MSE 2090 - 002 Introduction to Materials Science

Instructor: Ji Ma Contact: <u>jm@virginia.edu</u> Live Lecture: Tuesday/Thursday; 11:00-12:15 (In person and over zoom) Office Hours: TBA Teaching Assistant: TBA

All course material available on the Canvas website

This is an **online synchronous** course. We will have live lectures at the weekly class times. These lectures will also be archived for later viewing.

Course Description:

MSE 2090 is an introduction to materials: it is about how various materials behave, why they do so, and how materials are used in various engineering, scientific, and design applications. The atomic and bonding structure, microstructure, and defects in solids relate to their properties such as mechanical strength, diffusion, thermal, electric, and magnetic properties. In turn, how these properties propel the usage of various materials in applications will be discussed. **Catalog description**: This course provides a scientific foundation to promote a rigorous understanding of materials from an atomistic to macroscopic viewpoint. Material systems (polymers, metals, ceramics, and electronic) are developed sequentially to provide a framework to explain the fundamental, physical origins of observable and important macro scale properties.

Grading Scheme

This section operates on a point system: each homework assignment and exam contain a certain number of points to be earned. Final grade will be determined by the total number of points earned at the end of the semester. Extra points are available in every homework assignment and exam, and additional extracredit opportunities up to 3 points will be available. If the final course grade contains a fraction of a point, it will be rounded up to the nearest full point. This section will **NOT** be graded on a curve.

Total Points Earned	Grade
≥97	A+
94-96	Α
90-93	A-
87-89	B+
84-86	В
80-83	B-
77-79	C+
74-76	С
70-73	C-
67-69	D+
64-66	D
60-63	D-
<60	F
Academic Misconduct (Cheaters)	F

Activity	Quantity	Dates	Points (each)
Homework	6	Usually Thursday	5
Mid-term Exam	2	TBD	20
Final Exam	1	TBD	30

Activity Descriptions:

1. <u>Homework Assignments:</u>

- a. Homework assignments are worksheets created by the instructor. They will be posted as .pdf on Canvas under the "assignments" panel.
- b. You are permitted (and encouraged) to work on homework assignments with your peers.
- c. To submit an assignment, uploaded your file to the appropriate item under "assignments".
- d. Late homework **WILL** be accepted. However, one point will be deducted for each day after the due date it is turned in (weekend also counts). For example: <u>Assignment turned in between 0-24 hrs after due date</u>, based on Canvas time stam, will be deducted 1 point, and those turned in between 24-48 hrs after due date will be deducted 2 points.
- e. Homework may be graded by the instructor or the TA.

2. <u>Exams:</u>

- a. There will be two **midterm exams** and one comprehensive **final exam**.
- b. The exams will be distributed and submitted the same way as homework assignments. A single .pdf will be posted. You have 24 hrs to work on each exam and submit it to Canvas unless otherwise noted.
- c. All exams are to be completed individually. You are not permitted to work on the exams with the help (or the burden) of your peers.
- d. All exams are "open book".
- e. All exams are graded by the instructor.

3. Lecture and Class Participation:

- a. All live lectures will be archived and .pdf versions of the PowerPoint presentation of lectures will be uploaded to Canvas
- b. Attendance will not be taken; you will never lose points for not attending a live lecture. However, please note that there may be in-class activities (not graded) that take place, and you will be unable to participate in these without attending live lectures.

4. Extra Credit Assignments:

- a. Every homework assignment and exam will contain extra credit questions allowing for greater than the "maximum" number of points to be earned. These questions are more difficult, require more thought, and are graded more strictly.
- b. There will be additional extra credit opportunities up to a total of 3 points to be announced during the semester. Extra credit points earned on homework/exams do not count toward the 3-point limit.

Advice:

- 1. Attend the live lectures if you can interaction is a precise commodity in the days of on-line teaching, and this is the most direct place you can find it.
- 2. This is a materials science, not a materials calculations class; be ready to think and not plug in numbers.
- 3. Do not hesitate to consult the instructor/TA; we want you to do well and will make every effort to help.
- 4. Be sure to check Canvas for possible announcements if you miss a lecture.

5. We care about your feedback for the course. If you have any comments/concerns about the course, please contact me or the TA directly. If you are not comfortable with reaching out to us directly, feel free to also use the "anonymous feedback" tool in Canvas.

APPENDIX

Course/Class Etiquette and Rules

1. Mid-Term Examination:

- a. The mid-term exams can only be taken on the dates scheduled. If you have a valid reason (to be discussed with me at least **one week** in advance), you will be allowed to take the test on a different day.
- b. Make-up exams will contain different questions from the exam given in class.

