MICROELECTRONICS TECHNOLOGY

Rock Creek Campus
Science and Technology Division Office
Building 7, Room 202
971-722-7255
pcc.edu/programs/microelectronics/

CAREER AND PROGRAM DESCRIPTION

Are you interested in obtaining an interesting, rewarding and fulfilling career? Microelectronics Technology (MT) may be the answer.

- Portland is considered to be the “Silicon Forest” of the world, with a large semiconductor manufacturing base.
- Intel Corporation is the Portland region’s largest private employer, and there are many others including: Maxim Integrated, Qorvo, Biotronik/MSEI, Lam Research, Applied Materials, Siltronic, Microchip, FEI/Thermo Fisher, SolarWorld, and many others.
- MT graduates starting salary can be over $50,000 per year, with overtime pay, shift differential pay, extensive benefits including full health coverage, retirement saving plans, tuition reimbursement, Personal Time Off (PTO), paid holidays and more.
- Technicians work a regular fixed schedule: Compressed Work Week (CWW) of 12-hour shifts: 3-days one week (with four days off) followed by the second week working four days (with three days off).
- There is an opportunity for advancement and to make this a lifelong career.
- Military veterans have a long history working in this industry; technical military training can often be applied towards the MT credit requirements.
- Most, if not all, industry partners welcome and mention hiring initiatives in their employment materials to encourage veterans and members of protected classes to apply.

What you would do as a Technician:

- Help keep high tech fabrication facilities up and running.
- Work in teams solving problems, managing logistics, and practicing good communication.
- Work in clean room environments to maintain equipment, and monitor various manufacturing processes.

What you would experience as an MT student:

- Receive the technical training needed to work in this high tech environment.
- Most MT courses involve a hands-on laboratory component to develop equipment analysis, maintenance, and troubleshooting skills.
- Develop oral and written communication skills in the English language.
- Students may begin during any term of the academic year, however MT course sequences must start in fall or winter term.
- First year courses must be completed before starting the second year.
- Day classes are scheduled to accommodate the industry standard work CWW schedule enabling those students working CWW schedules to take courses.
- Evening classes are also available for 100 level MT courses.

How long will the MT program take to complete?

- Full-time students can complete the program in six to eight terms.
- Part-time students complete the program over a longer time.

- The core MT classes require two full academic years (six terms) in order to be completed.

Can my MT credits apply towards an advanced degree?

- Yes, up to 58 credits can apply toward a four-year baccalaureate degree.
- Graduates of the MT program may also transfer to Oregon Institute of Technology (OIT) to pursue a bachelor degree in Electronic Engineering Technology (EET).
- This allows the possibility to complete a bachelor’s degree in two additional years.
- Upper division OIT courses are offered at OIT’s Wilsonville Campus.

DEGREES AND CERTIFICATES OFFERED

ASSOCIATE OF APPLIED SCIENCE DEGREE

Microelectronics Technology
Microelectronics Technology: Automated Manufacturing Technology Option
Microelectronics Technology: Solar Voltaic Manufacturing Technology Option

LESS THAN ONE-YEAR: CAREER PATHWAY CERTIFICATE

Solar Voltaic Manufacturing Technology

Academic Prerequisites

- Students new to the program should establish math and writing level through college credit or by taking the college’s placement for mathematics and writing prior to program advising and registration.
- Students must meet the prerequisites as stated in the course descriptions of the current catalog before registering for first term math, writing, electronics and chemistry courses.
- Students intending to pursue any of the three Microelectronics Technology AAS degrees must be working towards MTH 95 and WR 121.
- Students interested in obtaining a Solar Voltaic Manufacturing Technology Career Pathway Certificate must be able to prove their competency in WR 115 or IRW 115 and MTH 65 through college credit or equivalent placement.

Academic Requirements

- None

Non-Academic Prerequisites

- New students are encouraged to meet with a department representative for advising prior to signing up for classes.

