UNIVERSITY OF ALBERTA

Section A1 (35897) MWF: 10:00-10:50AM ETLE 1-003	Instructor:	**Dr. J.A. Nychka** ECERF 7-040 780-492-4796 jnychka@ualberta.ca	Office Hours: Thurs. 1-3pm
Section A2 (35900) MWF: 10:00-10:50AM NREF 2-001	Instructor:	**Dr. D. Li** ECERF 7-038 780-492-6750 dongyang.li@ualberta.ca	Office Hours: Wed. 2-3pm
Section A3 (35901) MWF: 1:00-1:50PM NREF 2-001	Instructor:	**Dr. H. Zhang** ECERF 7-030 780-492-8340 hao.zhang@ualberta.ca	Office Hours: Fri. 2-4pm

MAT E 202 MATERIALS SCIENCE II

3.00 Units (3-0-3/2). An introduction to the science of materials relating their mechanical, thermal, electronic and chemical properties to atomic, molecular and crystal structure. Ceramic and metallic crystals, glasses, polymers and composite materials. Multi-phase materials, strengthening processes. Laboratories include mechanical properties of metals and polymers, microstructure, heat treatment of steel. Credit may not be obtained in this course if previous credit has been obtained in MAT E 252. Prerequisite: CHEM 105 or consent of Department.

STUDENT OUTCOMES FOR MAT E 202:

At the conclusion of the course, the student shall be able to demonstrate ***knowledge*** *in tasks dealing with:*

Proper use of relevant vocabulary; definitions; magnitudes of constants (*declarative knowledge – the what*)
Methods of solving problems (*procedural knowledge – the how*)
Application of theory and problem solving methods to different situations (*conditional knowledge – the when*)
Ability to explain how theoretical concepts apply to observations and behaviour (*reflective learning – the why*)

Assessment *will be through written communication, calculations, and application of concepts to common and* ***new*** *situations.*

Knowledge *is defined as having the ability to perform the above tasks to solve relevant problems that agree with expert opinion (i.e., a level of competence). The use of appropriate language and terminology when presenting solutions is also necessary.*

Office Hours: According to schedule or by appointment (24 hours advanced notice by email or phone).
Feel free to visit **any** of the instructors' office hours.

Helpdesk Teaching Assistant: TBA

Textbook: "Materials Science and Engineering, An Introduction", 7th Ed., by W.D. Callister Jr., John Wiley & Sons, 2007.

Labs: ***LABS START the week of September 14th***: see attached schedule

Head lab TA: Arash Ilbagi (ilbagi@ualberta.ca), CME 213, 780-492-0701

Lab Manual: must be purchased at bookstore.

Lab attendance is mandatory, and you must attend your section. Each lab session will consist of multiple experiments so be sure to ***do the pre-lab portion of each experiment, and hand it in at the beginning!***

Labs must be completed and handed in at the end of each lab period so bring your lab manual to the lab. All [AM] labs start at **8:00 AM** and all [PM] labs begin at **2:00 PM.**
Safety Glasses and closed-toe shoes (no sandals**) must** be brought to each lab (student responsibility).

Due to the limited number of people that can be in the lab at one time the lab schedule cannot closely follow the lecture. You may feel that the alignment is off, and you may get stressed learning in a different way that you are used to, but this is an important skill to learn, as it approximates real life!

Website: eCLASS Mat E 202 Fall 2009-Materials Science II
Includes: contact information, extra information, homework assignments (and solutions), and links.

Format: Homework will be posted for download from the website in advance of the due date. Downloadable homework solutions will be posted on the website on the due date.

Grading: The final grade will be calculated based on the students raw score weighted according to the following formula, and a letter grade assigned at the end of the course. Scaling may or may not be applicable depending on the class performance.

Homework (6)	10%
Laboratories (8 experiments)	15%
Midterm Exam (Saturday October 17th 2-4pm, location TBA)	25%
Comprehensive Final Exam (Saturday, December 5th 9am-12pm)	50%

For grades falling on borderlines, consideration will be given to attendance, participation, and performance trends.

