MICROELECTRONICS TECHNOLOGY

Microelectronics Technology: Automated Manufacturing Technology

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

ADMISSION PREREQUISITES

Academic Prerequisites

• Students new to the program should establish math and writing level through college credit or by taking the college’s placement examinations 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.

Other Prerequisites

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

PROGRAM REQUIREMENTS

Academic Requirements

• None

Other 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. 2)

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 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.

First Term

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH 104</td>
<td>5</td>
</tr>
<tr>
<td>or CH 221</td>
<td>1</td>
</tr>
<tr>
<td>MT 101</td>
<td>1</td>
</tr>
<tr>
<td>MT 102</td>
<td>1</td>
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</tbody>
</table>
MICROELECTRONICS TECHNOLOGY

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

**Third Term**
- MT 108 or MTH 243: Statistics for Process Control or Statistics I
- MT 113: Electronic Circuits & Devices III
- MT 122: Digital Systems II
- WR 227: Technical and Professional Writing 1

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

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

**Sixth Term**
- MT 200: Semiconductor Processing
- MT 228: Process Equipment III
- PHY 203 or PHY 213: General Physics or General Physics (Calculus)
- General Education: 3

**Total Credits:** 95

*SOLAR VOLTAIC 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.

**First Term**
- MT 101: Introduction to Semiconductor Manufacturing
- MT 102: Introduction to Solar Voltaic Processing
- MT 109: Intro to Electronics and Instrumentation
- General Education (Social Science)

**Total Credits:** 3

**Second Term**
- CH 100 (or higher): Everyday Chemistry with Lab
- MT 111: Electronic Circuits & Devices I
- MT 121: Digital Systems I
- WR 227: Technical and Professional Writing 1

**Total Credits:** 4

**Third Term**
- MT 108 or MTH 243: Statistics for Process Control or Statistics I
- MT 112: Electronic Circuits & Devices II
- MT 122: Digital Systems II
- MT 131: Introduction to Programmable Logic Controllers

**Total Credits:** 4

**Fourth Term**
- MT 113: General Physics
- MT 227: Process Equipment II
- MT 240: RF Plasma Systems
- PHY 201 or PHY 211: General Physics or General Physics (Calculus)

**Total Credits:** 4

**Fifth Term**
- COMM 130: Business & Professional Communication
- MT 180: High Tech Employment Strategies
- MT 222: Quality Control Methods in Manufacturing
- MT 223: Vacuum Technology
- MT 224: Process Equipment I
- PHY 201 or PHY 211: General Physics or General Physics (Calculus)

**Total Credits:** 4

**Sixth Term**
- COMM 215: Small Group Communication: Process and Theory
- MT 227: Process Equipment II
- MT 240: RF Plasma Systems
- PHY 202 or PHY 212: General Physics or General Physics (Calculus)

**Total Credits:** 4

**Seventh Term**
- MT 200: Semiconductor Processing
- MT 228: Process Equipment III
- PHY 203 or PHY 213: General Physics or General Physics (Calculus)

**Total Credits:** 3

*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.

**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.

**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.
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.

### 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.

### COURSE OF STUDY

**First Term**
- **MT 101** Introduction to Semiconductor Manufacturing 1 Credit
- **MT 102** Introduction to Semiconductor Devices 1 Credit
- **MT 104** Introduction to Solar Voltaic Processing 1 Credit
- **MT 111** Electronic Circuits & Devices I 4 Credits
- **MTH 111 (or higher)** College Algebra 5 Credits
- **WR 121** English Composition 4 Credits

**Second Term**
- **CS 161** Computer Science I 4 Credits
- **CIS 179** Data Communication Concepts I 4 Credits
- **MT 112** Electronic Circuits & Devices II 4 Credits
- **MT 121** Digital Systems I 3 Credits
- **WR 227** Technical and Professional Writing I 4 Credits

**Third Term**
- **CS 162** Computer Science II 4 Credits
- **MT 108** Statistics for Process Control or MTH 243 Statistics I 2 Credits
- **MT 113** Electronic Circuits & Devices III 4 Credits
- **MT 122** Digital Systems II 3 Credits
- **MT 131** Introduction to Programmable Logic Controllers 2 Credits
- **or ELT 125** Basic Programmable Controllers 4 Credits

**Fourth Term**
- **COMM 130** Business & Professional Communication 4 Credits
- **CIS 278** Data Communication Concepts II 4 Credits
- **MT 180** High Tech Employment Strategies 1 Credit
- **MT 224** Process Equipment I 3 Credits
- **PHY 201** General Physics 4 Credits
- **or PHY 211** General Physics (Calculus) 2 Credits

**Fifth Term**
- **COMM 215** Small Group Communication: Process and Theory 4 Credits
- **MT 227** Process Equipment II 3 Credits
- **Automation Elective (PLC track)** 3 (2) Credits
- **General Education** 4 Credits

**Sixth Term**
- **MT 222** Quality Control Methods in Manufacturing 3 Credits
- **MT 228** Process Equipment III 4 Credits
- **Automation Elective (PLC track ONLY)** 4 (2) Credits
- **Automation Elective (Microcomputer track ONLY)** 4 (2) Credits
- **General Education** 3 Credits

**Total Credits:** 91

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**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.

### AUTOMATION ELECTIVES

**Microcomputer Track**
- **CIS 145** Microcomputer Hardware and Troubleshooting 4 Credits
- **or EET 178** Computing Environments for Technicians

**PLC Track**
- **ELT 126** Intermediate Programmable Controllers (PC Based) 2 Credits
- **ELT 225** Advanced Programmable Controllers, PC Based 2 Credits

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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.

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**MT 80. Safety and Cleanroom Protocol. 2 Credits.**

Covers safety consideration for working in a semiconductor industry cleanroom. Introduces safety programs in the industry. Overviews available hazard information and how to obtain it. Covers personal safety and related equipment. Audit available.

**MT 90. Basic Electronics. 3 Credits.**

Includes Ohm’s Law, Kirchhoff’s Voltage and Current Law in series and parallel circuits, and troubleshooting problems of basic electric circuits. Labs include basic measurement and troubleshooting techniques, use of electronic test equipment and proper documentation procedures. Prerequisite/Concurrent registration: MTH 60; WR 115 or IRW 115. Audit available.

**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 semiconductivity. 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.

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* Could be used as General Education.
MT 104. Introduction to Solar Voltaic Processing. 1 Credit.
Introduces the methods used to manufacture silicon 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 109. Intro to Electronics and Instrumentation. 3 Credits.
Covers techniques of analysis and troubleshooting of basic electronic circuits that may include sensors and actuators. Labs include measurement and testing techniques, and documentation procedures. Prerequisite: Placement into MTH 60 and WR 115 or higher. Audit available.

MT 111. Electronic Circuits & Devices I. 4 Credits.
Covers Ohm’s Law, Kirchhoff’s Voltage and Current Law, Superposition, Thvenin’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.
Covers combinational logic devices and circuits. Includes basic operation of logic gates, Boolean algebra, and MSI logic devices. Labs emphasize circuit construction and include simulation of amplifier circuits. Prerequisite: MT 112. Audit available.

MT 121. Digital Systems I. 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, including 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)).

MT 240. RF Plasma Systems. 3 Credits.
Covers the theory and practice of RF (Radio Frequency) plasma systems as used in semiconductor manufacturing processes such as etching, chemical vapor deposition (CVD) and sputter deposition. Includes plasma physics, RF power system components, power matching and match circuits, and applications in semiconductor manufacturing. Prerequisite: MT 112, MT 223, CH 100 or higher, WR 227, or instructor permission. Audit available.