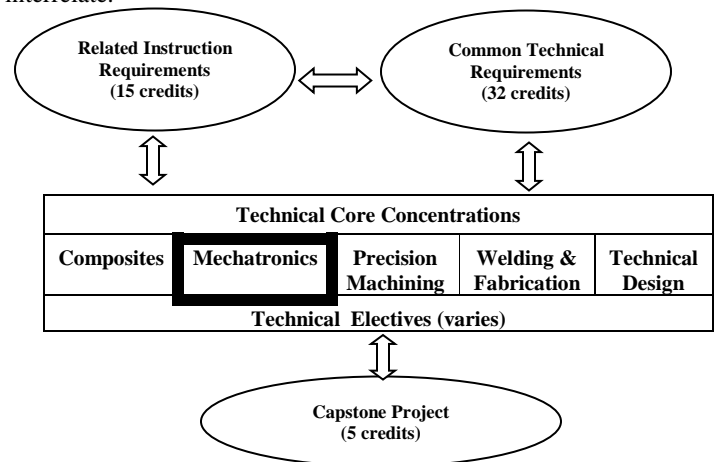
Adults with work experience or completion of industry training programs may be eligible for college credit by following “External Credit” evaluation procedures. Students currently in high school may take selected technical courses while in high school and apply at that time for college credit.

External Credit: Contact Enrollment Services
Call: 425-388-9219

Tech Prep: www.everettcc.edu/techprep
Or contact your high school counselor

THE COURSES

The courses for this program may be divided into four categories: related instruction requirements (15 credits), common technical requirements (32 credits), technical core concentration classes (28 to 40 credits), technical electives (credit varies) and the final capstone class (5 credits). Students seeking an ATA degree will take the number of credits shown in each area plus a number of technical elective classes until the total credit accumulations meets or exceeds the degree requirement. Note that a minimum of 28-40 credits need to come from any one technical concentration to qualify for that particular degree. The actual courses are listed further on in this curriculum guide. See the diagram below for an understanding of how the courses interrelate.



GETTING STARTED AT EVCC

Our Enrollment Services Office provides information about application, advising, orientation and registration for new and continuing students. Students interested in the program should talk to an advisor prior to selecting classes for the first quarter:

| | |
|-----------------------------------|--------------|
| Advising | 425-388-9339 |
| Enrollment Services | 425-388-9219 |
| Precision Machining (Darin Chase) | 425-388-9390 |
| CAD (David Primacio) | 425-267-0160 |
| CAD (Sean Auger) | 425-388-9534 |
| Welding (Robert White) | 425-388-9457 |
| Welding (Karl Fulton) | 425-388-9447 |
| Composites (Michael Patching) | 425-388-9092 |
| Mechatronics (Ken Ackerman) | 425-388-9290 |

Approved at Instructional Council March 2020



Advanced Manufacturing Tech - Mechatronics ATA Degree

The courses required for an **Associate in Technical Arts Degree in Advanced Manufacturing Tech – Mechatronics** are listed below. Students should meet with an advisor and maintain this checklist while at Everett Community College. The quarter before expected completion, this checklist should be submitted with a diploma application to the Enrollment Services Office. EvCC does not offer every course each quarter, so please consult a class schedule and an advisor to plan course selections. Note that to earn this degree, a cumulative GPA of 2.0 or higher must be maintained.

Student Name: _____ Advisor Signature: _____ Date: _____

COMPLETION of Diversity Course
(BUS 110D, ENGL 098D or ENGL& 101D suggested)

