

# ENGG2120

## Material Science - Fall 2005

### Instructor Information

Professor: Dr. Michele Oliver, P.Eng., Office: Room 1335, Thornbrough Building, Phone: (519) 824-4120 (Extension 52117), Fax: (519) 836-0227, E-Mail: moliver@uoguelph.ca

Office Hours: By appointment (if you've got a quick question/concern please feel free to send me an email or talk to me before or after class; if you have a question(s)/concern(s) that requires more time, we can set a time to meet that will work for both of our schedules)

Laboratory Coordinator: Mr. Ken Graham Office: Room 1177, Thornbrough Building, Phone: (519) 824-4120 (Extension 53924), E-Mail: kgraham@uoguelph.ca

### Teaching Assistants:

Mr. Brent Jessop ([bjessop@uoguelph.ca](mailto:bjessop@uoguelph.ca)), 3<sup>rd</sup> Floor, Old Wing of Thornbrough Building

Mr. Vincent Lo ([vlo@uoguelph.ca](mailto:vlo@uoguelph.ca)), 3<sup>rd</sup> Floor, Old Wing of Thornbrough Building

Ms. Navneet Parhar ([kparhar@uoguelph.ca](mailto:kparhar@uoguelph.ca)), 3<sup>rd</sup> Floor, Old Wing of Thornbrough Building

Mr. Taylor Murphy ([taylor@uoguelph.ca](mailto:taylor@uoguelph.ca)), 3<sup>rd</sup> Floor, Old Wing of Thornbrough Building

### Course and Schedule Information

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 micro-structure) 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.

Prerequisites: CHEM 1040, PHYS 1130

Class Time: Tues./Thurs. - 10-11:50 a.m. Room 113, MacNaughton Building.

Laboratory: Room 1119, Thornbrough Building. Please refer to the 2005 Material Science Laboratory Handout for lab procedures and schedule.

Text (Required): Callister, W.D. Material Science and Engineering: An Introduction (6th Edition), John Wiley and Sons, Inc., Toronto, 2003 (available for purchase in the bookstore).

### Course Website:

<http://www.soe.uoguelph.ca/webfiles/moliver/Documents/Academic%20Courses/Material%20Science%20and%20lectures%20Fall04.htm>

## Learning Objectives

Upon successful completion of this course, students will be able to:

- Describe the chemical and engineering aspects of materials
- Use typical material properties (particularly mechanical, thermal and electrical ones) to predict the behaviour of engineering components
- Specify the factors involved in manufacturing and using materials

## Schedule of Topics

Topic	Callister Reference Chapters	Approximate Date(s)	Approximate # of Lectures
Introduction: Course Outline and Course Expectations		Sept. 13	
Review: the nature of materials and chemical structures	1 and 2	Sept. 15,20	2
Crystalline state and disordered structures	3, 4, 5	Sept. 22,27	2
Mechanical and electrical properties	6 and 18	Sept. 29, Oct. 4	2
Magnetic and optical properties	20 and 21	Oct. 6	1
Hardening and strengthening	7	Oct. 11	1
Solution strengthening and phase diagrams	9	Oct. 13,18	2
Thermal properties	11and 19	Oct. 20	1
Properties of concrete, iron and steel	10, 11, 16	Oct. 25, Nov. 1	2
Properties of copper and its alloys, aluminum, nickel, magnesium and titanium	11	Nov. 3,8	2
Properties of polymers	14 and 15	Nov. 10	1
Properties of ceramics and semiconductors	12, 13, 18	Nov. 15	1
Composites	16	Nov. 17	1
Failure, corrosion and degradation of materials	8 and 17	Nov. 22,24	2
Materials selection and design considerations	22W	Nov. 29	1
Review lecture		Dec. 1	1

## Marking

Activity	Percentage of Final Grade
Laboratory write-ups (4)	20%
I-Deas Finite Element Assignment (FEA)	10%
Midterm Exam - Oct. 27th, 2005 10:00-11:20 p.m. (Room 113, MacNaughton Building)	35% or 0% (which ever provides the highest overall course grade)
Final Exam - Dec. 10, 2005 11:30 a.m. - 1:30 p.m. (Location TBA)	35% or 70% (which ever provides the highest overall course grade)

A series of 4 (1.5 hour long) tutorials will be held to enable you to do the I-Deas FEA assignment. The tutorials will be run during Engg. 2100 (Design) tutorial times by Engg. 2100 teaching assistants. If you are not enrolled in Engg. 2100, you will need to attend tutorials in a time slot that will work with your schedule. Tutorials 1 and 2 which will be held during class week 1 and 2 respectively will help you learn basic I-Deas™ drawing. Tutorials 3 and 4 which will be held during class weeks 4 and 7 respectively will help teach you finite element analysis techniques using I-Deas™. To be able to complete the assignment, you will need to attend all 4 tutorial sessions. **The FEA assignment is due on Tues. Nov. 15<sup>th</sup> before 4 p.m. in Dr. Oliver's office.**

Please be aware that there will be questions from material covered in the laboratories, I-Deas™ Tutorials and I-Deas™ assignment on both the midterm and final examinations.

If a student does not write the midterm exam, the percentage weighting will be shifted to the final exam such that the final exam will be worth 70% of the student's final grade.

***In order to pass the course, students must pass both the laboratory/FEA assignment and exam course portions. Students must obtain a grade of 50% or higher on the exam portion of the course in order for the laboratory write-up/FEA assignment portions of the course to count towards the final grade. Similarly, students must also obtain a grade of 50% or higher on the laboratory/FEA assignment portions of the course in order for the examination portion of the course to count towards the final grade. Students must attend and complete all laboratories. If a laboratory is missed due to illness or other extenuating circumstance, arrangements must be made with Mr. Ken Graham to complete a make-up lab.***

## Laboratory Experiments

Five laboratory sessions have been scheduled, with students working in groups of 3-5 as follows:

1. Introduction (includes laboratory safety) and Measurement Instruments
2. Compressive testing of materials
3. Tensile testing of materials
4. Heat treatment of steel
5. Impact testing of materials

Specific instructions for the preparation of laboratory reports are contained in the Material Science Laboratory Manual which should be downloaded from the course website.

### **General Policies Regarding Laboratories**

All labs must be submitted for marking in the assignment drop-off cabinet located in the main lobby of the engineering building (left side of box 298 labeled Oliver 'in') by 14:00 h one week after the laboratory is performed (labs which are due on Thanksgiving Monday can be handed in on Tuesday October 11th by 14:00 h).

### **Unmarked Assignments**

To aid understanding of the course material, approximately eight assignments will be issued throughout the term which will not be handed in for marking. Solutions will be posted on the course website.

### **Grading Scale (as per the 2005-2006 University of Guelph Undergraduate Calendar)**

<b>Letter Grade</b>	<b>Percent Range</b>
A+	90-100%
A	85-89%
A-	80-84%
B+	77-79%
B	73-76%
B-	70-72%
C+	67-69%
C	63-66%
C-	60-62%
D+	57-59%
D	53-56%
D-	50-52%
F	0-49%

### **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.