NEW

Associate Degree in

MEMS & Microelectronics

What are MEMS and Microelectronics?

Micro-Electrical Mechanical Systems, MEMS, is a technology that consists of electronic components, sensors, mechanical actuators, and structures that are built on a micro and submicro scale. Microelectronic technology is the manufacturable integration of electronic components and MEMS devices in a functioning circuit or product. The MEMS degree offers a variety of challenges to students interested in pursuing careers in any of the above fields whether that means earning a bachelor’s degree in engineering or science or starting a new career working as an operator within these fields. Students enrolled in MEMS courses at LCCC get hands-on experience and training working at the operator level in a class 10,000 cleanroom located on college grounds working with materials, equipment, protocols, and processes related to the microelectronics industry. Included are lectures on problem solving skills related to MEMS theory of design, sensor and microcircuit operation, material and size constraints, microelectronic packaging, printed circuit design, manufacturing, and project management. Students have the option of pursuing an associate degree, one-year technical certificate, or short-term technical certificate. Also available to students is the opportunity to be involved with LCCC’s work-based learning program, where the student is hired as a paid intern working with a company active in the field of microelectronics.

For more information on the MEMS and Microelectronics degree at LCCC, contact professor Johnny Vanderford at (440) 366-4206 or at jvanderford@lorainccc.edu.
MEMS and Microelectronics Degree
Micro-Electromechanical Systems (MEMS) Major

The associate degree is built upon five core courses in MEMS and microelectronics.

MEMS 122 Introduction to MEMS – A broad topic, application driven, introduction to microelectronic systems and MEMS sensors. The course is designed to give the student a comprehensive introduction to how the microelectronics industry has been affected by the implementation of MEMS technology and MEMS sensors. Lectures provide the student with examples of the history of MEMS devices, the applications of MEMS devices, and reviewing weekly current events to highlight new devices and emerging MEMS technologies. The laboratory introduces the student to working in an environmentally controlled laboratory called a cleanroom. Here the student is taught how to gown up for labs, how to use microscopes, make measurements with instrumentation, and how to work with the small components typically used in the microelectronics industry.

MEMS 132 MEMS Packaging – A firsthand approach to the manual and semi-automatic microelectronic packaging processes. The student learns how to take a microelectronic die or the sense element of a MEMS device and place it inside of an industry compliant component often referred to as a "package". This class teaches students how to operate equipment commonly used in MEMS and microelectronic manufacturing:
- Die Attach – a die placement tool and adhesive material is dispensed to adhere the sensor or semiconductor die to a package
- Wire Bonding - A fine wire, typically 0.001” in diameter and made of gold or aluminum, is thermosonically welded from the sensor to the package and with these parts
- Encapsulation – An environmental seal is created around the die and welded micro-wires preventing contamination or damage from air, moisture or other elements.

MEMS 211 Microelectronic Fabrication – A hands-on course in processes and materials used in the silicon and semiconductor fabrication industry. Students are instructed in safe handling methods of materials and the complex methods of how MEMS devices and integrated circuits (IC) are made from substrates called wafers. The students also get hands on experiences in the fundamental and complex processes and materials used for fabricating MEMS and microelectronic products including photolithographic process, mask alignment with UV exposure, wet/dry chemical etching, and thin film sputtering processes.

MEMS 221 Microsystems Capstone Project – A culmination of the previous three MEMS courses taking a hybrid circuit from design to a manufacturable prototype. This course combines elements of the hands-on experience in previous MEMS courses with the engineering methodology of project management as well as computer aided drafting (CAD) and circuit design. The student is given several key components of a circuit such as a sensor, a microelectronic die, and a package and with these parts. The student is then tasked with designing and building a prototype that performs to functionality specified by the instructor. The student is responsible for building two identical functioning circuits by the end of the course and providing a process report on how the circuit was designed, cost of all components, and step-by-step work instructions cards on how they operated equipment in the cleanroom to build this circuit. Hands-on topics learned in class include thick film circuit design, screen printing, SMT pick and place, solder reflow, and final test.

MEMS 287 & MEMS 288 Work-Based Learning - A supervised paid internship experience with one of several approved employers in the NE Ohio area active in the field of microelectronics. A student works 10 and 15 hours per week as a paid intern. The student intern works with a company part-time, typically involved with an equipment process or operation similar to what they have learned in the MEMS degree. Through WBL, students integrate classroom learning with work experience. Students are awarded WBL credit after satisfactory demonstration of work-place competencies.

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