ME 350: ENGINEERING MATERIALS

(Revised 1/13/10)

CATALOG DATA:

ME 350 – Engineering Materials: F 3 credits (3 lecture)
Application of materials selection to the engineering design process. Development of microstructure-processing-properties relationships on the mechanical and functional behavior of materials.

TEXTBOOK:

Michael Ashby, Hugh Shercliff, and David Cebon, "Materials: Engineering, Science, Processing, and Design." Elsevier

Recommended reference textbooks: Introduction to Materials Science and Mechanics of Materials

INSTRUCTOR:

Dr. Stephen W. Sofie, Roberts 201E, 994-6299, 994-6292 (fax), ssofie@me.montana.edu
Office Hours: As posted outside of my office or any time my door is open.
The use of e-mail is encouraged outside of office hours

E-MAIL POLICY:

According to MSU policies and procedures, the myMSU portal (student.name@myportal.montana.edu) is the official university means of communication with students. Students are expected to check their email no less frequently than twice a week in order to stay current with University-related communications. Students have the responsibility to recognize that certain communications may be time-critical. Failure to check for messages and failure to receive messages due to full mailboxes or auto-forwarded email are not acceptable excuses for missing official University communications. Students may auto-forward email to an outside email client at their own risk.

ENTRANCE EXPECTATIONS:

This course is designed to complement the students' knowledge on classical mechanics by incorporating the fundamentals of materials at the atomic level forming the foundation of tailorable properties and how that applies to the design process. The student is expected to have a working knowledge of materials science, physics, and mathematics.

PREREQUISITE: ChBE 213, ME 251
COREQUISITE: ME 341

COURSE OBJECTIVES:

The objective of this course is to introduce students to the concept of materials selection early in the design process and to understand the associated design degrees of freedom. Further, the student will be introduced to the fundamental properties of materials from an atomistic perspective in regards to stiffness, ductility, and modes of failure to establish the essential link between mechanics and materials science. The curriculum contains aspects of the engineering design process, materials selection strategies, defects/dislocations,

temperature affects & durability, manufacturing processes, structural materials, high temperature materials, functional materials, and processing/microstructure/properties relationships.

GENERAL INFORMATION:

A strong understanding of materials is crucial to the practice of mechanical engineering today and into the future. Advancements in technologies central to mechanical engineering will be driven in large part by advancements in materials. What is most important is that mechanical engineers understand the atomistic basis for material properties so they can intelligently conclude whether or not a given property is a "design degree of freedom". If a material property can be manipulated within some range of values, then it is a design degree of freedom. However, manipulating one material property may have unintended consequences for other material properties, and the engineer needs to have the depth of understanding to be aware of these trade offs.

ME 350 will provide the student with this level of understanding by teaching material science from an integrated engineering/design perspective

COMPUTER AND LABORATORY USAGE:

Students will be required to use the Cambridge Engineering Selector software package from Granta Design in addition to previously learned software for project development and presentation. Further, use of the laboratory and shop may be required for the group projects.

CLASS SCHEDULE:

Lecture, 11:00 -12:15am, TR, ROBH 218

COURSE OUTCOMES:

Upon completion of this course, students will have demonstrated the ability to:

1. Effectively use the Cambridge Engineering Selector software
2. Explain and apply the degrees of freedom to the design process
3. Understand the means and extent by which material properties can be manipulated
4. Understand the basis for properties variations among the key materials classes
5. Define the dependency of properties and atomic/microstructure relationships
6. Conceptualize elastic and plastic deformation from an atomistic perspective
7. Define the effects of heat on mechanical and functional materials properties
8. Predict the behavior of defects and dislocations under applied stress/strain
10. Effectively apply materials properties fundamentals and mechanics of materials design strategies to the materials selection process

ASSESSMENT AND EVALUATION:

The course outcomes will be evaluated, and the final letter grades will be based, on the following criteria:

Homework	25%	(the selection/design homework is extensive and time consuming and requires the use of the CES software when specified. Handwritten graphs are not acceptable)
Midterm Exams (3 total)	75%	

Note: no grading curve will be employed and students' final grades are not based on the respective performance of peers

Examinations missed due to unexcused absences cannot be made up except in highly unusual cases. If you know in advance that you must miss any exam, notice must be made *PRIOR* to the week of the exam and options will be discussed with you. Three equally weighted midterms will be administered during the course of the semester. Homework assignments are due in one week from the assignment date, unless otherwise noted. Late homework assignments will not be accepted for credit towards the final grade.

Point totals required to receive a particular letter grade will be assigned according to the chart below. Plus and minus grading will be used at the discretion of the instructor. Inappropriate conduct, late arrival to lecture, poor group performance, and cheating/plagiarism will affect the final grade.

A: 90 – 100%
B: 80 – 90%
C: 70 – 80%
D: 60 – 70%
F: <60%

The course objectives may be evaluated by means of midterm and semester end alumni surveys in the form of an un-graded quiz and/or questioner.

The new C- Grade Policy is presented on-line at http://www.montana.edu/wwwcat/academic/acad6.html. It is in the 2006-2008 Catalog on Page 61. This Minimum Competency Requirements policy affects new freshmen, new transfers, and continuing students in different ways.

ME, MET, and IE students who are exempt from the Board of Regents C- policy must understand that a D- grade is not considered passing by the M&IE Department. A grade of D- in any required course must be repeated, with a D or higher grade earned, for it to apply to degree requirements.

COURSE WEB SITE:

For course information see **http://www.coe.montana.edu/me/faculty/sofie/**

Course information including homework/test solutions, exam study guides, and project guidelines will be posted on the course website throughout the semester

SPECIAL NEEDS INFORMATION:

Students with special needs or requiring special accommodations should contact the instructor or the campus Disabled Student Services Office at the earliest opportunity.

STUDENT CONDUCT:

Students are expected to conduct themselves in accordance with the MSU Student Conduct Guidelines (http://www2.montana.edu/policy/student_conduct/), including the areas of academic honesty, behavior, and responsibilities.

SEMESTER SCHEDULE:

Available on the course website