UNIVERSITY OF CALIFORNIA
College of Engineering
Department of Materials Science & Engineering

Professor R. Gronsky

E45

Properties of Materials

Fall Semester 2014

Date	Lecture (12-1 PM)	AM Lab	PM Lab	HW/Exams
Thu, Aug 28, 2014	*Instruction Begins*			
Fri, Aug 29, 2014	Introduction to Engineering Materials			
Mon, Sep 1, 2014	*Labor Day Holiday*			
Tue, Sep 2, 2014		Orientation	Orientation	
Wed, Sep 3, 2014	Strength of Materials, Stress, Strain		Orientation	
Thu, Sep 4, 2014		Orientation	Orientation	
Fri, Sep 5, 2014	Deformation Modes, Elastic and Plastic	Orientation	Orientation	**HW01**
Mon, Sep 8, 2014	Hardness, Ductility, Toughness		Lab01	
Tue, Sep 9, 2014		Lab01	Lab01	
Wed, Sep 10, 2014	Materials at the Atomic Level		Lab01	
Thu, Sep 11, 2014		Lab01	Lab01	
Fri, Sep 12, 2014	Classifications by Bond Types	Lab01	Lab01	**HW02**
Mon, Sep 15, 2014	Primary and Secondary Bonds in Materials			
Tue, Sep 16, 2014				
Wed, Sep 17, 2014	Crystallinity and Crystal Systems			
Thu, Sep 18, 2014				
Fri, Sep 19, 2014	**Exam**			**Midterm 01**
Mon, Sep 22, 2014	Concepts of “Lattice” and “Motif”		Lab02	
Tue, Sep 23, 2014		Lab02	Lab02	
Wed, Sep 24, 2014	Crystallographic Notation: Indices		Lab02	
Thu, Sep 25, 2014		Lab02	Lab02	
Fri, Sep 26, 2014	Crystal Structures of Engineering Materials	Lab02	Lab02	**HW03**
Mon, Sep 29, 2014	Structural Analysis by Diffraction			
Tue, Sep 30, 2014				
Wed, Oct 1, 2014	Crystalline Defects			
Thu, Oct 2, 2014				
Fri, Oct 3, 2014	Dislocations, Grain Boundaries			**HW04**
Mon, Oct 6, 2014	Diffusion in Solids		Lab03	
Tue, Oct 7, 2014		Lab03	Lab03	
Wed, Oct 8, 2014	Phases, Components, Phase Rule		Lab03	
Thu, Oct 9, 2014		Lab03	Lab03	
Fri, Oct 10, 2014	Phase Diagrams	Lab03	Lab03	**HW05**
Mon, Oct 13, 2014	Understanding Reaction Isotherms			
Tue, Oct 14, 2014				
Wed, Oct 15, 2014	Predicting Microstructural Development			
Thu, Oct 16, 2014				
Fri, Oct 17, 2014	**Exam**			**Midterm 02**