Attendance: Attendance to class is highly encouraged. Anything presented in class will be considered testable material (in addition to text readings, handouts, etc.). Participation will only help you learn the material, and questions are encouraged. Punctuality is expected, and tardiness will not be tolerated.

Absences: If for any reason you are unable to be present for an exam or hand in a written assignment on time, you need to contact your instructor. If the absence can be predicted in advance, you are expected to notify your instructor in advance (24 hours minimum, but preferably as soon as you know). If the absence is not planned, you must contact your instructor within one week and supply evidence of an excusable absence. Until you are excused of your absence a grade of zero will be assigned for that assignment or exam. If sick, a note from your doctor is required. If your instructor is unavailable, you must try to contact the TA. Do not rely on e-mail as a confirmation that your message has gotten through. Please take the effort to confirm your message is received. For legitimate absences, students will be expected to make time in their schedules to make up the exam as soon as possible within 1 week. Failure to follow these guidelines will result in a failing grade for the exam. Excusable absences can be found in the University Calendar.

Homework: While homework only counts for 10% of your course grade, the importance of doing the homework cannot be overemphasized, as it will help you learn the material. Homework assignment due dates are listed below. Examine the schedule and inform your instructor of any known conflicts as soon as possible *before* the due dates.

Problem Set #	Assigned	Due	Topic
1	Sept 4	Sept 11	Classes of materials, mech. properties
2	Sept 11	Sept 25	Mech. Properties, Failure
3	Sept 25	Oct 9	Structure, Atom movements
4	Oct 9	Oct 30	Deformation, Annealing, Phase diagrams
5	Oct 30	Nov 13	Transformations
6	Nov 13	Nov 27	Transformations, Polymers, Ceramics, Corrosion

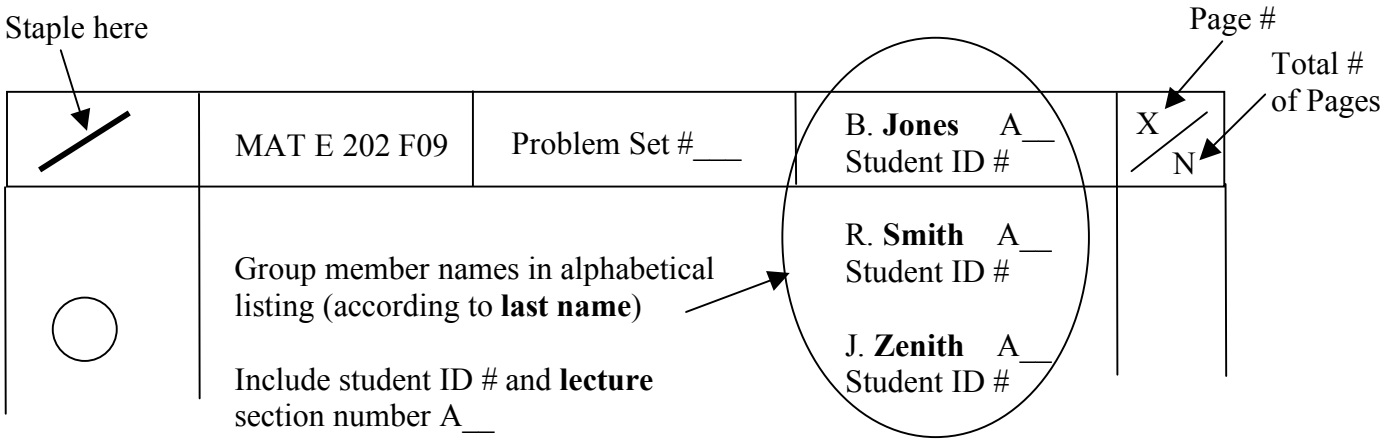
Homework assignments will posted on eCLASS and are due promptly by 5:00pm on the specified due date in the drop boxes located on the **third floor CME building** (by the classrooms near the pedway to NINT and Mec E; there are two identical drop boxes – you can put your homework in either box). **THERE IS NO SUCH THING AS LATE HOMEWORK!** Always use SI units and an appropriate number of significant figures in your answer.

Homework solutions will be posted on the website.

