INTRODUCTION TO MATERIALS SCIENCE AND ENGINEERING

INSTRUCTOR: Prof. Pinshane Huang (office: MRL 258, email: pyhuang@illinois.edu)
LOCATION: 12:30–1:50 pm, Tuesday and Thursday, 103 Talbot
TEACHING ASSISTANT:
WEBPAGE: https://compass2g.illinois.edu/

COURSE DESCRIPTION: This 2-credit course provides students with a first look into the vibrant, interdisciplinary field of materials science and engineering. The course introduces fundamental building blocks for thinking like a materials scientist, such as: how to draw and interpret phase diagrams, how to relate materials structure, properties, processing, and performance, how draw crystal structures and identify crystal plans and directions, how to evaluate and test materials for specific applications, and how to describe the major materials classes, their properties, and how they are used in our world. We will also discuss frontiers of materials research and engineering in diverse areas including nanomaterials, biomaterials, energy materials, and more. To facilitate learning, the course will include laboratory demonstrations, experiments, case studies of advances in new materials and processes, and design-team analysis.


COURSE MATERIALS: Course materials, including hand-outs and problem sets will be available online through our course Compass website.

EXPECTATIONS: I expect you to: come to class prepared and on time, actively participate during class, interact collegially with other members of the class, complete readings and assignments in a timely manner, and seek help when you run into difficulty. You are also expected to check Compass and your e-mail regularly for course updates.

PROBLEM SETS:
Problem sets will typically be due on Thursdays at the beginning of class. You will be issued one Late Homework Coupon, which can be stapled to and turned in with one homework set for a 24-hour extension. Late homework should be submitted to the course homework box on the 2nd floor of the MSE building. Otherwise, late problem sets will not be accepted.

In all problem sets and quizzes, it is your responsibility to provide explicit evidence that you applied appropriate concepts, used logical reasoning, and followed correct procedures in order to get points for each problem. It is not the responsibility of the grader to decipher what you did or how you got your answer.

You are encouraged to collaborate and seek help. But, your write-ups must be in your own words, not copied or paraphrased from your classmates or any other sources. You must acknowledge in writing anyone who you talked to or worked with in order to help complete your work. For example, asking “Do you know how to start problem 5” is OK as long as it is acknowledged, but it is not appropriate to divide up problems 1–4 between students and then copy the answers from each other.

EVALUATION:
Grading for the course will be broken down as follows:
Attendance and in-class exercises (15%)
Homework (25%)
Class Project (10%)
Quizzes (50%)
GETTING HELP:
If you need help or simply would prefer to work in the company of others, you have several options:

1. Come to the help/study sessions 5-6 pm Monday and Wednesday in the MSEB undergraduate lounge. Here, you can interact with the TA, work with your classmates, and discuss the homework.

2. Interact with Prof. Huang. You can stop by MRL 258 during her “Interactive Conversation” time on Thursday from 2-3 pm, or make an appointment to discuss your questions or concerns.

3. Post questions on Compass. We ask you to post homework and content-related questions on a forum in Compass rather than e-mail because if you have a question, other students are likely to have similar questions. I will not respond to content-related questions via e-mail. The TA or professor will respond to questions posted on Compass as soon as reasonable (typically within 48 hours.)

4. If you find that you are having a great deal of trouble, you may wish to get additional help at the Center for Academic Resources in Engineering (CARE), which provides workshops, tutoring, and more for students in engineering. http://care.engineering.illinois.edu/

ATTENDANCE:
Attending and engaging in class meetings is integral to this interactive nature of this course. For this reason, your attendance in the class will be graded according to the formula below. Excused absences are given for reasons such as extended illness, family emergency, and approved campus activities. Do not sign in for a friend. Doing so can result in an automatic “F” for the course.

100%: 0 or 1 unexcused absence
90%: 2 unexcused absences
85%: 3 unexcused absences
-5% for each additional unexcused absence

ACCOMMODATIONS:
To obtain disability-related academic adjustments and/or aids, students should contact the course instructor and the Disability Resources and Educational Services (DRES) as soon as possible. To contact DRES, you may visit 1207 S. Oak St., Champaign, e-mail disability@illinois.edu, or go to the DRES website. If you are concerned you have a disability related condition that is impacting your academic progress, academic screening appointments are available on campus that can help diagnose a disability.

ACADEMIC INTEGRITY:
Honesty and integrity are fundamental to our community. Guidelines for academic integrity are detailed in Article 1, Part 4 of the Illinois Student Code. Any confirmed violations of that code will be taken seriously and may result in failure for the course.
COURSE TOPICS

THE ATOMIC WORLD:
1. What is materials science and engineering?
2. Bonding
3. Crystal Structures and defects
4. Characterization

MECHANICAL PROPERTIES AND PHASE BEHAVIOR:
1. Mechanical properties
2. Phase diagrams

HARD MATERIALS:
1. Ceramics
2. Electronic materials and band structure
3. Nanomaterials

SOFT MATERIALS:
1. Polymers
2. Biomaterials

xkcd.com, courtesy Randall Monroe