

# MICRO-ELECTROMECHANICAL SYSTEMS (MEMS)

## **MEMS 122, INTRODUCTION TO MICRO-ELECTROMECHANICAL SYSTEMS (MEMS) 4 (6)**

The course presents the theory construction methods, terminology and application of this emerging field. Micro-Electro-Mechanical Systems (MEMS) is the integration of mechanical elements, sensors, actuators, and electronics on a very small scale. Topics include: MEMS applications in sensing physical phenomena, applications to biological processes, and DMDS-Digital Mirror Devices used in communications and internet applications. Lab required. (A special fee will be assessed.)

**General Education:** IN1

**Course Entry Requirement(s):** None

**Typically Offered:** Fall Semester

## **MEMS 132, MEMS PACKAGING 3 (4)**

The course focuses on microelectronic mechanical systems (MEMS) packaging including micro-enabled systems and how these devices are integrated with electronic circuits and product interfaces. The student will be introduced to common packaging techniques used in the industry such as die attach, wirebonding and reliability testing. Lab required. (A special fee will be assessed.)

**General Education:** IN1

**Course Entry Requirement(s):** Prerequisite: MEMS 122

**Typically Offered:** Spring Semester

## **MEMS 211, MICRO-FABRICATION PROCESSING 3 (4)**

The course focuses on microelectronic mechanical systems (MEMS) surface and bulk fabrication processes including photolithography, wet and dry anisotropic and isotropic etch, thin film deposition methods, and process interaction with materials. An introduction to fabrication process control, characterization and development principles with design of experiments and metrology theory will also be covered. Lab required. (A special fee will be assessed.)

**General Education:** IN1, IN5

**Course Entry Requirement(s):** Prerequisite: MTHM 121 and MEMS 132

**Typically Offered:** Fall Semester

## **MEMS 221, MICRO-SYSTEM CAPSTONE PROJECT 3 (4)**

This course is a capstone project built upon the previous MEMS classes. The student will design a device which will then be packaged and reproduced within the MEMS cleanroom demonstrating the student's ability to manufacture two identical fully functional circuits with starting components, devices, and final circuit requirements chosen by the instructor. Lab required. (A special fee will be assessed.)

**General Education:** IN1

**Course Entry Requirement(s):** Prerequisite: MEMS 211 and ELCT 111

**Typically Offered:** Spring Semester

## **MEMS 287, WORK-BASED LEARNING I - MEMS 1-3 (1)**

This course provides supervised, paid work experience with approved employer(s) in an area related to the student's program. Emphasis is placed on integrating prior or concurrent classroom learning with work experience through career readiness competencies. Students will be able to evaluate career selection and satisfactorily demonstrate work-related competencies.

**General Education:** IN1, IN2, IN3, IN4

**Course Entry Requirement(s):** A student must be pursuing a degree seeking program at LCCC; have completed 12 semester hours with a minimum of 6 semester hours in the discipline of placement; have a min GPA of 2.5 in the discipline and a 2.0 overall GPA; and have division approval.

**Typically Offered:** Offer as required, Offer as required

## **MEMS 288, WORK-BASED LEARNING II - MEMS 1-3 (1)**

Building on experiences from Work Based Learning I, this course provides supervised, paid work experience with approved employer(s) in an area related to the student's program. Emphasis is placed on integrating prior or concurrent classroom learning with work experience through career readiness competencies. Students will be able to evaluate career selection and satisfactorily demonstrate work-related competencies.

**General Education:** IN1, IN2, IN3, IN4

**Course Entry Requirement(s):** Prerequisite: MEMS 287

**Typically Offered:** Offer as required

## **MEMS 289, WORK BASED LEARNING III - MEMS 1-3 (1)**

Building on experiences from Work Based Learning II, this course provides supervised, paid work experience with approved employer(s) in an area related to the student's program. Emphasis is placed on integrating prior or concurrent classroom learning with work experience through career readiness competencies. Students will be able to evaluate career selection and satisfactorily demonstrate work-related competencies.

**General Education:** IN1, IN2, IN3, IN4

**Course Entry Requirement(s):** Prerequisite: MEMS 288

**Typically Offered:** Offer as required

## **MEMS 299, INDIVIDUALIZED STUDIES IN MICRO-ELECTROMECHANICAL SYSTEMS 1-3 (1)**

An in-depth study of areas in micro-electromechanical systems presented by discussion and/or individual research and reading. Topics will vary. Repeatable up to six (6) times for a total of six (6) credit hours.