Problem sets will be done in **groups** (of 3 or 4 people ***only***). The lab component of this course has time available to work in your groups and seek help from TAs within the lab time. Therefore, you are encouraged to work with people that are in the same lab section as you. Your problem set group will be permanent for the semester. If you are having trouble finding a group please see your instructor.

Your first problem set is designed to get you to form groups and begin working together. Subsequent problem sets will allow ample time for you to schedule group working time, along with problem set time in labs. The problem sets are designed to require group work. Engineers work in groups, so consider this professional training. **ONE assignment** will be handed in for each **group** and all group members will receive the **same grade**. The assignments will be returned in the lecture section of the first person listed on the group roster (last name closest to the beginning of the alphabet).

All assignments will be handed in on **engineering paper**, with the format specified below. Marks will be deducted if you do not adhere to the format. If you hand in a printout of a graph or chart, please include the same information as you would if the graph were on engineering paper.



Exams:

One **midterm** exam (120 minutes) is scheduled for **Saturday, October 17st, from 2-4pm**. The midterm will include all material in Units 1-5 inclusive, and Labs 1 and 2.

The **final** exam is comprehensive (all material covered in the course, including the labs) and will be held at **9am-12pm on Saturday, December 5th, 2009**.

All exams will be cumulative, and closed book. You are allowed a university approved non-programmable calculator and writing utensils. No other items will be allowed on your desk – no drinks, food, papers, phones, etc.

Data and equations absolutely necessary to solve problems will be provided as needed, but be forewarned…more data than you need may also be incorporated.

Exams will be based on the homework and the labs, but will not be the same problems to be regurgitated. Integration and application of knowledge will be tested. There will be theory and worked problems.

Referencing and Citing:

Plagiarism is a serious and punishable offense, both in the classroom setting and in real life. Any work submitted for credit or to a publication house must be the student's own work. This includes any material found on-line, or in books, which should be referenced properly. Verbatim copying is not permitted.

Any cheating offense will be reported, and in real life who knows what could happen – you could have your degree revoked, you could be fired from your job, or be publicly shamed.

Please visit "Code of Conduct" for Instructors. This site will give you an idea what the instructors responsibilities are. http://www.quasar.ualberta.ca/edit537/conduct.htm

Civility

The classroom is a community for learning. Please respect each other and do not speak while others are speaking. You will find that you can learn a great deal from your peers, so pay close attention and pay respect when they are asking questions. There will be no attacks of a personal nature or statements denigrating another on the basis or race, sex, religion, sexual orientation, age, ethnicity, or other such irrelevant factors. This will help to create an interactive class, and participation will enhance your learning experience!

Learning Accommodations

Students who require accommodations in this course due to a disability affecting mobility, vision, hearing, learning, or mental or physical health are advised to discuss their needs with Specialized Support and Disability Services, 2-800 SUB, 492-3381 (phone) or 492-7269 (TTY).
Other student services can be found at Student Services www site
http://www.uofaweb.ualberta.ca/studentservices/
If you are having academic difficulties there are resources available at
http://www.uofaweb.ualberta.ca/academicsupport/nav02.cfm?nav02=50367&nav01=5
Information on student ombudsmen services is available at:
http://www.uofaweb.ualberta.ca/OmbudService/
Information on important university deadlines can be found at
http://www.registrar.ualberta.ca/calendar/Academic/Schedule/11.html

Course Survival Skills:

Mutual respect for all.

The **students** should be registered in the University of Alberta to take this course.
The **students** are responsible for learning the content of the course and for demonstrating the knowledge that they have acquired.

The **instructors** are responsible for enabling the students in learning the content of the course, for testing the knowledge of the students in the subject, supplying feedback, and for reporting the results of the testing.

Guidelines for the student to fulfill his/her responsibility in a course (the rule of "5 times"):
Read the textbook the day before a lecture,
Attend the lecture,
Review the material in the textbook and notes within a day of the lecture,
Do the homework on time, and
Review the material and study for the test.
Have fun!

Guidelines for the instructor to fulfill his/her responsibility in a course:
Prepare and present lectures,
Prepare and assign homework,
Be accessible to answer questions,
Prepare and administer test(s), and
Grade and report outcomes from test(s).
Have fun!