(Where Completed/Course Title) (Year Completed) (Grade)

| <u>Course Number</u> | <u>Course Title</u> | <u>Credits</u> | <u>Quarter Planned</u> | <u>Quarter completed</u> | <u>Grade</u> |
|---|---|----------------|------------------------|--------------------------|--------------|
| RELATED INSTRUCTION (15 credits) | | | | | |
| ENG T 101 (or MATH 086 or higher) | Introduction to Graphics and Measurements | 5 | _____ | _____ | _____ |
| ENGL 98/98D or ENGL& 101/101D | Intro to College Writing or English Composition I | 5 | _____ | _____ | _____ |
| BUS 110D, BUS 165, CMST& 210, or CMST 230 | Human Relation Course from this group. Business 110D Recommended | 5 | _____ | _____ | _____ |
| COMMON TECHNICAL REQUIREMENTS (32 credits) | | | | | |
| MFG T 100 | Preparation for Success and Safety in Industry | 5 | _____ | _____ | _____ |
| CT 101 | Introduction to Composites | 5 | _____ | _____ | _____ |
| MFG T 117 | Blueprint Reading and Schematics | 3 | _____ | _____ | _____ |
| ENG T 100 or 108 or 185 | Engineering Graphics: Intro to CAD | 4 | _____ | _____ | _____ |
| MFG T 101 or MFG T 113 | Introduction to Machining | 5 | _____ | _____ | _____ |
| WELD 101 or Higher | Introduction to Welding | 5 | _____ | _____ | _____ |
| MECH 119 or Higher | Introduction to Robotics | 5 | _____ | _____ | _____ |
| MECHATRONICS TECHNICAL CORE REQUIREMENTS (32 credits) | | | | | |
| MECH 118 | Predictive Maintenance and Operations Efficiency | 2 | _____ | _____ | _____ |
| MECH 120 | Electrical Components | 5 | _____ | _____ | _____ |
| MECH 121 | Mechanical Components & Electrical Drives | 5 | _____ | _____ | _____ |
| MECH 122 | Electro-Pneumatic and Hydraulic Control Circuits | 5 | _____ | _____ | _____ |
| MECH 123 | Digital Fundamentals and PLCs | 4 | _____ | _____ | _____ |
| MECH 124 | Controls and Instrumentation | 5 | _____ | _____ | _____ |
| MECH 295 | Mechatronics Internship 1 | 3 | _____ | _____ | _____ |
| MECH 296 | Mechatronics Internship 2 | 3 | _____ | _____ | _____ |
| TECHNICAL ELECTIVES (6-12 credits - see last page for suggestions) | | | | | |
| MFG T 102 (recommended) | Manufacturing Employment Readiness | 12 | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ |

CAPSTONE PROJECT REQUIREMENTS (5 credits – select one class from the list below. Generally follows all other classes.)

MFG T 229 or MFG T 230 Manufacturing Team Project 5 _____

MINIMUM REQUIRED CREDITS 90 Min 2.0 cumulative GPA

Interested in transferring to a university?

Students completing this ATA degree can transfer directly to the Information Technology and Administrative Management (ITAM) program at Central Washington University or to the Manufacturing Operations program at Clover Park Technical College to pursue a Bachelor of Applied Science (BAS) degree. Go to www.cwu.edu/it-management/bas-overview or www.cptc.edu/programs/basmo for more information.

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GENERAL INFORMATION

The Mechatronics Systems Certificate program is designed to provide students with the basic skills in electrical, mechanical and computerized components in an industrial mechatronic system used for manufacturing and assembly. The hands-on training and instruction will view the components or devices in terms of their roles within the system, with an emphasis on the system running at maximum capacity.

Upon completion, the student will function as a well-grounded machine operator in a complex system, with responsibility for efficient operation of the equipment, with minimal down-times. Students will be able to assist in identifying where malfunctions are occurring and communicate with experts who can carry out the required repairs.

This certificate may be considered a stand-alone credential for people seeking to enter the manufacturing field, or as part of a stackable set of certificates in the EvCC Advanced Manufacturing degree pathway.

PROGRAM INFORMATION

The certificate program will focus on skills used in plant assembly sites, warehouse and service operations which utilize complex mechatronics systems. The foundational skill set for these integrated systems are interrelated in a variety of industries – aerospace, automotive, farming, mining, pharmaceuticals, power and energy, and food processing.

Mechatronics combines the study of mechanics, electronics, pneumatics, and digital control technology with a focus on an integrated systematic approach. By studying the system as a whole, students gain understanding of the intertwined system. They learn how the electronics, mechanics and digital control interact; how to analyze operations; and how to trouble shoot to solve problems.