Non-Academic Requirements

- None

ASSOCIATE OF APPLIED SCIENCE DEGREE

Microelectronics Technology (p. 1)
Microelectronics Technology: Solar Voltaic Manufacturing Technology Option (p. 2)
Microelectronics Technology: Automated Manufacturing Technology Option (p. 3)

MICROELECTRONICS TECHNOLOGY AAS DEGREE

Minimum 95 credits. Students must also meet Associate Degree Comprehensive Requirements and Associate of Applied Science Requirements. Students must complete a total of sixteen credits of General Education. Some courses specified within the program may be used as General Education. Math/computation competency is
Students should consult with program advisors for academic planning.

**COURSE OF STUDY**

The coursework listed below is required. The following is an example of a term-by-term breakdown for a student starting in fall term. Students starting in other terms or otherwise altering this plan should work with an MT advisor regarding proper sequencing and limited offerings.

### First Term
- **CH 104** or **CH 221**: Allied Health Chemistry I or General Chemistry I **5 Credits**
- MT 101: Introduction to Semiconductor Manufacturing **1 Credit**
- MT 102: Introduction to Semiconductor Devices **1 Credit**
- MT 103: Introduction to Micro and Nano Processing **1 Credit**
- MT 111: Electronic Circuits & Devices I **4 Credits**
- WR 121: English Composition **4 Credits**
- **Total Credits**: 95

### Second Term
- **CH 105** or **CH 222**: Allied Health Chemistry II or General Chemistry II **5 Credits**
- MT 112: Electronic Circuits & Devices II **4 Credits**
- MT 121: Digital Systems I **3 Credits**
- MTH 111: College Algebra (or higher) **5 Credits**
- **Total Credits**: 95

### Third Term
- MT 108 or MTH 243: Statistics for Process Control or Statistics I **2 Credits**
- MT 113: Electronic Circuits & Devices III **4 Credits**
- MT 122: Digital Systems II **3 Credits**
- WR 227: Technical and Professional Writing I **4 Credits**
- **Total Credits**: 95

### Fourth Term
- COMM 130: Business & Professional Communication **4 Credits**
- MT 180: High Tech Employment Strategies **1 Credit**
- MT 222: Quality Control Methods in Manufacturing **3 Credits**
- MT 223: Vacuum Technology **3 Credits**
- MT 224: Process Equipment I **3 Credits**
- PHY 201 or PHY 211: General Physics or General Physics (Calculus) **4 Credits**
- **Total Credits**: 95

### Fifth Term
- COMM 215: Small Group Communication: Process and Theory **4 Credits**
- MT 227: Process Equipment II **3 Credits**
- MT 240: RF Plasma Systems **3 Credits**
- PHY 202 or PHY 212: General Physics or General Physics (Calculus) **4 Credits**
- **Total Credits**: 95

### Sixth Term
- MT 200: Semiconductor Processing **3 Credits**
- MT 228: Process Equipment III **4 Credits**
- PHY 203 or PHY 213: General Physics or General Physics (Calculus) **4 Credits**
- **Total Credits**: 95

*CH 104, CH 105, CH 221, CH 222, COMM 215, MTH 111, MTH 243, PHY 201, PHY 202, PHY 203, PHY 211, PHY 212, and PHY 213 could be used as General Education.*
General Education | 3
---|---
Total Credits | 91

* CH 100, COMM 215, MTH 111, MTH 243, PHY 201, PHY 202, PHY 203, PHY 211, PHY 212, and PHY 213 could be used as General Education.

### AUTOMATED MANUFACTURING TECHNOLOGY AAS DEGREE

Minimum 91 credits. Students must also meet Associate Degree Comprehensive Requirements and Associate of Applied Science Requirements. Students must complete a total of sixteen credits of General Education. Some courses specified within the program may be used as General Education. Math/computation competency is met through the math course(s) required in the program of study. Students should consult with program advisors for academic planning.

