University Of California, Berkeley
Department of Mechanical Engineering

ME 222: Modeling and Simulation of Advanced Manufacturing Processes (3 units)

Graduate Course

Syllabus

CATALOG DESCRIPTION

This course provides the student with a modern introduction to the basic industrial practices, modeling techniques, theoretical background and computational methods to treat classical and cutting edge manufacturing processes in a coherent and self-consistent manner.

COURSE PREREQUISITES

An undergraduate course in strength of materials or ME 122.

TEXTBOOK(S) AND/OR OTHER REQUIRED MATERIAL.

Reader and notes. No textbook.

COURSE OBJECTIVES:

An introduction to modeling and simulation of modern manufacturing processes.

DESIRED COURSE OUTCOMES:

The ability to model and simulate forming, lithography, heat treatment, etc.

TOPICS COVERED

In summary, the following topics are discussed in detail:

1. An overview of manufacturing processes
2. A review of basic mechanical behavior of materials
3. A review of microstructure of materials
4. A review of surfaces and tribology
5. A review of casting and heat treatment
6. A review of analytical methods for the analysis of cold-working
7. Advanced modeling tools for manufacturing: continuum formulations in three-dimensions
8. Elasto-plastic analysis of forming with thermal effects
9. Foundations of industrial finite element codes
10. Finite element methods for forming at finite-deformations

11. Surface treatments with applications to carburization, case-hardening and chemical etching. Modeling and simulation with finite differences
12. Laser processing of materials. Modeling and simulation with finite differences
13. Solidification and grain growth. Modeling and simulation with finite differences
14. Analysis of sprays and jets: coating, epitaxy, implantation and ablation. Modeling and simulation with discrete element methods
15. Composite material design and optimization of materials using numerical methods
16. Electromagnetic (induction) processing and its foundations. Modeling and simulation with finite differences.

CLASS/LABORATORY SCHEDULE.

3 hours of lecture a week.

CONTRIBUTION OF THE COURSE TO MEETING THE PROFESSIONAL COMPONENT.

A major portion of manufacturing process are numerically modeled in order to give students exposure to industrial practice.

ASSESSMENT OF STUDENT PROGRESS TOWARD COURSE OBJECTIVES

(a) 6-8 projects worth 75 % and (b) final worth 25 %

PERSON(S) WHO PREPARED THIS DESCRIPTION

Professor Tarek Zohdi
February 15, 2011

ABBREVIATED TRANSCRIPT TITLE (19 SPACES MAXIMUM): MOD & SIM ADV MAN
TIE CODE: LECT
GRADING: Letter
SEMESTER OFFERED: Fall and Spring
COURSES THAT WILL RESTRICT CREDIT: None
INSTRUCTORS: Prof. Zohdi
DURATION OF COURSE: 14 Weeks
EST. TOTAL NUMBER OF REQUIRED HRS OF STUDENT WORK PER WEEK: 9
IS COURSE REPEATABLE FOR CREDIT? No
CROSSLIST: None