

Course Syllabus for MFGE 2332, Fall 2010

Course Title: MFGE 2332: Material selection and manufacturing processes

Prerequisites: ENGR 2300

Instructor: Dr. Jitendra S. Tate

Telephone: (512) 245-1826 (dept. office), (512) 245-4872 (direct line)

E-Mail: jt31@txstate.edu

Office: RFM 2218

Office Hours: Tuesday; Wednesday; and Thursday (1-3pm). Friday by appointment.

Class Time: *Lecture: Tuesday/Thursday 6.30-7.50pm, RFM 5242 (5th floor)*

Lab: Thursday 8-9.20pm (1st floor labs)

Required Text:

- Serope Kalpakjian and Steven R. Schmid Manufacturing Engineering And Technology 6th Edition, Prentice Hall, 10-digit ISBN: 0-13-608168-1, 13-digit ISBN: 978-0-13-608168-5

Reference Books:

- El Wakil, Sherif D. Processes and Design for Manufacturing, 2nd edition, Waveland Pr Inc 2002, 10-digit ISBN: 1-57766-255-5, 13-digit ISBN: 978-1-57766-255-6

Course Description:

This course provides an overview of material processing, material selection and process parameter determination. Processes covered include: material removal, forming, casting, polymer processing, semiconductor manufacturing and assembly processes. Laboratory activities provide opportunities for applying the design through manufacture activities of the product cycle.

Course Objectives:

- To provide an overview of manufacturing processes associated with metallic, polymeric, ceramic and semiconductor based products.
- To provide students with an understanding of the relationship between material properties and manufacturing processes.
- To provide students with an understanding of process parameters and process optimization.
- To provide students laboratory learning experiences in the operation and control of manufacturing processes.

Evaluation:

Performance in classwork, homework, and class exams will determine the student's numerical score out of a possible 100. Specifically, the following determine the numerical score:

Grading (Scale: 90-100 (A), 80-89.9 (B), 70-79.9 (C), 60-69.9 (D), 59.9 or less (F))

o Exams	60%
o Lab Work*	20%
o Homework	10%
o Quiz(s)	10%
	100

Attendance (unexcused)

Reduction of 2% per day absence

Additionally, the student's overall performance in the course as subjectively evaluated by instructor will be used as an input in determining grades. ***Your grade is determined by your results – not effort, or need.***

****This course has lab component. If you miss more than one lab you will not pass this course.***

General Policies and Procedures:

- No food or drinks are permitted in the classroom and labs.
- No smoking or tobacco use of any kind in the lab or classrooms per state law.
- All departmental and University policies on academic integrity and absences apply and should be taken very seriously.
- No cell phone/I-Pod/laptop/netbook use during appointed class times and lab hours.
- Coming late and leaving early is completely unacceptable. You will be marked absent if you do so.

- 6) You must check your emails regularly and also need to visit 'TRACS' for important announcements, due dates, course documents, and assignments.
- 7) Attendance for lab hours is MANDATORY.
- 8) You must follow all safety rules while working in the lab.

Absences:

It is urged that the students not miss any class. Attendance policies as mandated by the department will also be strictly adhered. **Scheduled exam absences or overdue homework and projects will not be accepted** unless there exists legitimate excuses (illness, death in family, etc.). However, it is the student's responsibility to obtain class notes, handout materials, if any, etc., when a scheduled lecture is missed.

Special Needs:

Students with special needs (as documented by the Office for Disability Services) should identify themselves to the instructor at the beginning of the semester so that provisions for accommodation can be made.

Course Outline:

Topic #	Topic	Chapter #	Week #
0	Syllabus, Lab Tour and Safety Instructions	Notes	1
1	Introduction, Product Design and Concurrent Engineering	Notes	2
2	Material Engineering Overview and Materials Selection Issues	Notes based on Ch. 1-9	3
4	Casting and Foundry	10,11,12	4/5
5	Joining of Metal	30,31,32	6/7
6	Metal Forming	14,15,16	8/9
7	Machining of Metal	23,24	10/11
8	Cutting Tools for Machining	22	12
9	Computer Numeric Control	Notes	12
10	Powder Metallurgy	17	13
11	Manufacturing with Polymers and Composites	19	14

Fall 2010 Semester Important Dates:

- Classes begin: August 25th
- Thanksgiving break Nov 24-26 (week 12)
- Final Exam: Thursday, Dec 9th (8-10.30pm)
- Last day of class: December 6th
- Test#1: October 7th (6.30-8pm)tentative date, subject to change
- Test#2: November 11th (6.30-8pm) ...tentative date, subject to change