GETTING STARTED AT EVCC

Our Enrollment Services Office provides information about application, advising, orientation and registration for new and continuing students. If students have questions about applying or getting started they may contact Enrollment Services. Contact:

- ◆ Enrollment Services, Parks Student Union, 425-388-9219
- ◆ Advising Center, Rainier Hall 108, 425-388-9339

COURSE INFORMATION

MFG T 120 - Electrical Components

Basic functions and physical properties of electrical components, and the roles they play within a complex mechatronics system.

MFG T 121 – Mechanical Components and Electrical Drives

Based upon a physical system, basic functions and physical properties of mechanical components, electrical drives (AC/DC), flow of energy, trouble shooting, and preventative maintenance.

MFG T 122 – Electro-Pneumatic and Hydraulic Control Circuits

Basics of pneumatic, electro-pneumatic and hydraulic control circuits in a complex machatronic system; properties and documentation of same.

MFG T 123 – Digital Fundamentals and Programmable Logic Controllers

Fundamentals of digital logic and introduction to PLCs with a focus on the automation system and appropriate programming software; basic PLC elements; and trouble shooting strategies.

CERTIFICATE OUTCOMES

- Understand and explain the principal operations of the mechatronics subsystems in a complex system;
- Understand how these subsystems work together;
- Recognize potential or impending malfunctions, and contact expert assistance in order to keep the production line functioning; prevent production loss;
- Perform routine, preventative maintenance; localize, and identify causes and sources of malfunctions where possible;
- Read and understand the technical documents, reports and outlines specific to the systems and subsystems; be able to consult with experts; and be able to document malfunctions;
- Work effectively as a team member and coordinate the activities with upstream and downstream operations;
- Understand and implement safety regulations required for operation of the system.

Certificate: Mechatronics Systems (19 Credits)

This checklist is targeted at students with a Mechatronics interest. Courses have prerequisites. 12 weeks prior to the anticipated receipt of this certificate, this checklist should be submitted with a diploma application to the Enrollment Services Office.

Student: _____ Advisor: _____ Date: _____

| Course Number | Course Title | Credits | Quarter Planned | Quarter Done | Grade |
|-------------------------|--|-------------------|------------------------|--------------|-------|
| REQUIRED COURSES | | | | | |
| MECH 120 | Electrical Components | 5 | _____ | _____ | _____ |
| MECH 121 | Mechanical Components & Electrical Drives | 5 | _____ | _____ | _____ |
| MECH 122 | Electro-Pneumatic and Hydraulic Control Circuits | 5 | _____ | _____ | _____ |
| MECH 123 | Digital Fundamentals and PLCs | 4 | _____ | _____ | _____ |
| TOTAL: | | 19 credits | Minimum 2.0 GPA | | |

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Robotics Foundations Certificate

GENERAL INFORMATION

The Robotics Foundations Certificate is designed as a general introduction to the basics of robotic operation, basic programming, interfacing, and material handling in a complex mechatronics system. Students will gain conceptual, technical, and practical knowledge of robotic applications and how robotics is applied to industrial tasks using hands-on, interactive robotic devices. The Robotics Foundations Certificate is designed to prepare students for entry-level positions using robotics in a manufacturing facility and the aerospace industry.

The robotics certificate serves as an introduction to components in an industrial mechatronics system used for manufacturing and assembly. The certificate is recommended for anyone seeking to understand the basics of robotic operation, manual operation, end effector operation, interfacing, material handling, basic robotic programming, editing, positioning and homing in a mechatronic system. Students will perform hands-on exercises to promote learning and to build skills required by industry.

The certificate may be considered as a stand-alone credential for people seeking to enter the manufacturing field, or as the first

level of a stackable set of certificates in the Advanced Manufacturing Technology ATA degree pathway.

PROGRAM CERTIFICATE OUTCOMES

- Describe what comprises basic robotics in a mechatronic system or module;
- Understand the role of automation and robotics in manufacturing and assembly operations;
- Demonstrate understanding of terms such as homing, looping, end effector operation, and I/O interfacing;
- Discuss and demonstrate manual operations and basic robotic commands;
- Identify and use basic robotic programming, editing, positioning and homing in a mechatronic system;
- Apply safety rules while working on the system;
- Transfer the knowledge learned from one robotic system to another robotic system;
- Be prepared for successful employment.

