

Course No: MET 4780
Course Name: Advanced Manufacturing Processes
Credits: 3 semester credits, (0 – 2 – 2)
Semester: Spring 2007
Section: R01
Day / Time: Recitation M W 9:05 - 9:55 (07-216)
 Lab F 10:05 - 11:55 (07-216)

Instructor: Mark A. Johnson Ph.D.
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Office Hours: M-Th 10:00 – 11:00
 F 1:00 – 2:00

Textbook: Kalpakjian, Serope. & Schmid, Steven R. (2006). Manufacturing Engineering and Technology, 5th edition, Upper Saddle River, New Jersey: Prentice-Hall, Inc, ISBN#0-13-148965-8.

Prerequisites: MET 1540 and MEEM 2500

Additional Materials/References: There may be additional reading, homework, etc. distributed via email or on reference in the library. Even though it is not listed on the syllabus, it is your responsibility to make sure that you review the material. This material could be included on exams.

Course Description: Focuses on practical aspects of design and manufacturing. Covers advanced manufacturing methods and issues that influence component design. Incorporates computer-aided manufacturing tools and rapid prototyping concepts.

Course Objectives: After completing this course, you should be able to:

- Understand the basic advanced manufacturing processes used to produce and develop durable goods.
- Define relevant terminology relating to many advanced processes, quality issues and available design tools.
- Apply the tools you have learned to real-life problems.
- Understand how using the latest manufacturing techniques can impact the organization.

Class Sessions:

Instructional Methods

A variety of methods will be used to transfer the knowledge and skills of manufacturing to you as a student. The following methods will be used:

- Lecture
- Class Discussion
- Select DVD's of processes and material production and history
- Reviewing Sample Problems
- Lab trips and demonstrations

Skills

You will be using many different skills in this course. There are several prerequisites prior to taking this course, which serve as the foundation for topics covered. It is important to have completed the prerequisites prior to taking this course. You will use the following skills:

- Problem solving skills
- Critical thinking skills
- Analytical skills

Course Evaluation: Grades will be based on the following:

| | | |
|------------------------|------|----------|
| • Quiz | 10% | 100 pts |
| • Lab and Trip Reports | 15% | 150 pts |
| • Exam #1 | 20% | 250 pts |
| • Exam #2 | 20% | 250 pts |
| • Exam #3 | 20% | 250 pts |
| • Total Points | 100% | 1000 pts |

Grading Scale:

| | |
|-----------|--|
| A | 93% and above (Excellent, with 4.0 grade points per credit) |
| AB | 88-92 (Very good, with 3.5 grade points per credit) |
| B | 82-87% (Good, with 3.0 grade points per credit) |
| BC | 76-81% (Above average, with 2.5 points per credit) |
| C | 70-75% (Average, with 2.0 points per credit) |
| CD | 65-69% (Below average, with 1.5 points per credit) |
| D | 60-64% (Inferior, with 1.0 points per credit) |
| F | 59% and below (Failure, with 0.0 points per credit) |
| I | Incomplete; given only when a student is unable to complete a segment of the course because of circumstances beyond the student's control. It must be made up by the close of the next four quarters in residence or the incomplete grade becomes a failure. A grade of incomplete maybe given only when approved in writing by the department chair. Incomplete grades at graduation are considered (F) grades in computing the final grade |

Homework:

No homework assignments will be given in this course, however it is highly recommended that you work all suggested problems in the syllabus. Exams and quizzes are based on knowledge gained working these text problems. If you have any questions, please feel free to contact the instructor for further information or direction.

Hour Examinations:

There will be three exams. The exams will consist of a combination of multiple choice, short answer, and problems. There will be no makeup exams except in extreme, documented circumstances.

Cheating or Plagiarism:

Proper professional and ethical behavior is expected of all students in this class. If cheating is suspected the Dean of Students will be notified and standard MTU policies will be followed.

Student Expectations:

The most important expectation would be to learn about manufacturing process that you could use in your working life. However, to be able to be successful in this course, the following are expectations I have to ensure your completion and a good grade:

- Attend every class (except under extreme circumstances that you should provide documentation to instructor).
- Read the required material prior to attending the course.
- Complete all assignments on time (Absolutely no late submissions accepted)
- Participate in class and group discussions.
- Be prepared for class.
- Present professional reports and presentations.
- Abide by the Academic Integrity policy.
- Use recommended software and word processing for required assignments.
- Interact with class members and be respectful of other's opinions.
- Apply continuous improvement and make recommendations to instructor.

This class is designed for you to participate in the learning experience. You are responsible for being a learner and a teacher of information. You can learn as much from the instructor as you can from exchanges and discussions with other students in the class. Many of the students bring valuable work experience that is relevant to the subjects being discussed.

If you are not in class, it is hard to participate. If you have an extreme situation, which prevents you from attending the course, please document the circumstance and provide the written notice to the instructor. Universities excused absences include documented plant trips and other university related business. Please provide **written notice of absence in advance** of missing class. Class participation includes full attendance, being prepared for in-class group work and discussions, and responding to discussion topics.

Notice:

If you have any special needs because of personal circumstances, please feel free to meet with me in the beginning of the semester or as soon as possible. MTU complies with all federal and state laws and regulations regarding discrimination, including the Americans with Disability Act of 1990 (ADA). If you have a disability and need reasonable accommodation for equal access to education or services at MTU, Associate Dean of Students at 487-2212. For other concerns about discrimination, you may contact your advisor, department head, or the Affirmative Action Office at 487-3310.