Weekly Schedule of Teaching (subject to change)

1. Syllabus and Overview/ Lab tour and safety instructions
Syllabus, textbook, lab schedule, lab tour, and safety instructions
2. Introduction, Product Design and Concurrent Engineering
Definition of manufacturing and design, value added, classification of materials, overview of manufacturing processes (Fig 1.6a-f), history of manufacturing, definition/advantages/ limitations of concurrent engineering vs traditional engineering, DFX especially Design for manufacturability (DFM),
3. Overview on Materials Engineering. Material Selection Issues.
Engineering materials, Relative mechanical/physical properties of engineering materials, stress vs strain behavior, concept of plastic and elastic strain, temperature effect, heat treatments for steels, applications for selected carbon and alloy steels, stainless steel applications, tool and die steel , general characteristics of nonferrous metals, basics of polymeric materials, basics of ceramic materials, and basics of composite materials.
- 4/5 Casting and Foundry
Introduction, history, casting terminology, steps in sand casting process, stages of shrinkage, solidification time, issues with shrinkage, solidification pattern and grain structure, casting design practices, casting defects, types of casting processes (expendable mold and non-expendable mold), pros and cons of casting
- 6/7 Joining of Metals
Joining processes and equipment, welding, history of welding, fusion welding, solid-state welding, brazing and soldering, joint design and welding defects, heat affected zone, welding symbols, mechanical fasteners (rivets, bolts,
- 8/9 Metal forming
Forging (open die and closed die), rolling (shape, ring, and thread), extrusion, hydrostatic extrusion, cold working and hot working, metal forming (punching, bending, shearing, drawing, laser cutting)
- 10/11 Machining of Metals
Types of machining, sawing, milling (horizontal and vertical), climb vs conventional milling, end milling, face milling, turning, lathe (vertical and horizontal), parts of lathe, drilling, drill geometry, reaming, grinding, EDM, broaching, and lapping.
- 12 Cutting Tools for Machining. Computer Numeric Control
- 13 Powder Metallurgy
- 14 Manufacturing with Polymers and Composites
Polymers, polymerization processes, polymer chain, crystallinity, injection molding, injection molds, defects in injection molding, trade names of plastics, thermoforming, extrusion, and blow molding. Composites processes: vacuum infusion, compression molding, calendaring, filament winding, pultrusion

Course Requirements

Homework (Total 8) based on following topics.

- 1 Metal Casting Processes
- 2 Casting Equipment and Defects in Casting
- 3 Metal Joining Processes: Welding
- 4 Metal Joining Processes: Brazing, and Soldering
- 5 Metal Forming Processes Forging and Extrusion
- 6 Metal Forming Processes: Sheet metal
- 7 Metal Machining Processes: Milling
- 8 Metal Machining Processes: Turning
- 9 Powder Metallurgy
- 10 Manufacturing with Polymers and Composites

Quizzes (Total 2) based on following topics

1. Metal Casting Processes and Metal Joining Processes
2. Metal Forming Processes
3. Metal Machining Processes
4. Manufacturing with Polymers and Composites

Labs (Attendance is Mandatory. Sequence of labs subject to change)

1. Lab Safety Practices
2. Demonstration: Metal Casting
3. Hands on Training: Milling and Drilling
4. Hands on Training: Turning
5. Hands on Training: Welding
6. Hands on Training: Sheet Metal
7. Demonstration: Plastics and Composites
8. Watching Video: Silicon Run I
9. Watching Video: Silicon Run II

Test#1 based on following topics

- Metal Casting Processes and Equipment
- Metal Joining Processes: Welding, Brazing, and Soldering
- Metal Forming Processes: Forging

Test#2 based on following topics

- Metal Forming Processes: Extrusion, and Sheet metal
- Metal Machining Processes: Turning and Milling
- Powder metallurgy
- Manufacturing with Polymers and Composites

Final Exam is Comprehensive

Contribution to the Professional Component:

This course provides students with the ability to select appropriate material and the most efficient and cost effective manufacturing method for various engineering applications. Furthermore, course provides fundamental understanding of the behavior and properties of materials as they are altered and influenced by processing in manufacturing; various process parameters associated with particular manufacturing method; and how these parameters are optimized. It covers large domain of materials including metals, polymers, composites, and semi-confuting materials.

Relationship to Program Outcomes:

Program Outcomes	MFGE 2332
1. An ability to apply the principles of math, science, and engineering to the solution of practical problems.	X