#### COURSE OF STUDY

The coursework listed below is required. The following is an example of a term-by-term breakdown for a student starting in fall term. Students starting in other terms or otherwise altering this plan should work with an MT advisor regarding proper sequencing and limited offerings.

<table>
<thead>
<tr>
<th>First Term</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT 101: Introduction to Semiconductor Manufacturing</td>
<td>1</td>
</tr>
<tr>
<td>MT 102: Introduction to Semiconductor Devices</td>
<td>1</td>
</tr>
<tr>
<td>MT 104: Introduction to Solar Voltaic Processing</td>
<td>1</td>
</tr>
<tr>
<td>MT 111: Electronic Circuits &amp; Devices I</td>
<td>4</td>
</tr>
<tr>
<td>MTH 111: College Algebra (or higher)*</td>
<td>5</td>
</tr>
<tr>
<td>WR 121: English Composition</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Second Term</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CJS 179: Data Communication Concepts I</td>
<td>4</td>
</tr>
<tr>
<td>CS 161: Computer Science I*</td>
<td>4</td>
</tr>
<tr>
<td>MT 112: Electronic Circuits &amp; Devices II</td>
<td>4</td>
</tr>
<tr>
<td>MT 121: Digital Systems I</td>
<td>3</td>
</tr>
<tr>
<td>WR 227: Technical and Professional Writing I</td>
<td>4</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Third Term</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CS 162: Computer Science II*</td>
<td>4</td>
</tr>
<tr>
<td>MT 108: Statistics for Process Control or Statistics I</td>
<td>2</td>
</tr>
<tr>
<td>or MTH 243</td>
<td></td>
</tr>
<tr>
<td>MT 113: Electronic Circuits &amp; Devices III</td>
<td>4</td>
</tr>
<tr>
<td>MT 122: Digital Systems II</td>
<td>3</td>
</tr>
<tr>
<td>MT 131: Introduction to Programmable Logic Controllers or Basic Programmable Logic Controllers</td>
<td>2</td>
</tr>
<tr>
<td>or ELT 125</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Fourth Term</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CJS 278: Data Communication Concepts II</td>
<td>4</td>
</tr>
<tr>
<td>COMM 130: Business &amp; Professional Communication</td>
<td>4</td>
</tr>
<tr>
<td>MT 180: High Tech Employment Strategies</td>
<td>1</td>
</tr>
<tr>
<td>MT 224: Process Equipment I</td>
<td>3</td>
</tr>
<tr>
<td>PHY 201: General Physics</td>
<td>4</td>
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<tr>
<td>or PHY 211: General Physics (Calculus)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Fifth Term</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>COMM 215: Small Group Communication: Process and Theory</td>
<td>4</td>
</tr>
<tr>
<td>MT 227: Process Equipment II</td>
<td>3</td>
</tr>
<tr>
<td>Automation Elective (PLC track)*</td>
<td>2</td>
</tr>
<tr>
<td>General Education (Social Science)</td>
<td>4</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Sixth Term</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT 222: Quality Control Methods in Manufacturing</td>
<td>3</td>
</tr>
<tr>
<td>MT 228: Process Equipment III</td>
<td>4</td>
</tr>
<tr>
<td>Automation Elective (PLC track ONLY)*</td>
<td></td>
</tr>
<tr>
<td>Automation Elective (Microcomputer track ONLY)*</td>
<td>4</td>
</tr>
<tr>
<td>General Education</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credits | 91

* Could be used as General Education.

1 All students must earn 4 credits from the Automation Elective list. Students choosing the PLC track within this list should take a 2-credit course from this track in the 5th term and a 2-credit course from this track in the 6th term. Students choosing the Microcomputer track should take a 4-credit course from this track in the 6th term.