Time Management

This course is one of several courses you are required to complete for your degree. It is always helpful to have an idea of the time requirements associated with a particular course. It is estimated that outside of class you will need to spend approximately, on average, 2-3 hours per credit hour or 6-9 hours a week to complete the recommended assignments. It is possible in some weeks that it will be more and other weeks it will be less.

Web

All current material will be found on the MTU W: drive under www.tech.mtu.edu/courses/MET4780

Date Chapter/Required Reading/Suggested Problems**Week 1**

- 1/15 **No Class - Martin Luther King Day**
- 1/17 **Course Introduction**
Review of course syllabus
- 1/19 **Chapter 20: Rapid-Prototyping Operations**
Required reading: Text pages 580-601
Suggested Problems 20.21, 20.22

Week 2

- 1/22 **Rapid Prototyping DVD (SME)**
Class Discussion
- 1/24 **Chapter 25: Machining Centers, Advanced Machining Concepts and Structures, and Machining Economics**
Required Reading: Text pages 760-787
Suggested Problems 25.36, 25.38
- 1/26 **Milling and Machining Center Basics DVD (SME)**
Class Discussion and demonstration

Week 3

- 1/29 **Chapter 27: Advanced Machining Processes**
Suggested reading: Text Pages 835-864
Suggested Problems 27.33, 27.36
- 1/31 **Electrical Discharge Machining DVD (SME)**
Class Discussion
- 2/2 **Water-Jet Machining Demo**

Week 4

- 2/5 **Chapter 28: Fabrication of Microelectronic Devices**
Required reading: Text pages 868 - 907
Suggested Problem Set: 28.21, 28.23
- 2/7 **Chapter 28: Fabrication of Microelectronic Devices (continued)**
- 2/9 **Winter Carnival (No Lab)**

Week 5

- 2/12 **Chapter 29: Fabrication of Microelectromechanical Devices and Systems**
Required reading: Text pages 908 – 935
Suggested Problem Set: 29.24, 29.27
- 2/14 **Problem Set Review & Exam Review**
- 2/16 **Exam #1 (Chapters 20, 25, 27, 28, 29)**

Week 6**2/19 Chapter 30: Fusion-Welding Processes**

Required reading: Text pages 940 - 979
Suggested Problem Set: 30.34, 30.39

2/21 Welding DVD (SME) with class discussion

2/23 Welding Demo

Week 7**2/26 Chapter 31: Solid-State Welding Processes**

Required reading: Text pages 980-1002
Suggested Problem Set: 31.35, 31.37

2/28 Chapter 31: Solid-State Welding Processes (Cont)

3/2 Plant Trip (tentative)

Week 8**3/5 Chapter 32: Brazing, Soldering, Adhesive-Bonding, and Mechanical Fastening Processes**

Required reading: Text pages 1003 - 1033
Suggested Problem Set: 32.24, 32.25

3/7 Brazing and Soldering DVD (SME) with class discussion

3/9 Lab Demonstration

Spring Break March 10-18

Week 9**3/19 Chapter 33: Surface Roughness and Measurement ; Friction, Wear, and Lubrication**

Required reading : Text pages 674-722
Suggested Problem Set: 33.15

3/21 Chapter 33: Surface Roughness and Measurement ; Friction, Wear, and Lubrication (continued)

3/23 Chapter 34: Surface Treatments, Coatings, and Cleaning

Required Reading: Text pages 1059 - 1083
Suggested Problem Set: 34.17, 34.20, 34.22, 34.29 Problem Set Review & Exam Review

Week 10

3/26 Exam Review and Problem Review

3/28 Exam #2 Chapters 30, 31, 32, 33, 34

3/30 Exam #2 Returned

Week 11

- 4/2 **Chapter 35: Engineering Metrology and Instrumentation**
Required Reading: Text Pages 1085 - 1109
Suggested Problem Set 35.17, 35.22, 35.23, 35.25
- 4/4 **Chapter 35: Engineering Metrology and Instrumentation (Continued)**
- 4/6 LAB Problem

Week 12

- 4/9 **Chapter 36: Quality Assurance, Testing, and Inspection**
Required reading: Text pages 1110-1141
Suggested Problem Set: 36.27, 36.29, 36.31, 36.32, 36.35
- 4/11 **Chapter 36: Quality Assurance, Testing, and Inspection**
- 4/13 Lab Problem

Week 13

- 4/16 **Chapter 37: Automation of Manufacturing Processes**
Required reading: Text pages 1144 – 1190
Suggested Problem Set: 37.17, 37.24, 37.27
- 4/18 **Chapter 37: Automation of Manufacturing Processes (continued)**
- 4/20 Machine Tools DVD (History Channel)

Week 14

- 4/23 **Chapter 38: Computer-Aided Manufacturing**
Required reading 1191 - 1217
Suggested Problem Set 38.3,38.9, 38.15, 38.20
- 4/25 **Chapter 39: Computer- Integrated Manufacturing Systems**
Required reading: Text pages 1218 - 1237
Suggested Problem Set 39.4, 39.7, 39.16, 39.20, 39.23
- 4/27 Exam #3 Review & Problem Review

Finals Week April 30-May 4