

## Mechanical Engineering and Mechanics

### MEM437 MANUFACTURING PROCESSES I

Fall 2006/Spring 2007

#### Course (catalog) description

This course will introduce basic manufacturing process technology and the mechanical properties of metals and plastics. The course is a combined lecture and laboratory teaching. The course will cover Dimensional and Geometry Tolerancing, Surface Finishing, Manufacturing Product Quality Assurance; Metal casting; Metal Cutting Processes and Machine Tools of Turning and Milling, CNC programming and machining; Manufacturing Processes of Polymers and Reinforced Plastics, and Injection Molding. Three hands-on laboratory sections are designed for this class, they are: machine shop practice and lathe and milling machine operations, CNC programming and operation, and injection molding process.

#### Prerequisite(s)

MEM 220 Basic Fluid Mechanics, MEM 230 Mechanics of Materials I

#### Textbook(s) and/or other required material

Required : "Manufacturing Processes for Engineering Materials," Fourth Edition, Serop Kalpakjian, Addison Wesley, 2002

Reference Texts: "*Fundamentals of Modern Manufacturing,*" Second Edition, Mikell Groover, John Wiley & Sons, 2003

#### Course Objectives

1. Acquire fundamentals of the mechanical behavior of materials including tension, compression, torsion and bending, especially the concept of true stress and true strain.
2. Recognize the importance of dimensional tolerance, geometrical tolerance and surface roughness standards in manufacturing inspection and quality assurance.
3. Acquire the knowledge of metal casting processes and equipment including solidification process of metals, cast structure, fluid flow and heat transfer and cast design.
4. Describe and explain material removal processes, metal cutting mechanism such as mechanics of chip formation, cutting processes and machine tools for producing round and various shapes. Write CNC codes to make metal parts.
5. Identify the structures of polymers and general mechanical behaviors and properties of thermal plastics and thermal sets.
6. Indicate various applications of plastics, such as thermal plastics, thermal sets, elastomers and special polymers. Operate injection molding machine to make plastic parts.
7. Describe general properties of reinforced plastics (composite materials) on their structures and calculate their mechanical strength.

#### Topics Covered

1. Introduction to Manufacturing Processes
2. Review of Mechanics and Materials
3. Dimensional and Geometry Tolerancing
4. Surface Finishing
5. Metal Casting
6. Material Removal Processes: Mechanics of Metal Cutting; Cutting Processes and Machine Tools, CNC machining
7. Introduction of Processing of Polymers and Reinforced Plastics; Forming, Shaping and Processing of Plastics; Injection Molding Machining

**Class/laboratory schedule, i.e., number of sessions each week and duration of each session**

Three hour lectures, once a week, and additional three labs

**Contribution to Professional Component**

The course builds upon the principles learned in MEM 220 Basic Fluid Mechanics, MEM 230 Mechanics of Materials I as their professional course. The knowledge taught in MEM 437 can be used by students in their capstone senior design project, and future engineering career.

**RELATION TO ABET CRITERIA 3 OUTCOMES:**

0 = No content; 1 = Some content; 2 = Significant content

<b>Outcomes a - k</b>	<b>Content</b>	<b>Explanation</b>	<b>Evidence *</b>
a. An ability to apply knowledge of mathematics, science and engineering	<b>2</b>	This course requires the students to develop a general understanding of materials and its processing and manufacturing technologies. The students learn how to apply and synthesize their knowledge of mathematics, science, and engineering.	Homework, team projects and Exams
b. An ability to design and conduct experiments as well as to analyze and interpret data	<b>0</b>	Students have three experimental labs and need to write lab report and deal with various data.	Lab reports.
c. An ability to design a system, component or process to meet desired needs	<b>1</b>	The assigned design problems are always required to meet societal and industrial needs.	Homework, projects and text book
d. An ability to function on multidisciplinary teams	<b>0</b>	NA	NA
e. An ability to identify, formulate and solve engineering problems	<b>2</b>	The homework problems and exams require students to identify, formulate and solve engineering problems.	Homework, exams,
f. An understanding of professional and ethical responsibility	<b>1</b>	This is emphasized as part of the engineer's overall responsibility.	Classroom discussion; text book
g. An ability to communicate effectively	<b>0</b>	Students need to answer questions in the class, write project reports, discuss in the team projects	Lecture, Team project discussion and report
h. The broad education necessary to understand the impact of engineering solutions in a global/societal context	<b>1</b>	The impact of engineering design and manufacturing on the economy and society are covered.	Classroom discussion, text book
i. A recognition of the need for and an ability to engage in lifelong learning	<b>0</b>	NA	
j. A knowledge of contemporary issues	<b>0</b>	NA	
k. An ability to use the techniques, skills and modern engineering tools necessary for engineering practice	<b>1</b>	Students can use computer aided design, manufacturing and analysis software to solve design and engineering analysis problems.	Homework and projects

Prepared by: Jack Zhou 11/15/2006