#### AUTOMATION ELECTIVES

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIS 145</td>
<td>Microcomputer Hardware and Troubleshooting</td>
<td>4</td>
</tr>
<tr>
<td>or EET 178</td>
<td>Computing Environments for Technicians</td>
<td></td>
</tr>
<tr>
<td>PLC Track</td>
<td>Intermediate Programmable Logic Controllers (PC Based)</td>
<td>2</td>
</tr>
<tr>
<td>ELT 225</td>
<td>Advanced Programmable Controllers, PC Based</td>
<td>2</td>
</tr>
</tbody>
</table>

#### SOLAR VOLTAIC MANUFACTURING TECHNOLOGY CAREER PATHWAY CERTIFICATE

Minimum 14 credits. Students must meet all certificate requirements. The Solar Voltaic Manufacturing certificate is a Career Pathway. All courses are contained in the Solar Voltaic Manufacturing Technology AAS Degree.

### Solar Voltaic Manufacturing Technology Certificate Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH 100</td>
<td>Everyday Chemistry with Lab (or higher)</td>
<td>4</td>
</tr>
<tr>
<td>MT 101</td>
<td>Introduction to Semiconductor Manufacturing</td>
<td>1</td>
</tr>
<tr>
<td>MT 102</td>
<td>Introduction to Semiconductor Devices</td>
<td>1</td>
</tr>
<tr>
<td>MT 104</td>
<td>Introduction to Solar Voltaic Processing</td>
<td>1</td>
</tr>
<tr>
<td>MT 109</td>
<td>Electronic Circuits &amp; Devices I</td>
<td>3</td>
</tr>
<tr>
<td>or MT 111</td>
<td>Digital Systems I</td>
<td>3</td>
</tr>
<tr>
<td>or MT 111</td>
<td>Electronic Circuits &amp; Devices I</td>
<td></td>
</tr>
<tr>
<td>MT 121</td>
<td>Advanced Programmers, PC Based</td>
<td>2</td>
</tr>
<tr>
<td>MT 180</td>
<td>High Tech Employment Strategies</td>
<td>1</td>
</tr>
</tbody>
</table>

Total Credits | 14

**MT 101. Introduction to Semiconductor Manufacturing. 1 Credit.**

Presents an overview of careers in Microelectronics Technology. Also presents a succinct history of the semiconductor manufacturing processing and fundamental clean room protocol. Students will learn about the importance of quality and contamination control emphasis in the industry. Audit available.

**MT 102. Introduction to Semiconductor Devices. 1 Credit.**

Examines commonly made semiconductor devices, including diodes, solar voltaic cells, and MOSFET transistors. Includes electronic materials fundamentals of electricity, conductivity and semiconductor. Audit available.

**MT 103. Introduction to Micro and Nano Processing. 1 Credit.**

Introduces the methods used to manufacture Micro and Nano technologies. Traces semiconductor processing from raw material to a finished integrated circuit using planar technology. Introduces the processes and equipment used to create devices on the micro and nano scale. Emerging applications of MEMS and Nanotechnology are discussed. Audit available.
MT 104. Introduction to Solar Voltaiic Processing. 1 Credit.
Introduces the methods used to manufacture solar cells. Traces cell processing from raw material to a finished product using planar technology. Introduces the processes and equipment used to create pure single crystal silicon wafers and the processes used to form the solar devices on top of these substrates. Audit available.

MT 108. Statistics for Process Control. 2 Credits.
Covers Statistical Process Control (SPC), including plotting and interpreting charts and dealing with disposition situations. Develops understanding of what is meant by common statistical quantities such as mean, median, mode, standard deviation, skew, and also understanding of how common distributions represent real populations. Integrates practice performing computer calculation of these structures and their application to SPC. Prerequisite: MTH 60, and (WR 115 or IRW 115). Audit available.

MT 111. Electronic Circuits & Devices I. 4 Credits.
Covers Ohm’s Law, Kirchhoff’s Voltage and Current Law, Superposition, Thevenin’s Theorem, and R-C circuits. Includes labs on basic measurement techniques, use of electronic test equipment and proper documentation procedures. Prerequisites: (WR 115 or IRW 115), and placement into MTH 95. Audit available.

