Instructors:
Dr. Richard P. Vinci, Whitaker 464, x8-4581, email: vinci
Dr. Richard W. Hertzberg, Whitaker 454, x8-4226, email: rwh1

Lab TA: Ed Gorzkowski, Whitaker 445b, x8-3842, email: epg2

Office hours:
It is anticipated that Dr. Vinci will be available from 12-12:45 on Tuesdays and Thursdays immediately after lecture. Additional meeting times may be arranged (in person or by email), but please do not come to the office immediately before class unless there is a pressing need. Review sessions (to be scheduled) will be held prior to exams.

Text:

References:
Physical Metallurgy Principles, Reed-Hill
Phase Transformations: Metals and Alloys, Porter and Easterling
Principles of Polymer Systems, Rodriquez

Attendance Requirements:
Students are expected to attend and participate in all classroom hours. Should anyone miss an assignment or an important announcement, it will be his/her responsibility to obtain the necessary information. In addition to the regular class times, there will be several special sessions/labs scheduled throughout the semester (dates to be announced). Attendance is required at all special sessions.

Homework:
Written homework assignments will be due as noted in the syllabus. Late assignments will be penalized at the rate of 10% per day unless prior arrangements have been made. Discussion of homework problems is acceptable (and is encouraged), but plagiarism with respect to written assignments is not.

Reading:
Reading assignments are expected to be up-to-date to enable the student to participate in class discussions and activities. Assigned sections should therefore be read prior to the lecture date. Simple quizzes based on the reading will be given as needed.
Examinations:

Two hourly examinations will be given during the semester. The final exam will be cumulative, but will emphasize the material covered in the final third of the course. If a student is unable to take a scheduled hourly examination, Dr. Vinci must be notified and provided with an Absence Information Report (obtained through the Office of Student Life — see Student Handbook) no later than 24 hours after the exam. If possible, notification before the exam is encouraged. Failure to provide adequate notification and an acceptable excuse will result in a grade of zero. There are no exceptions to this rule.

Grading Philosophy:

The ultimate grade for the course will be based on a composite of performance in the hourly and final exams, lab reports, and other factors such as homework, quizzes and classroom participation. Exams will be scaled but not curved (i.e., points may be added uniformly to bring the average up to an acceptable level, but there is no preconceived grade distribution in the class — it is technically possible for everyone to earn an A). The breakdown of the grading factors is:

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hourly Exams, each 20%</td>
<td>40%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>35%</td>
</tr>
<tr>
<td>Additional assignments</td>
<td>10%</td>
</tr>
<tr>
<td>Homework, quizzes and class discussion</td>
<td>15%</td>
</tr>
</tbody>
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General Course Objectives:

At the end of this course, students should be able to:

1. Explain the tensile response of standard materials in terms of engineering values and in terms of interatomic bonding.
2. Calculate the engineering and true stress and strain states in common engineering structures such as beams and thin-walled pressure vessels.
3. Perform standard tensile tests and analyze the elastic and plastic behavior.
4. Describe the roles that edge and screw dislocations play in plasticity of crystalline materials.
5. Estimate the magnitude of stresses necessary for dislocation movement.
6. Describe the effects of stacking fault energy on plastic behavior.
7. Calculate the conditions for slip and twinning.
8. List and describe the primary strengthening mechanisms in metals, and how these mechanisms are exploited in industry.
9. Predict time and temperature effects on the mechanical response of engineering materials.
10. Specify material characteristics for high temperature use.
11. Explain the differences between metal and polymer plasticity.
12. Calculate polymer stress and strain states using mechanical analogs.
13. Explain the departure between ideal cohesive strength and actual fracture behavior of engineering materials.
15. Define the terms unique to the fracture field.
16. Prepare fracture specimens, identify the key features of a fracture surface, and describe the information that can be derived from such features.
17. Apply fracture mechanics to design philosophy.
18. Select fracture tests appropriate for a particular design.
19. List and describe the primary toughening mechanisms in engineering materials, and how these mechanisms are exploited in industry.
20. Describe the effects of environmental conditions on fracture and design practice.
21. Identify simple fatigue failures from fracture surface morphology.
22. Estimate fatigue life of engineering materials.
23. Specify design and manufacturing techniques to minimize fatigue damage.

Note: more detailed course objectives will be distributed throughout the semester. They may be viewed as the elements of a “contract” between the instructors and the students, and therefore serve as the basis for student assessment. As such, the exams will be designed with these objectives in mind.

Prerequisites:

Students are responsible for certain prior coursework. While the following list is not exhaustive, it is assumed that students will already be able to:
1. Identify and describe the basic crystal structures of common engineering materials, including FCC, BCC, HCP, DC, rocksalt, and zincblende.
2. Calculate engineering stresses and strains for uniaxial loading.
3. Draw and label an ideal stress-strain curve for common metals (at a Mat33 level).
4. Draw and explain the structure of an edge dislocation in a simple cubic material.
5. Label the (100), (111) and (110) points on a stereographic projection for FCC and BCC materials.
6. Plot experimental data and extract physical constants (such as activation energy).

If anyone has difficulty with these topics from prior coursework, it is their responsibility to review the material and request help if needed.