**Course Entry Requirement(s):** Prerequisite: Second year standing and division approval

**Typically Offered:** Offer as required

## **MEMS 311, PCB AND FLEX DESIGN 3 (5)**

This course introduces the student to the fundamental concepts of Printed Circuit Board (PCB) construction and design using typical PCB design, simulation and implementation software. Topics include design based in general rigid fiberglass based PCB materials, flexible substrate PCB materials, circuit schematic implementation, revision documentation, bill of materials (BOM) generation with cost-control, layout with comparison of electronic design vs. physical design, multilayer auto-router, GBR file generation and time management for purchase. Laboratory required. (A special fee will be assessed.)

**General Education:** IN1, IN2

**Course Entry Requirement(s):** Prerequisite: TECN 111; Concurrent: CADD 111 and MEMS 122

**Typically Offered:** Fall Semester

**MEMS 321, PCB ASSEMBLY 3 (4)**

The course focuses on the training in the operation and programming of automated high-volume equipment used in the manufacturing of printed circuit board (PCB) and surface mount technology (SMT) electronic assembly. Student will be required to read and understand documentation on the standards of electronic assembly related to SMT process engineering while training on high-volume SMT electronic assembly as an operator. Equipment operation includes stencil printers for solder paste dispense, programmable SMT pick & place, belt driven convection reflow ovens, ESD preventative tools and stereo microscope or lens-based inspection equipment. Laboratory required. (A special fee will be assessed.)

**General Education:** IN1, IN2

**Course Entry Requirement(s):** Prerequisite: MEMS 311; Concurrent: ELCT 115 and MEMS 221

**Typically Offered:** Spring Semester

**MEMS 387, WORK-BASED LEARNING - MEMS 1-3 (1)**

Building on prior Work Based Learning experience(s), this course provides supervised, paid work experience with approved employer(s) in an area related to the student's program. Emphasis is placed on integrating prior or concurrent classroom learning with work experience through career readiness competencies. Students will be able to evaluate career selection and satisfactorily demonstrate work-related competencies.

**General Education:** IN1, IN2, IN3, IN4, IN5

**Course Entry Requirement(s):** Prerequisite: MEMS 287, Prerequisite: MEMS 287 or division approval

**Typically Offered:** Offer as required

**MEMS 388, WORK BASED LEARNING - MEMS 1-3 (1)**

Building on prior Work Based Learning experience(s), this course provides supervised, paid work experience with approved employer(s) in an area related to the student's program. Emphasis is placed on integrating prior or concurrent classroom learning with work experience through career readiness competencies. Students will be able to evaluate career selection and satisfactorily demonstrate work-related competencies.

**General Education:** IN1, IN2, IN3, IN4, IN5

**Typically Offered:** Offer as required

**MEMS 411, PCB INSPECTION & REWORK 3 (4)**

The course focuses on the training in the operation and programming of equipment used in quality inspection and failure analysis of manufactured printed circuit boards (PCB) and surface mount technology (SMT). Students will be required to read and understand documentation on the standards of PCB testing and inspection related to SMT process engineering while training on PCB test & inspection equipment to identify, report on, and repair/rework PCB. Laboratory required. (A special fee will be assessed.)

**General Education:** IN1, IN2

**Course Entry Requirement(s):** Prerequisite: MEMS 321

**Typically Offered:** Fall Semester

**MEMS 421, ELECTRONIC ASSEMBLY - SENIOR DESIGN 3 (4)**

The course will require a student to work in a pre-determined team with the purpose of manufacturing a batch of identical printed circuit boards (PCB). Student teams will program equipment, create manufacturing documentation for assembly, verify multiple working PCB both by inspection and demonstrated test, and write a quality report verifying green-light ready for volume manufacturing. During the class, the student will also take and pass the Surface Mount Technology Association (SMTA) Process Engineering Certification Exam. Laboratory required. (A special fee will be assessed.)

**General Education:** IN1, IN2

**Course Entry Requirement(s):** Prerequisite: MEMS 411

**Typically Offered:** Spring Semester

**MEMS 487, WORK BASED LEARNING MEMS 1-3 (1)**

Building on prior Work Based Learning experience(s), this course provides supervised, paid work experience with approved employer(s) in an area related to the student's program. Emphasis is placed on integrating prior or concurrent classroom learning with work experience through career readiness competencies. Students will be able to evaluate career selection and satisfactorily demonstrate work-related competencies.

**General Education:** IN1, IN2, IN3, IN4, IN5

**Course Entry Requirement(s):** Prerequisite: MEMS 387

**Typically Offered:** Offer as required