UNITS	Dates	# of Lectures	Assigned Reading (7th Ed. Callister)
1. Introduction - types of materials - basic concepts of bonding	Sept 2	1	Chpt 1 2.5-2.6
2. Mechanical Properties - tension testing : elastic and plastic deformation - hardness testing - variability of material properties	Sept 4-14	4	6.1-6.3, 6.5-6.6, 6.8 6.10(Rockwell), 6.11, 6.12
Labour Day: NO CLASSES Sept 7th			
3. Failure - fundamentals of fracture : ductile and brittle - impact testing : Charpy, DBTT - fatigue : S-N curve, crack initiation/propagation - creep : steady state creep, stress and T effects	Sept 16-21	3	8.1-8.5 8.6 8.7-8.11 8.12-8.14
4. Structure of Materials - interatomic bonds : covalent, ionic, metallic - crystalline solids: systems, unit cells atomic packing , density, polymorphism, - crystallographic features : directions, planes, linear and planar density - crystalline vs. noncrystalline - imperfections: vacancies, solid solutions, dislocations, grain boundaries	Sept 23- Oct 2	5	(Review 2.1-2.4) 2.5-2.8 3.1-3.4, 3.7 3.5, 3.6 3.8-3.10 3.11, 3.12 3.13-3.14, 3.17 4.1-4.8
5. Atom Movements in Materials - diffusion : interstitial, vacancy - Arrhenius equation	Oct 5-7	2	5.1-5.3 5.5
Thanksgiving: NO CLASSES October 12th			
6. Plastic Deformation - mechanism: dislocation motion - grain boundary strengthening - solution hardening - strain hardening: cold working - precipitation hardening	Oct 9,14, 16	2.5	7.1-7.4, 7.6 7.8 7.9 7.10 11.9
Evening Review Session week of October 12th: Time and location TBA			
Midterm Exam: Saturday, October 17th, 2-4pm (Units 1-5 inclusive + Labs 1-2)			
7. Annealing - recovery, recrystallization and grain growth - hot working	Oct 19	0.5	7.11- 7.13 11.4

UNITS	Dates	# of Lectures	Assigned Reading (7th Ed. Callister)
8. Phase Diagrams - basic concepts and definitions - binary phase diagram : isomorphous, lever rule - binary phase diagram : eutectic - iron carbon phase diagram	Oct 19- 28	4.5	9.1-9.5 9.6-9.10 9.11- 9.12 9.14, 9.18- 9.19
9. Transformations - kinetics : time dependence, Avrami equation - TTT diagram steel : phases, properties of phases - CCT diagram steel - tempering of martensite - Hardenability : Jominy End Quench - Precipitation heat treatment of aluminum	Oct 30- Nov 13	6	10.1-10.4 10.5,10.7 10.6 10.8 11.8 11.9
Fall Break: NO CLASSES November 10-11th			
10. Polymers - types of engineering polymers - polymer microstructure : monomer, chain length, degree of polymerization, crystallinity - mechanical behaviour : linear, crosslinked, crystallinity, alignment of chains - glass transition temperature - degradation	Nov 16-18	2	14.9,15.15 14.1-14.7, 14.11, 14.12 15.2-15.4 15.12-15.14 17.11-17.13
11. Ceramics - structures - properties, - processing : powder methods	Nov 20-23	2	12.1-12.3 12.8-12.9 13.9-13.12
12. Corrosion - fundamentals : corrosion cells, EMF, Nernst equation, galvanic series - types of corrosion - corrosion control : material selection, coatings, cathodic protection	Nov 25- 27	2	17.1-17.3 17.7 17.8, 17.9
In CLASS Review Dec 2nd			
LAST DAY OF CLASSES Dec 3rd			
Evening Review Session Dec 3rd: Time and location TBA			
FINAL EXAM: Sat., December 5th, 9am-12pm (Comprehensive = all units and all labs)			

