MIE 201
Introduction to Materials Science and Engineering

Syllabus for Fall 2009

Instructor: J. I. Goldstein  313 ELab, 545-2165, jig0@ecs.umass.edu

Teaching Assistants: To be announced


Course Website: http://mielsvr1.ecs.umass.edu/mie201

Office Hours: Flexible or by appointment. Appointments immediately after class are easy to get.
Course Goals

1. To comprehend the broad classification of materials into metals, ceramics, polymers, composites, and electronic materials based on atomic bonding, crystal structure and properties.
2. To understand how material properties depend upon composition, structure, and processing with emphasis on mechanical properties.
3. To apply knowledge of materials properties to the selection of materials for design, production, and end use.
4. To introduce the concepts of cost, environmental, and safety factors in engineering design with materials.

Course Outcomes

- Understand the differences between ionic, covalent, metallic and secondary bonding.
- Ability to describe crystal structures of metals, ceramics and other materials.
- Ability to visualize and calculate crystallographic directions and planes.
- Working knowledge of the structure and chemistry of polymers.
- Understand various types of point defects in materials and their importance.
- Calculation of steady-state and non-steady state diffusion and its effects in solid materials.
- Understand elastic deformation in materials and its relation to mechanical properties of metals, ceramics, and polymers.
- Calculation of slip systems in crystals and their relation to plastic deformation.
- Ability to relate grain size, solid solution strengthening, strain hardening, recovery, recrystallization, and grain growth to the strengthening of crystalline and non-crystalline materials.
- Understand the basic phenomena of fracture, fatigue, and creep in different materials.
- Ability to use phase diagrams to calculate solubility, phase equilibrium, and to predict the microstructure of materials as a function of composition and temperature.
- Understand the basic microstructure of Fe-C alloys as a function of temperature, composition, and cooling rate.
- Relate phenomena of crystallization, melting, and glass transition in polymers and glassy materials.
- Ability to describe fabrication techniques such as casting, forming, heat treatment, etc. and their application to metals, ceramics, and polymers.
- Knowledge of the most common alloys, ceramics, and polymers and their performance.
Outcome Measurement and Assessment

- Weekly homework problem sets on principles covered in class lectures and reading assignments.
- Two 1-hour-long exams to provide feedback on the comprehension of lectures, homework, and reading assignments.
- One 2-hour-long final exam to provide comprehensive feedback on the comprehension of lectures, homework, and reading assignments.
- Course instructor evaluations to provide student feedback on perceived success of the course and instructor at meeting the objectives and projected outcomes.
- Short in-class quizzes to emphasize major course outcomes and provoke class discussion.

Grading

Grades will be determined on the following basis:

- Two in-class exams (20% each)
- Final Exam (30%)
- Homework (20%)
- Class quizzes (10%)

The final exam will be comprehensive, but with greater emphasis on material covered after the second quiz.

Homework and design problem policy

A number of problems/exercises will be assigned in order to reinforce the subject matter covered in lectures. You will normally have one or two class periods to complete each problem set, and you will be asked to turn in a subset of the problems at the beginning of the appropriate class lecture. Late submissions will not be accepted without prior approval of the instructor. Students may discuss homework problems (indeed we would encourage you to cooperate), but the final calculations and the presentation of the solutions must represent individual effort.

Final exam policy

NO EXEMPTIONS ARE GRANTED. Exams must be taken (and turned in) in the assigned room. Graded examinations are not returned to students. Course instructors do retain
examinations for at least two weeks into the new semester and students are encouraged to review their examination papers (but not to take them out of the office).

**Recitation Sessions**

Several lecture sessions will be converted to recitations where homework, sample exams or difficult concepts will be discussed. These sessions are optional although the classes are offered to improve understanding of course materials and to help prepare for exams and the course final.

**Class Attendance**

Attendance is required for lectures. Class quizzes will be given without prior notification. Review sessions are held in class just before the exams. Experience of past students in this course has been that regular attendance is critical for a good understanding of the subject and good success in the course.

**Communication**

Homework, course announcements, and other information will be posted on the Web. You will be responsible for finding assignments and turning them in on time. Some of the announcements and documents will be posted as Word and/or pdf documents.