PROGRAM ADVISOR

For specific guidance about this certificate, contact:

- ◆ Robert White, 425-388-9457 rowwhite@everettcc.edu

Certificate: Robotics Foundations Certificate 5 Credits

This checklist is targeted at students with an interest in an entry level manufacturing systems and/or the aerospace industry. Upon enrollment, this checklist should be submitted with a diploma application to the Enrollment Services Office.

Student: _____ Advisor Signature: _____ Date: _____

| Course Number | Course Title | Credits | Quarter Planned | Quarter Done | Grade |
|---------------|--------------|---------|-----------------|--------------|-------|
|---------------|--------------|---------|-----------------|--------------|-------|

REQUIRED COURSES

| | | | | | |
|----------|--------------------------|---|-------|-------|-------|
| MECH 119 | Introduction to Robotics | 5 | _____ | _____ | _____ |
|----------|--------------------------|---|-------|-------|-------|

TOTAL: 5 credits Minimum 2.0 GPA

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GENERAL INFORMATION

The Manufacturing Pre-Employment certificate is a one-quarter program designed to prepare students to work at the entry level in a manufacturing facility and the aerospace industry.

This course serves as an introduction to manufacturing. The knowledge and skills acquired in this course are required for entry level positions in diverse workplace scenarios with special emphasis on aerospace. Content includes a survey of mechanical concepts, precision measurement, blueprint reading, quality assurance, workforce skills/communication, ergonomics, lean manufacturing, and sustainable business practices.

This certificate may be considered a stand-alone credential for people seeking to enter the manufacturing field, or as part of a stackable set of certificates and degrees in the EvCC Advanced Manufacturing Program.

GETTING STARTED AT EVCC

Our Enrollment Services Office provides information about application, advising, orientation and registration for new and continuing students. All prospective students are invited to contact the Educational Planning Center if they would like to speak one-to-one with an educational planner. If students have questions about applying or getting started they may contact Enrollment Services. Contact:

- ◆ Enrollment Services, Parks Student Union, 425-388-9219
admissions@everettcc.edu

- ◆ Educational Planning Center, Third Floor, Parks Student Union, 425-388-9339

PROGRAM CERTIFICATE OUTCOMES

- Understand and solve basic technical mathematical problems;
- Communicate orally and in writing about technical activities;
- Be prepared for successful employment;
- Understand and work with entry level technical and mechanical systems;
- Perform work using basic computer skills;
- Meet industry requirements for safety and first aid.

PROGRAM ADVISOR

For specific guidance about this certificate, contact:

- ◆ Advanced Manufacturing Training & Education Center (AMTEC) 425-388-9570, mfg@everettcc.edu

Certificate: Manufacturing Pre-Employment 12 Credits

This checklist is targeted at students with an interest in an entry level manufacturing systems and/or the aerospace industry. Upon enrollment, this checklist should be submitted with a diploma application to the Enrollment Services Office.

Student: _____ Advisor Signature: _____ Date: _____

| Course Number | Course Title | Credits | Quarter Planned | Quarter Done | Grade |
|---------------|--------------|---------|-----------------|--------------|-------|
|---------------|--------------|---------|-----------------|--------------|-------|

REQUIRED COURSES

| | | | | | |
|-----------|------------------------------------|----|--|--|--|
| MFG T 102 | Manufacturing Employment Readiness | 12 | | | |
|-----------|------------------------------------|----|--|--|--|

TOTAL: 12 credits Minimum 2.0 GPA

This certificate satisfies the requirements for MFG T 100 and Technical Electives of the Advanced Manufacturing ATA Degree.

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DEGREE ELECTIVES

You may complete elective credits to satisfy the ATA degree requirements in this program. These should be technical in nature, but need not be if your selection enhances your ultimate employability. Any college level English course, for example, would enhance your communication skills and be considered acceptable. Please browse through the college catalog and examine the wide variety of courses offered at EvCC. The following list is presented for your convenience and represents some of the more **commonly selected elective courses**.