MATE 202 – Fall 2009 Lab Schedule

				M *[PM]*	*W* *[PM]*	*R* *[AM]*	*F* *[AM]*	*F* *[PM]*	*M* *[PM]*	*W* *[PM]*	*R* *[AM]*	*F* *[AM]*	*F* *[PM]*
Lab	*Exp.*	*Q#*	*Title*	***D01***	***D03***	***D05***	***D07***	***D09***	***D02***	***D04***	***D06***	***D08***	***D10***
1	*1* *2*	***2*** ***3,4***	*Tension Test* *The Microscope* *Problem set 2*	***Sep 14***	***Sep 16***	***Sep 17***	***Sep 18***	***Sep 18***	***Sep 21***	***Sep 23***	***Sep 24***	***Sep 25***	***Sep 25***
2	*4* *5*	***1,3*** ***6***	*Creep of Metals (1.5 h)* *Crystal Structures (1.5h)* *Problem set 3*	***Sep 28***	***Sep 30***	***Oct 01***	***Oct 02***	***Oct 02***	***Oct 05***	***Oct 07***	***Oct 08***	***Oct 9***	***Oct 9***
3	*6* *7*	***3*** ***3***	*Strain Hardening* *Annealing and Recrystallization* *Problem set 4*	***Oct 26***	***Oct 28***	***Oct 29***	***Oct 30***	***Oct 30***	***Oct 19***	***Oct 21***	***Oct 22***	***Oct 23***	***Oct 23***
4	*8* *11*	***1*** ***1,2***	*Eutectic Microstructure* *Heat Treatment of Steels* *Problem set 5*	***Nov 9***	***Nov 25***	***Nov 12***	***Nov 13***	***Nov 13***	***Nov 2***	***Nov 04***	***Nov 05***	***Nov 06***	***Nov 06***

****** All labs meet in Rm 672 of the Chem/Mat Bldg******

1] Labs reports must be completed during lab period.

2] Bring lab manual to lab with completed Pre-labs (labs being plural) *****manual must be purchased at the bookstore*****

3] All [AM] labs start at ***8:00 AM*** and all [PM] labs begin at ***2:00 PM***

4] ***Safety Glasses***, close-toed shoes (no sandals**)** and long pants **must** be brought to each Lab.

5] Lab coordinator contact information: Arash Ilbagi – ilbagi@ualberta.ca

6] Attending a different lab section from you own is not permitted without lab coordinator approval. A grade of ZERO will be assessed if you attend a lab section without proper permission from the lab coordinator.

MATE 202

Sep 2009 (Mountain Time)

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
30	31	1	2	3	4	5
6	7	8	9	10	11 Assignment 1 Due Date	12
13	14 2pm - D01 - First Lab. @	15	16 2pm - D03 - First Lab. @	17 8am - D05 - First Lab. @	18 8am - D07 - First Lab. @ 2pm - D09 - First Lab. @	19
20	21 2pm - D02 - First Lab. @	22	23 2pm - D04 - First Lab. @	24 8am - D06 - First Lab. @	25 Assignment 2 Due Date 8am - D08 - First Lab. @ 2pm - D10 - First Lab. @	26
27	28 2pm - D01 - Second Lab.	29	30 2pm - D03 - Second Lab.	1 8am - D05 - Second Lab.	2 8am - D07 - Second Lab. 2pm - D09 - Second Lab.	3

MATE 202 Oct 2009 (Mountain Time)

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
27	28 2pm - D01 - Second Lab.	29	30 2pm - D03 - Second Lab.	1 8am - D05 - Second Lab.	2 8am - D07 - Second Lab. 2pm - D09 - Second Lab.	3
4	5 2pm - D02 - Second Lab.	6	7 2pm - D04 - Second Lab.	8 8am - D06 - Second Lab.	9 Assignment 3 Due Date 8am - D08 - Second Lab. 2pm - D10 - Second Lab.	10
11	12 Thanksgiving Day	13	14	15	16	17
18	19 2pm - D02 - Third Lab. @	20	21 2pm - D04 - Third Lab. @	22 8am - D06 - Third Lab. @	23 8am - D08 - Third Lab. @ 2pm - D10 - Third Lab. @	24
25	26 2pm - D01 - Third Lab. @	27	28 2pm - D03 - Third Lab. @	29 8am - D05 - Third Lab. @	30 Assignment 4 Due Date 8am - D07 - Third Lab. @ 2pm - D09 - Third Lab. @	31

MATE 202

Nov 2009 (Mountain Time)