Date	Lecture (12-1 PM)	AM Lab	PM Lab	HW/Exams
Mon, Oct 20, 2014	Reaction Kinetics		Lab04	
Tue, Oct 21, 2014		Lab04	Lab04	
Wed, Oct 22, 2014	TTT Curves		Lab04	
Thu, Oct 23, 2014		Lab04	Lab04	
Fri, Oct 24, 2014	Control of Kinetics in Engineering Alloys	Lab04	Lab04	**HW06**
Mon, Oct 27, 2014	Failure of Engineering Materials			
Tue, Oct 28, 2014				
Wed, Oct 29, 2014	Brittle Fracture: Griffith Crack Model			
Thu, Oct 30, 2014				
Fri, Oct 31, 2014	Fatigue Damage			**HW07**
Mon, Nov 3, 2014	Polymers and Polymerization		Lab05	
Tue, Nov 4, 2014		Lab05	Lab05	
Wed, Nov 5, 2014	Viscoelastic and Elastomeric Behavior		Lab05	
Thu, Nov 6, 2014		Lab05	Lab05	
Fri, Nov 7, 2014	Composite Materials	Lab05	Lab05	**HW08**
Mon, Nov 10, 2014	Isostrain and Isostress Loading			
Tue, Nov 11, 2014	*Veterans' Day Holiday*			
Wed, Nov 12, 2014	Property Averaging			
Thu, Nov 13, 2014				
Fri, Nov 14, 2014	**Exam**			**Midterm 03**
Mon, Nov 17, 2014	Electrical and Electronic Properties		Lab06	
Tue, Nov 18, 2014		Lab06	Lab06	
Wed, Nov 19, 2014	Magnetic Properties		Lab06	
Thu, Nov 20, 2014		Lab06	Lab06	
Fri, Nov 21, 2014	Optical Properties	Lab06	Lab06	**HW09**
Mon, Nov 24, 2014	Dielectrics, Ferroelectrics, Piezoelectrics			
Tue, Nov 25, 2014				
Wed, Nov 26, 2014	Solid State Devices			
Thu, Nov 27, 2014	*Thanksgiving Day Holiday*			
Fri, Nov 28, 2014	*Thanksgiving Day Holiday*			
Mon, Dec 1, 2014	Environmental Degradation of Materials			
Tue, Dec 2, 2014				
Wed, Dec 3, 2014	Materials Selection and Design			
Thu, Dec 4, 2014				
Fri, Dec 5, 2014	Epilogue — Review for Final Exam			**HW10**
Mon, Dec 8, 2014	*RRR*			
Tue, Dec 9, 2014	*RRR*			
Wed, Dec 10, 2014	*RRR*			
Thu, Dec 11, 2014	*RRR*			
Fri, Dec 12, 2014	*RRR*			
Mon, Dec 15, 2014	*Finals Week*			
Tue, Dec 16, 2014	*Finals Week*			
Wed, Dec 17, 2014	*Finals Week*			
Thu, Dec 18, 2014	*Finals Week*			
Fri, Dec 19, 2014	Final Exam, 11:30AM–2:30PM			**Final Exam**

E45 Logistics

Course Website bCourses

Lecture **MWF 12-1PM, 10 Evans Hall**

Office Hours **218 Hearst Memorial Mining Building**
M 8-10 AM, and **W 8-9 AM,** and/or by appointment

Textbook **J.F. Shackelford**, *Introduction to Materials Science for Engineers*, Eighth Edition, Pearson Higher Education, Inc., Upper Saddle River, NJ 07458, (2015).

USED copies of the 7th (2009), 6th (2005), or 5th (2001) editions are also acceptable, but please verify numbering of homework problems, as they may be different.

Note: Outside reading from other textbooks and auxiliary sources is **strongly** encouraged.

Laboratory All lab sections meet in **Room 230 HMMB** unless otherwise instructed by GSIs.

Six laboratory exercises complement the lectures in biweekly experiments investigating the properties of materials, using the *Lab Guide* and *Lab Manuals* posted to our *bCourses* site.

Lab 01 *Basics of Mechanical Behavior*
Lab 02 *The Uniaxial Tensile Test*
Lab 03 *Recovery, Recrystallization, and Grain Growth*
Lab 04 *Binary Alloy Phase Diagrams*
Lab 05 *Heat Treatment of Steel*
Lab 06 *Electronic Properties of Materials*

The lab is divided into 8 sections, meeting biweekly according to the following calendar.

Lab Sections	Monday	Tuesday	Wednesday	Thursday	Friday
8-11 AM		101		104	106
2-5 PM	108	102	103	105	107

Each lab section has a primary Graduate Student Instructor (GSI) who is responsible for grading lab reports, and a secondary GSI, who assists with safety and staffing of experimental stations.

E45 Grading

"As a member of the UC Berkeley community,I act with honesty, integrity, and respect for others."

Ethics

Please remember that this is your honor code. It is a simple pledge that will serve you well during your academic career, and provide a solid foundation for success in your career as a practicing professional, when you will be held to even higher standards.
The National Society of Professional Engineers™ articulates those standards here.

Course Grade

There are no individual grading thresholds assigned to individual assessment methods. All components are scored, weighted, pooled, then mapped onto a curve for a course grade determination at the **end** of the semester, according to the following guidelines.