COMPOSITES TECHNOLOGY

| | |
|--------|----------------------------|
| CT 161 | Materials and Processes |
| CT 202 | Composites |
| CT 120 | Composite Fabrication |
| CT 125 | Composite Assembly |
| CT 130 | Composite Repair |
| CT 145 | Composite Special Projects |
| CT 101 | Introduction to Composites |

WELDING/FABRICATION TECHNOLOGY

| | |
|-------------------------|---|
| WELD 111 | Basic Layout |
| WELD 150 | Blueprint Reading for Industry |
| WELD 151 | Carbon Steel Metallurgy for the Trades |
| WELD 152 | Welding Base Materials: Processes & Procedures |
| WELD 153 | Non-Ferrous Metallurgy for the Trades |
| WELD 190 | Oxyacetylene |
| WELD 191 | Basic Arc |
| WELD 192 | Advanced Arc |
| WELD 193 | Basic Pipe |
| WELD 194 | Gas Tungsten Arc Welding (TIG) |
| WELD 195 | Gas Metal Arc/Flux Core Arc Welding |
| WELD 196 | Flux Core Arc Welding |
| WELD 210 | Heavy Plate Fabrication |
| WELD 211 or WELD 217 | Sheet Metal Fabrication or Aerospace Sheet Metal Fabrication |
| WELD 212 | Pipefitting & Pipe Systems Fabrication |
| WELD 213 | Practical Fabrication & Adv. Welding Techniques |
| WELD 214 | Sub-Arc Welding |
| WELD 216 | Advanced Tig Welding |
| WELD 225 | Welding Skills Building |
| WELD 285 or WELD 286 | CNC Plasma Cutting or Aerospace CNC Plasma Cutting |
| WELD 287 | CNC Waterjet Cutting |
| WELD 295 | Work Experience Internship |

ENGLISH COURSES

You may select any English course, ENGL& 101 or higher, or any Communications course (CMST).

HUMAN RELATIONS (R)

You make take any human relations course listed on Page 2

INTERNSHIP

MFG T 171
MFG T 172

MANUFACTURING TECHNOLOGY

| | |
|-----------|------------------------------------|
| MFG T 102 | Manufacturing Employment Readiness |
| MFG T 104 | Machine Operator I |
| MFG T 105 | Machine Operator II |
| MFG T 113 | CNC Cutting Solutions |
| MFG T 202 | Lean and Operations Management |

TECH DESIGN (CAD)

| | |
|-----------|---|
| ENG T 100 | Introduction to Engineering Graphics and 2D AutoCAD |
| ENG T 103 | Introduction to Revit |
| ENG T 196 | Advanced Workbenches with CATIA v5 |

OTHER SUGGESTIONS

| | |
|-----------|---|
| BT 100 | Beginning Keyboarding |
| ACCT 110 | Small Business Accounting |
| BT 100 | Beginning Keyboarding |
| BUS& 101 | Introduction to Business |
| BT 162 | Job Search & Professional Development |
| BT 242 | Excel |
| BT 243 | Advanced Excel |
| IT 117 | CCNA 1: Introduction to Networking |
| ECON 101D | Understanding Economics |
| ENG T 104 | Mechanical Blueprint Reading |
| ENGR& 104 | Introduction to Design |
| ENVS 150 | Land Use Planning & Regulation |
| GEOG 205 | Physical Geography with GIS, GPS, and Remote Sensing labs |
| GRAPH 100 | Intro to Digital Studio |
| GRAPH 110 | Foundations of Graphic Design |
| GRAPH 113 | Graphic Design and Typography |
| PHOTO 110 | Photography I: Basic Elements |

MATHEMATICS COURSES

MATH 086 is particularly recommended for the degree, if you haven't taken a higher level course in Technical Geometry and Trigonometry.

SCIENCE COURSES

You may select any physics, chemistry, or engineering course

BUSINESS COURSES

You may select any business course