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2 2pm - D02 - Fourth Lab.	3	4 2pm - D04 - Fourth Lab.	5 8am - D06 - Fourth Lab.	6 8am - D08 - Fourth Lab. 2pm - D10 - Fourth Lab.	7
8	9 2pm - D01 - Fourth Lab.	10	11 Remembrance Day	12 8am - D05 - Fourth Lab.	13 Assignment 5 Due Date 8am - D07 - Fourth Lab. 2pm - D09 - Fourth Lab.	14
15	16	17	18	19	20	21
22	23	24	25 2pm - D03 - Fourth Lab.	26	27 Assignment 6 Due Date	28
29	30	1	2	3	4	5

The University of Alberta is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the Code of Student Behaviour (online at www.uofaweb.ualberta.ca/secretariat/studentappeals.cfm) and avoid any behaviour which could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University

CODE OF STUDENT BEHAVIOUR

The complete Code of Student Behavior is contained in the General Faculties Council Policy Manual Section 30, and in the University Calendar. Any amendments made during the year are published in the Gateway.

EXTRACTS FROM THE CODE OF STUDENT BEHAVIOR -- TO BE REVIEWED WITH EACH CLASS AS EARLY AS POSSIBLE EACH TERM .

The Code of Student Behavior (Section 30A, the section relating to Individual Students) defines Plagiarism and Cheating as follows:

1. Plagiarism
No student shall submit the words, ideas, images or data of another person as the student's own in any academic writing, essay, thesis, research project or assignment in a course or program of study.

2. Cheating
No-student shall:
a. in-the course of an examination, obtain or attempt to obtain information from another student or other unauthorized source or give or attempt to give information to another student, or knowingly possess, use or attempt to use any unauthorized material;
b. represent or attempt to represent oneself as another or have-or attempt to have oneself represented by another in the taking of an examination, preparation of a paper or other similar activity;
c. submit in any course or program of study, without the written approval of the course instructor, all or a substantial portion of any academic writing, essay, thesis, research report, project or assignment for which credit has previously been obtained by the student or which has been or is being submitted by the student in another course or program of study in the University or elsewhere:
d. submit in any course or program of study any academic writing, essay, thesis, research report, project or assignment containing a statement of fact known by the student to be false or a reference to a source which reference or source has been fabricated.

The Code of Student Behavior provides for the following penalties for plagiarism, cheating, and other academic offences:

Section 30A.5.1.b
i. Expulsion,
ii. Suspension,
iii. Mark reduction on the assignment or examination,
iv. A grade of F in a credit/no credit course and 1F for a graded course,
v. Conduct probation,
vi. Written reprimand,
vii. Suspend any degree already awarded,
viii. Rescind any degree already awarded.

Section 30A.8.2 sets out the procedures to be followed by an instructor or supervisor in the event of an alleged academic offence. The following is excerpted from the full listing of procedures:

c. The instructor must discuss the alleged offence with the student. In the event that the alleged offender refuses to meet with the instructor to discuss the matter the instructor shall proceed as outlined below (Section 30A.8.2.d).

d. Where the instructor has reason to believe that an offence has been committed, the instructor shall report the incident to the Dean and shall file with the Dean a statement in writing setting out:
i. a brief summary of the conduct alleged to constitute the offence, and
ii. a statement that the instructor has complied with Section 30A.8.2.c, and
iii. a brief statement of any action taken by the instructor as a result of the incident.

e. Where the instructor feels a discipline penalty should be considered the instructor may make that recommendation to the Dean, and may refer to one or more of the penalties listed in Section 30A.5.1.b.

Section 30A.9. 1 outlines the steps a student follows should he or she decide to appeal the imposition of a penalty. The following is excerpted from the full listing of procedures:

a. A student may appeal the decision of the Discipline Officer or the Dean by submitting a notice of appeal in writing to the Appeals Coordinator. Such notice must be received by the Coordinator no later than fifteen (15) calendar days after notification of the written decision of the Discipline Officer.

A Bachelor of Engineering is a professional degree. As such, it is regulated and has very high ethical and professional standards, just as law and medicine. According to this tradition, cheating and plagiarism will not be tolerated in MAT E 202.