Homework 10%

Homework is submitted by uploading solutions in pdf to *bCourses* by the due date and time. No raw "word processing" documents are accepted; submissions must be converted to pdf to preserve formatting, which is common professional engineering practice. Deadlines are firm, to allow for timely uploading of solutions as additional study guides. Each homework submission is individually worth 50 points.

The topmost objective of your homework assignments is to **guide your self-learning**. Homework is **not** meant to be "group learning" exercise, and certainly not an artistic alteration of answers from others to avoid a plagiarism charge. Homework problems are taken directly from the textbook, so your answers can be found in the textbook.
You should therefore think of your homework assignments this way: **read the textbook** and **develop your own (imaginative, creative, fully articulated, and professionally presented) answers** to the homework problems.

Your homework submissions MUST be your own work; **consultation with others is strictly forbidden**. If you choose to adopt or modify the solutions presented in any of the "Instructor's Manuals" available on line, or an instructor's previously distributed solutions to any of the problems assigned this semester, you MUST give a full citation of such resources; otherwise you are engaging in plagiarism. Such academic dishonesty yields NO points and risks a report to the Center for Student Conduct.

Please note that your GSIs are **not** consultants on homework submissions; they have special responsibilities to serve as your mentors in laboratory "hands-on" experimental practice. If you are having trouble with your homework, please use your instructor's posted **office hours** to seek guidance **after** you've attempted your solutions.

Lab Reports 30%

Formal lab reports are due on the dates established by your GSIs, normally one week after completion of the lab exercises, also by uploading them in pdf to our *bCourses* site. Late penalties are enforced. Each lab report is individually worth 100 points.

In the laboratory you will be working in small groups to gather data, which, most of the time, must be shared by all members of your lab group. This is **not** plagiarism. Rather, it should be an incentive to work with your group members to secure the best data set possible. Reading the laboratory protocols ahead of time to be sure of the data required for your report is the prudent path to proper preparation. Afterwards, with your data set in hand, you will **individually** analyze, render in drawings, plot in graphs, interpret, and present your findings in your **own** formal laboratory report. Sharing a plot made by one of your lab group members **is** plagiarism, as is the incorporation of any analysis or interpretation that is not your own. Such content MUST be cited appropriately in professional citation format, and points will be deducted for not individually executing the content requested in the manual.

After your graded lab reports are returned, you may notice differences in scoring between lab sections. Some GSIs may appear much "harder" than others. Please know that at the end of the semester, all lab scores are normalized, removing any variations in grading styles among lab sections. Accept the challenge to work with your GSIs, especially those who hold you to high standards, to guide you in your learning.

Midterm Exams 30%

Three in-class midterm examinations taken during normal class times on three different Fridays throughout the semester (see calendar above for dates) are administered by your instructor and/or GSIs. Midterm exams begin at 12:10 PM and end at 1:00 PM sharp. Each exam is individually worth 100 points.

Studying for exams is best done as a **group** effort. This is **not** plagiarism. Please consider organizing/joining study groups and challenging one another on the concepts covered in lecture, emphasizing the fundamentals and varying the applications. Take turns explaining those concepts and applications to one another. It should be evident to you when you cannot explain yourself that you don't fully understand the topic. There will be practice exams and study guides posted to *bCourses*. Use these as a guide, but don't make the mistake of simply memorizing answers; be vigilant about recognizing the concepts that underpin the questions. Your lecture notes, not the textbook, are your best guide to examination content. If a topic is not covered in lecture, it will not be on the exam, even if it is covered in the text.

All examinations are "closed book" exams. No reference materials are permitted. No calculators are permitted. No "Blue Books" are permitted. No electronic devices are permitted. Cell phones must be turned OFF. You are allowed a supply of pencils and pens (at least two colors will be helpful), erasers (remember the properties of isoprene when choosing yours), and a straightedge (long enough to construct figures across an 8 ½ × 11 inch page).

Final Exam 30%

Although your midterm exams have focused sequential coverage with little or no overlap, the final examination is a fully "comprehensive" one, covering all concepts developed throughout the semester. It is a "closed book" 3-hour exam (no 10-minute delay at start) worth 300 points.