2. Final Examination:

- a. If you are unable to take the final exam on the scheduled date and have a valid reason for this, you will be allowed to take the test on a different day.
- b. Make-up exams will contain different questions from the exam given in class.

3. Academic Misconduct:

- **a.** Academic misconduct is not tolerated (honor.virginia.edu).
- **b.** Academic misconduct will be handled in accordance with the University Regulations.
- **c.** In-class sanctions for academic misconduct can range from a grade reduction to an F, depending on the severity of the action. Offense may also be reported to the University Honor Committee at the discretion of the instructor.

d. Regarding plagiarism:

- i. It is your responsibility to understand what plagiarism is.
- *ii.* The instructor may run all your work through plagiarism-detecting software, so please avoid the temptation. This software will compare your paper with millions of other papers to search for possible cases of intellectual dishonesty. <u>Realize:</u> ignorance is not an excuse.

Week	Topics
	Introduction to Materials Science (JM)
1	Atoms and bonding (JM)
	Crystal Structures (AB)
	Crystal Structures (AB)
2	Grain structure and anisotropy (JM)
	Planes & Directions (AB)
	Ordering and ceramics (AB)
3	Polymers (JM)
	Glasses and amorphous solids (JM)
	Mechanical properties and defects (JM)
4	Mechanical properties and defects (AB)
	Anatomy of a dislocation (JM)
	Anatomy of a dislocation (JM)
5	Strength and Failure (JM)
	Atomic motion in solids (JM)
	Diffusion (JM)
6	Midterm 1 (weeks 1-5) (AB)
	Optional Lecture 1 (JM)
	Phases and phase diagrams (AB)
7	Phases and phase diagrams (AB)
	Phase diagrams and kinetics (JM)
	Mechanical properties of metals (JM)
8	Mechanical properties of metals (JM)
	Mechanical properties of Ceramics (AB)
9	Mechanical properties of Polymers (AB)
	Strengthening (AB)
	Strengthening (AB)
10	Fatigue (AB)
	Creep (JM)
	Modes of failure in solids (AB)
11	Corrosion (AB)
	Midterm 2 (weeks 1-10) (AB)
	Introduction to electronic structures (JM)
	Introduction to electronic structures (JM)
12	Semiconductors (JM)
	Semiconductors (JM)
13	Thermal properties (AB)
	Magnetic properties (AB)
14	Magnetic properties (AB)
	Optical properties (AB)
15	Optional Lecture 2 (JM)
	"What's on the final?" (BOTH)

Students with Disabilities or Learning Needs

It is the instructor's goal to create a learning experience that is as accessible as possible. If you anticipate any issues related to the format, materials, or requirements of this course, please meet with me outside of class so we can explore potential options. Students with disabilities may also wish to work with the Student Disability Access Center to discuss a range of options to removing barriers in this course, including official accommodations. Please visit their website for information on this process and to apply for services online: (sdac.studenthealth.virginia.edu) If you have already been approved for accommodations through SDAC, please send me your accommodation letter and meet with me so we can develop an implementation plan together.

Discrimination and Power-based Violence

The University of Virginia is dedicated to providing a safe and equitable learning environment for all students. To that end, it is vital that you know two values that the instructor and the University hold as critically important:

- 1. Power-based personal violence will not be tolerated.
- 2. Everyone has a responsibility to do their part to maintain a safe community on Grounds.

If you or someone you know has been affected by power-based personal violence, more information can be found on the UVA Sexual Violence website that describes reporting options and resources available - www.virginia.edu/sexualviolence.

As your professor and as a person, know that I care about you and your well-being and stand ready to provide support and resources as I can. As a faculty member, I am a responsible employee, which means that I am required by University policy and federal law to report what you tell me to the University's Title IX Coordinator. The Title IX Coordinator's job is to ensure that the reporting student receives the resources and support that they need, while also reviewing the information presented to determine whether further action is necessary to ensure survivor safety and the safety of the University community. If you wish to report something that you have seen, you can do so at the Just Report It portal. The worst possible situation would be for you or your friend to remain silent when there are so many here willing and able to help.

Religious Accommodations

It is the University's long-standing policy and practice to reasonably accommodate students so that they do not experience an adverse academic consequence when sincerely held religious beliefs or observances conflict with academic requirements.

Students who wish to request academic accommodation for a religious observance should submit their request in writing directly to me by Piazza private message as far in advance as possible. Students who have questions or concerns about academic accommodations for religious observance or religious beliefs may contact the University's Office for Equal Opportunity and Civil Rights (EOCR) at UVAEOCR@virginia.edu or 434-924-3200.