**ESSEX COUNTY COLLEGE**

**Engineering Technologies and Computer Sciences Division**

**MET 202 – Modern Manufacturing Systems and Robotics**

**Course Outline**

**Course Number & Name:**  MET 202 Modern Manufacturing Systems and Robotics

**Credit Hours:**  4.0 **Contact Hours:**  6.0 **Lecture:** 3.0 **Lab:**  3.0 **Other:**  N/A

**Prerequisites**:  Grade of “C” or better in MET 201 or placement

**Co-requisites:** None **Concurrent Courses:** None

**Course Outline Revision Date:**  Fall 2010

**Course Description**: This course introduces the concept of computer integrated manufacturing systems through the use of a flexible manufacturing center comprised of a number of workcells.  It covers communication between the individual process controllers and a factory control system. Robot operation and programming is introduced. The course also covers the mechanical aspects of material manipulation, various feedback mechanisms, and the integration of robots with other machines in the workcell. The student applies the design concept and techniques to develop a machine tool operation system. Field trips to assembly plants are included.

**Course Goals:** Upon successful completion of this course, students should be able to do the following:

1. use cutting tools, machine tools, and workholding devices to carry out machining processes; and

2. discuss and implement robotics classification, safety, and programming.

**Measurable Course Performance Objectives (MPOs)**: Upon successful completion of this course, students should specifically be able to do the following:

1. Use cutting tools, machine tools, and workholding devices to carry out machining processes:

* 1. *select appropriately and use correctly cutting tools, machine tools, and workholding devices for a given machining process;*
  2. *describe and implement turning processes;*
  3. *describe and implement milling processes;*
  4. *program the CNC lathe and mill with basic operations;*
  5. *discuss broaching, sawing, and filing;*
  6. *discuss abrasive machining processes;*
  7. *discuss thread-and-gear manufacturing;* and
  8. *discuss joining processes*

**Measurable Course Performance Objectives (MPOs)** (continued):

2. Discuss and implement robotics classification, safety, and programming:

2.1 *discuss robot classification and safety;*

2.2 *program a robot to carry out basic operations;* and

2.3 *discuss integration of the robot into the workcell*

**Methods of Instruction**: Instruction will consist of lectures and supervised experiments in the lab.

**Outcomes Assessment:** Selected homework, quiz, test, and exam questions are blueprinted to course objectives. A checklist rubric is used to evaluate projects and lab reports for the presence of course objectives. Data is collected and analyzed to determine the level of student performance on these assessment instruments in regards to meeting course objectives. The results of this data analysis are used to guide necessary pedagogical and/or curricular revisions.

**Course Requirements:** All students are required to:

1. Maintain regular attendance and participate in classroom discussions.

2. Complete homework assignments and lab reports on time.

3. Take all quizzes, tests and exams as scheduled.

4. Participate in all lab experiments and submit lab reports.

5. Read all assigned textbook pages.

6. Make oral presentations of projects.

7. Share responsibilities when working as a team.

**Methods of Evaluation:** Final course grades will be computed as follows:

**% of**

**Grading Components final course grade**

* **Homework, Quizzes and Class Participation**  **10 – 30%**

A perusal of homework and quiz questions and analysis of class discussion will indicate the extent to which students master course objectives.

* **Projects and Lab Reports 15 – 30%**

Projects will show evidence of the extent to which students can apply course concepts to real world problems, design a solution, and compose a technical report. Lab reports will show evidence of the extent to which students can apply course concepts to physical problems, analyze errors, and compose a technical report. Labs are designed to reinforce student mastery of course objectives.

**Methods of Evaluation** (continued)**:**

**% of**

**Grading Components final course grade**

* **3 or more Tests** (dates specified by the instructor) **30 – 45%**

Tests will show evidence of the extent to which students meet course objectives, including but not limited to identifying and applying concepts, analyzing and solving problems, estimating and interpreting results and stating appropriate conclusions using correct terminology.

* **Final Exam** (comprehensive)  **20 – 30%**

The same objectives apply as with tests, but it is anticipated that students will provide increased evidence of synthesizing a combination of concepts.

Note: The instructor will provide specific weights, which lie in the above-given ranges, for each of the grading components at the beginning of the semester.

**Academic Integrity:** Dishonesty disrupts the search for truth that is inherent in the learning process and so devalues the purpose and the mission of the College. Academic dishonesty includes, but is not limited to, the following:

* plagiarism – the failure to acknowledge another writer’s words or ideas or to give proper credit to sources of information;
* cheating – knowingly obtaining or giving unauthorized information on any test/exam or any other academic assignment;
* interference – any interruption of the academic process that prevents others from the proper engagement in learning or teaching; and
* fraud – any act or instance of willful deceit or trickery.

Violations of academic integrity will be dealt with by imposing appropriate sanctions. Sanctions for acts of academic dishonesty could include the resubmission of an assignment, failure of the test/exam, failure in the course, probation, suspension from the College, and even expulsion from the College.

**Student Code of Conduct:** All students are expected to conduct themselves as responsible and considerate adults who respect the rights of others. Disruptive behavior will not be tolerated. All students are also expected to attend and be on time for all class meetings. No cell phones or similar electronic devices are permitted in class. Please refer to the Essex County College student handbook, *Lifeline*, for more specific information about the College’s Code of Conduct and attendance requirements.

**Course Content Outline:** based on the text **DeGarmo’s Materials and Processes in Manufacturing,** 10th edition, by J T Black and Ronald A Kohser; published by John Wiley & Sons, Inc, 2008; ISBN #: 978-0470-05512-0; and the reference text **Introduction to Robotics in CIM Systems**, 5th edition, by J A Rehg; published by Prentice Hall, 2003; ISBN #: 978-0130-60243-5.

**Week**

**(2 meetings**

**@ 160 minutes) Topic/Content**

1 Fundamentals of Chip-type Machining Processes

2 Cutting Tools for Machining

3 Turning and Boring and Related Processes

Drilling and Related Hole-making Processes

4 Lab 1: CNC Lathe Programming and Operation

**Test 1**

5 Milling and Workholding Devices

6 Computer Numerical Control and Machining Centers

7 Lab 2: CNC Mill Programming and Operation

**Test 2**

8 Broaching, Sawing, and Filing

9 Abrasive Machining Processes

10 Thread-and-Gear Manufacturing

11 Joining Processes

**Test 3**

12 Robot Classification and Safety

13 Robot Programming

14 Robot in CIM Cell

Lab 3: Robot Programming and Operation

15 **Comprehensive Final Exam**