MT 112. Electronic Circuits & Devices II. 4 Credits.
Covers AC circuits. Includes both single frequency and frequency response analysis of circuits containing resistance, capacitance, and inductance. Both trigonometry and phasors will be covered. Labs include circuit construction, computer simulation and testing. Prerequisites: MT 111; MTH 95. Audit available.

MT 113. Electronic Circuits & Devices III. 4 Credits.
Overviews discrete semiconductor devices - diodes, BJTs, and FETs - and operational amplifiers. DC models as well as frequency response, bandwidth/ rise time relationships, and performance criteria are emphasized. Labs emphasize circuit construction and include simulation of amplifier circuits. Prerequisite: MT 112. Audit available.

MT 121. Digital Systems I. 3 Credits.
Covers combinational logic devices and circuits. Includes basic operation of logic gates, Boolean algebra, and MSI logic devices. Labs emphasize prototyping and testing of combinational logic circuits. Prerequisites: WR 115; MTH 65. Audit available.

MT 122. Digital Systems II. 3 Credits.
Covers sequential logic devices and circuits. Includes the operation of latches and flip-flops, ripple and synchronous counters, shift registers, memories, and a simple microprocessor system. Labs emphasize prototyping and testing of sequential logic circuits. Prerequisite: MT 121. Audit available.

MT 131. Introduction to Programmable Logic Controllers. 3 Credits.
Introduces Programmable Logic Controller programming. Includes PLC components, architecture, execution cycle, data file type and management, variable monitoring, and basic programming instructions. Recommends MT121, MT122 or equivalent. Prerequisite: Placement into MTH 111 and WR 121.

MT 180. High Tech Employment Strategies. 1 Credit.
Covers strategies for researching, preparing for, and acquiring a job in the MT associated industries of solar, microelectronics and automated manufacturing. Prerequisite/concurrent: MT 101, 102, 103 or 104.

MT 200. Semiconductor Processing. 3 Credits.
Explores aspects of semiconductor processing. Covers semiconductor device design (photo-voltaic cells, diodes, bipolar and MOSFET transistors) and the following manufacturing processes: oxidation, lithography, etch, doping, deposition, planarization, and test/sort. Prerequisites: MT 102, MT 103 or MT 104, MT 240, COMM 130 or COMM 215, or instructor permission. Audit available.

MT 222. Quality Control Methods in Manufacturing. 3 Credits.
Explores quality control methods used in semiconductor manufacturing. Topics include statistical process control (SPC), control charts, performance representation and capability measurements. Emphasizes computer manipulation of actual data for analysis and design of quality. Prerequisites: MTH 243 or MT 108, and WR 227. Audit available.

MT 223. Vacuum Technology. 3 Credits.
Covers the theory and practice of vacuum as used in semiconductor manufacturing. Topics include vacuum principles, vacuum systems and their components such as pumps, gauges and valves, and finally vacuum troubleshooting. Prerequisites: MT 101, MT 102, (MT 103 or MT 104), CH 100 or higher, WR 121, or instructor permission. Audit available.

MT 224. Process Equipment I. 3 Credits.
Part 1 of our series on semiconductor manufacturing equipment. Covers components commonly used in industrial equipment, such as controllers, controlling software, signal conditioner, sensors, switches, DC and stepper motors and their driver circuits. Also examines how these components can be used together to achieve automatic control in industrial equipment. Prerequisites: (MT 103 or MT 104), MT 113, MT 122, or instructor permission. Audit available.

MT 227. Process Equipment II. 3 Credits.
Covers subsystems of a semiconductor processing system. Includes pneumatics and robotic systems. Focuses on analysis, maintenance and troubleshooting. Prerequisite: MT 223 or CS 162, and MT 224. Audit available.

MT 228. Process Equipment III. 4 Credits.
Covers a semiconductor processing system. Includes power, vacuum, gas, delivery, robotic and control systems. Focuses on maintenance and troubleshooting. Prerequisites: MT 227, and (CS 162 or (MT 223 and MT 240)).