

UNIVERSITY OF GUELPH
SCHOOL OF ENGINEERING
ENGG*2120
MATERIAL SCIENCE
Winter 2013

Instructor: Dr. Ryan Clemmer (rclemmer@uoguelph.ca)

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Office hours: By appointment

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Text: W.D. Callister and D.G. Rethwisch, "Materials Science and Engineering: An Introduction," 8th Edition, John Wiley & Sons, Inc., 2010

i>clickers: May be purchased from the bookstore and are required for quizzes. Your i>clicker must be registered for your quiz marks to count towards your final grade.

Lecture Times: Tue & Thu 2:30 – 3:50 PM MCLN 102

Lab Times:	Tue	10:30 AM – 12:20 PM	THRN 1008
	Thu	8:30 AM – 10:20 AM	THRN 1008
	Thu	10:30 AM – 12:20 PM	THRN 1008
	Thu	12:30 PM – 2:20 PM	THRN 1008
	Fri	12:30 PM – 2:20 PM	THRN 1008
	Fri	3:30 PM – 5:20 PM	THRN 1008

Course Description:

Study of the mechanical, electrical, magnetic, optical, and thermal properties of solids. Atomic order and disorder in solids, single-phase metals, and multiphase materials (their equilibria and microstructure) are examined as a basis for understanding the causes of material properties. Interwoven throughout the course is an introduction to materials selection and design considerations

Learning Objectives

This course introduces the fundamentals of material science with the following objectives:

- Describe the general properties of key engineering materials: metals, ceramics, polymers, and composites
- Understand the link between the atomic structure of a material and its macroscopic properties and how to manipulate the microstructure to alter material properties through assignments, quizzes, and exams
- Compare measured material property behaviour with expected theoretical behaviour through lab reports
- Predict which materials are most appropriate for a given application when designing components and manufacturing processes by completing individual assignments

Course Notes

The lectures will revolve around a sequence of PowerPoint slides with elaboration and examples during the lectures. These will be generally available on Courselink before the lecture – it is expected that you will have a copy of these available during the lectures.

Schedule of Topics

Topic	Callister 8th Edition Reference Chapters	Approx. Date(s)	Approx. # of Lectures
Introduction: Course Outline and Course Expectations		Jan 8	1
Review: The Nature of Materials and Chemical Structures	1 & 2	Jan 10	1
Structure of Crystalline Solids	3	Jan 15	1
Mechanical Properties of Metals	6	Jan 17, 22	2
Imperfections in Solids	4	Jan 24, 29	2
Strengthening Mechanisms	7	Jan 31, Feb 5	2
Properties and Processing of Polymers	14 & 15	Feb 7, 14	2
MIDTERM EXAM (in class)		Feb 12	1
Phase Diagrams	9	Feb 26, 28	2
Phase Transformations	10	Mar 5, 7	2
Applications & Processing of Metals	11	Mar 12, 14	2
Properties and Processing of Ceramics	12 & 13	Mar 19, 21	2
Properties of Composites	16	Mar 26, 28	2
Failure Mechanisms	8	Apr 2	1
Electrical, Thermal, Magnetic, and Optical Properties of Materials	18, 19, 20, & 21	Apr 4	1

Method of Evaluation

Final grades will be determined in the following manner:

Quizzes	10%
Lab Reports	25%
Midterm Exam	25%
Final Exam	<u>40%</u>
Total	100%

Note: Students must achieve at least 50% of the marks assigned to the midterm and final exams in order for the labs and quizzes to be counted in the final grade. If you do not achieve at least 50% of the marks assigned to the midterm and final exams, the weighting of the lab reports and quizzes in your final grade will be zero.

Assignments

Study Assignments will be posted at the end of a chapter or a group of chapters, with the solutions to follow about one week later. Assignments will not be marked. It is strongly recommended that you work through these assignments as they are valuable study aids and similar to the types of questions that may be asked on an exam.

Quizzes

There will be several i>clicker quizzes during the lectures throughout the semester. Students are expected to be present and use their own i>clicker during these quizzes. The quizzes are intended to help you better understand the course content and account for 10% of the course marks. You will receive 1 mark for each question answered and an additional 2 marks if the answer is correct. Prior to the first quiz, you must register your i>clicker serial number by clicking on the “*Student i>clicker Registration*” link on the right side of the webpage: <http://www.tss.uoguelph.ca/lhci/clickers/index.cfm>

Laboratory Reports

The laboratory forms an important part of the course; material introduced in the lab may be part of the midterm and final exams. There are 4 labs and a Lab Safety and Introduction session for the course that take place during the following weeks:

Lab	Lab Performed	Due Date
Lab Safety and Introduction	Jan 21 – Jan 25	
Compressive Testing of Materials	Jan 28 – Feb 1	Feb 11 – Feb 15
Impact Testing of Metals	Feb 4 – Feb 8	Feb 25 – Mar 1
Tensile Properties of Materials	Feb 25 – Mar 8	Mar 11 – Mar 15/ Mar 18 – Mar 22
Heat Treatment of Steels	Mar 11 – Mar 22	Mar 25 – Mar 30/ Apr 1 – Apr 5

- An introductory lab session, including laboratory safety and group sign-up will take place the week of **January 21st**. The laboratory activities will start the week of **January 28th**.
- The laboratory work is group based. You will need to organize yourselves into **groups of three (3) or four (4) within your lab section by Friday, January 25th**. The sign-up sheets for lab groups will be available in the Materials Lab in THRN 1008 during the introductory lab session. **Remember your group number.** Each group will be responsible for conducting the labs and writing a single report for each lab. You will be equally responsible for your group’s laboratory reports. Each group member must contribute to the writing of the lab report and sign the lab report cover page in order to receive a lab report mark. **Be sure to choose your lab partners wisely!**
- **Attendance at all labs is mandatory.** Anyone not attending the lab will not receive marks for that lab, irrespective of his/her contribution to the report. Failing to hand in a lab report before they are returned to the class will result in a mark of zero on that report.
- **You will not be allowed to do the project or the labs unless you attend the safety session and sign a form indicating that you have done so.**
- **Laboratories:**
 - a) All lab reports must be submitted for marking in the assignment drop-off cabinet located in the engineering alley by the Machine Shop (THRN 1015) by 4:00 PM **two weeks** after the laboratory is performed. (Labs due on Good Friday (Mar 29th) may be handed in on Saturday, March 30th by 4:00 PM). **There will be a late penalty of 10 %/day or part thereof.**
 - b) Lab reports will be marked and the marks posted on Courselink. **Note that up to 20% of the lab mark may be deducted for poor lab report format, poor graph or table format, or poor English (spelling, grammar, etc.).** Any reports judged to be entirely unacceptable will be returned without marking for rewriting. Lab reports will be handed back to the group during the lab session after all

reports for that specific lab have been handed in. If you have questions about your mark, see the GTA responsible for that lab and they will discuss it with you.

- c) The labs begin the week of **January 28th**, according to the group schedule. Make sure you remember the schedule for your group when you sign up. You should download and print a copy of the ENGG*2120 Lab Manual from Courselink. **Be sure to carefully read the specific manual section before you go to perform each of the laboratory exercises.**
- d) All reports must be your own original work. Any material taken directly from other refereed sources such as text books, handbooks or journal articles must be properly referenced. Please note that most web pages are not refereed and, therefore, are not normally considered to be reliable sources of information for engineering purposes. Submission of reports that contain unreferenced, copied, or plagiarized material from other student reports or other external sources is considered an academic offence and will be forwarded to the Dean of the College of Physical and Engineering Science for consideration of Academic Misconduct.

Midterm Examination

A midterm examination will be given on **Tuesday, February 12th**, during the normally scheduled class time. You are allowed one **single-sided** 8.5" x 11" note sheet for the exam. Each note sheet must be prepared by you and be your own original work (i.e. not a copy). If the midterm is missed due to an accepted verification of illness, the weighting of the final will increase to 65%; otherwise, the midterm will be given a mark of zero.

Final Examination

The final examination is scheduled for **Tuesday, April 16th** from 11:30 AM to 1:30 PM (room TBA). You are allowed one **double-sided** 8.5" x 11" note sheet for the exam. Each note sheet must be prepared by you and be your own original work (i.e. not a copy).

Major Holy Days

Students must contact the instructor within the first two weeks of class if academic consideration is to be requested because of religious reasons.

University Policy on Academic Misconduct:

Academic misconduct, such as plagiarism, is a serious offence at the University of Guelph. Please consult the Undergraduate Calendar 2012-2013 and School of Engineering programs guide, for offences, penalties and procedures relating to academic misconduct.

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml>

Disclaimer:

The instructor reserves the right to change any or all of the above in the event of appropriate circumstances, subject to the University of Guelph Academic Regulations.