

## **MATSCIE 250-200 Principles of Engineering Materials**

**Instructor:** Prof. Claudia Loebel (loebelcl@umich.edu)  
Fall 2023

**Meeting time:** Mo/Wed/Fri 1:30-2:20pm (3 lectures per week of 1 hour each)

**Classroom:** 1670 BEYSTER

### **Discussion sections:**

MATSCIE 250-201 Th 10:30-11:30am, 1206 DOW  
MATSCIE 250-202 Th 11:30am-12:30pm, 2166 DOW  
MATSCIE 250-203 Th 12:30-1:30pm, 1005 EECS  
MATSCIE 250-204 Th 2:30-3:30pm, 1690 BEYSTER

**References:** *Materials Science and Engineering: An Introduction*, Ninth or Tenth Edition, William D. Callister, Jr., Wiley, New York.

### **Communications Policy:**

All instructor communication must be conducted through Canvas conversations. (<https://umich.instructure.com/conversations#filter=type=inbox>). Select "Inbox" from the left menu bar, choose "MATSCIE 250-200 F 2023" from the course list, and in the "To:" field type Claudia Loebel, this name will be easily available to message.

### **GenAI tools:**

Learning how to use AI functions such as ChatGPT is important for all of us. Used properly, ChatGPT can enhance our work; used improperly, it can border on plagiarism. If you have used ChatGPT on anything you submit for MATSCIE250-200, please include an explanation as to (1) what was your original prompt to the chatbot; (2) what are some examples of incorrect data that the chatbot provided to you; and, (3) how did you rework and revise so that your final document was both factually accurate and reflected your writing voice and style.

### **Accommodations for Students with Disabilities:**

If you think you need an accommodation for a disability, please let me know at your earliest convenience. Some aspects of this course, the assignments, the in-class activities, and the way I teach may be modified to facilitate your participation and progress. As soon as you make me aware of your needs, we can work with the Office of Services for Students with Disabilities (SSD) to help me determine appropriate accommodations. SSD (734-763-3000 or [ssd.umich.edu](http://ssd.umich.edu)) typically recommends accommodations through a Verified Individualized Services and Accommodations (VISA) form. I will treat any information you provide as private and confidential.

Your success in this class is important to me. If you are not formally registered with Office of Services for Students with Disabilities (SSD) and have anxiety, depression, learning disabilities or any other issues that affect your ability to fully participate and learn in this class, you are encouraged to check-in with me so that we can best help you do well. Please set up a meeting with me via e-mail.

### **Inclusion and Diversity:**

I aim to create an inclusive classroom where we value all students regardless of their background, country of origin, race, religion, ethnicity, disability status, gender, sexual orientation, etc. I am committed to providing a climate of excellence and inclusiveness within all aspects of the course. If there are aspects of your culture or identity that you would like to share with me as they relate to your success in this class, I am happy to meet to discuss. Likewise, if you have any concerns in this area or

are facing any special issues or challenges, you are encouraged to discuss this matter with me (set up a meeting via e-mail) with an assurance of full confidentiality (only exception being mandatory reporting of academic integrity/honor code violations and sexual harassment).

### **Student Mental Health and Well-being:**

Students may experience stressors that can impact both their academic experience and their personal well-being. These may include academic pressure and challenges associated with relationships, mental health, alcohol or other drugs, identities, finances, etc.

If you are experiencing concerns, seeking help is a courageous thing to do for yourself and those who care about you. If the source of your stressors is academic, please contact me so that we can find solutions together. For personal concerns, U-M offers many resources, including:

- **C.A.R.E. Center** - 734-615-1405; [engin-support@umich.edu](mailto:engin-support@umich.edu); the central hub to assist engineering students by providing genuine and practical support, both inside and outside of the classroom.
- **Counseling and Psychological Services (CAPS)** - confidential; 734-764-8312; for after-hours urgent support, call and press 0; counseling, workshops, groups and more. Engineering embedded counselors can be reached at [caps-engin@umich.edu](mailto:caps-engin@umich.edu)
- **Dean of Students Office** - 734-764-7420; provides support services to students and manages critical incidents impacting students and the campus community
- **Ginsberg Center for Community Service Learning** - 734-763-3548; opportunities to engage as learners and leaders to create a better community and world
- **Maize and Blue Cupboard (MBC)** - 734-936-2794; Food pantry with groceries, kitchen and cooking supplies, personal and household items, and support
- **Multi-ethnic Student Affairs (MESA)** - 734-763-9044; diversity and social justice through the lens of race and ethnicity
- **Office of Student Conflict Resolution** - 734-936-6308; offers multiple pathways for resolving conflict
- **Office of the Ombuds** - 734-763-3545; students can raise questions and concerns about the functioning of the university.
- **Services for Students with Disabilities (SSD)** - 734-763-3000; accommodations and access to students with disabilities
- **Sexual Assault Prevention and Awareness Center (SAPAC)** - confidential; 734-764-7771 or 24-hour crisis line 734-936-3333; addresses sexual assault, intimate partner violence, sexual harassment, and stalking
- **Spectrum Center** - 734-763-4186; support services for LGBTQ+ students
- **Trotter Multicultural Center** - 734-763-3670; intercultural engagement and inclusive leadership education initiatives
- **University Health Service (UHS)** - 734-764-8320; clinical services include nurse advice by phone, day or night
- **Well-being for U-M Students website** - searchable list of many more campus resources
- **Wolverine Wellness** - confidential; 734-763-1320; provides Wellness Coaching, Collegiate Recovery Program, and much more

### **Religious Observances**

The University of Michigan, as an institution, does not observe religious holidays. However, I will make every reasonable effort to help students avoid negative academic consequences when their religious obligations conflict with academic requirements. If you find that an exam or assignment due date conflicts with a religious observance, it is your obligation to let Prof. Loebel know at least 2 weeks in advance of the conflict. You will be given every opportunity to make up the work without penalty, unless

it interferes unreasonably with course delivery. Read the University of Michigan's full policy here: [http://www.provost.umich.edu/calendar/religious\\_holidays18-19.html#conflicts](http://www.provost.umich.edu/calendar/religious_holidays18-19.html#conflicts)

**It is recommended that you review all other general University of Michigan College of Engineering policies, academic rules, information and more in the online bulletin, which can be found at <https://bulletin.engin.umich.edu/>**

### **Course structure and Expectations:**

This is an undergraduate level course in Principles of Engineering Materials which provides the fundamentals of materials properties (metals, polymers, ceramics) and their internal structures with an emphasis on properties and applications of soft and biomaterials. The overall objectives of this course include:

1. Provide fundamental knowledge on materials properties and applications
2. Introduction of biomaterials and design approaches to biomaterial engineering
3. Understand fundamental principles of materials internal structures, including atomic, molecular, crystalline, micro- and macro-structures
4. Provide fundamental knowledge on materials processing and service conditions, including aspects of mechanical, thermal, chemical, electrical, magnetic and radiation

### **Class policy:**

Do not arrive late or leave early. Attendance is highly recommended. I appreciate the current uncertainty of our lives and I will do my best to provide all the content of this class (lecture recordings and other materials) if you are feeling unwell, are isolating or have other difficulties that prevent you from coming to class.

### **Quizzes:**

Five multiple-choice quizzes will be given to assess understanding of the topics and selected problems. These quizzes are closed book and will be given during the first 20 min of discussion sections as indicated in the syllabus. Calculators are allowed.

### **Office Hours:**

Mo/Wed/Fri directly after class (outside of classroom)

Tue: 12:30-2:30pm in 2122 DOW (in person)

Thu: 4:00-5:00pm (zoom: <https://umich.zoom.us/j/91738767274>)

### **Piazza:**

This term we will be using Piazza for class discussion. The system is highly catered to getting you help fast and efficiently from classmates, the GSIs, and myself. Rather than emailing questions to the teaching staff, I encourage you to post your questions on Piazza. If you have any problems or feedback for the developers, email [team@piazza.com](mailto:team@piazza.com).

Find our class signup link at: <https://piazza.com/umich/fall2023/matscie250200fa2023>

### **Grading Criteria:**

Homework = 40%

Quizzes = 35%

Final Exam = 25%

Evaluation = +3%

Introductory meeting = +10% point credit on 1<sup>st</sup> quiz

**Grade = 0.25 (Final Exam) + 0.4 (HW) + 0.35 (Quiz)**

A- to A+  $\geq 90.0\%$   
 B- to B+  $\geq 80.0\%$   
 C- to C+  $\geq 70.0\%$   
 D- to D+  $\geq 60.0\%$   
 E  $< 59.9\%$

B- is 80.0 to 82.99, B is 83.0 to 86.99, B+ is 87.0 to 89.99, etc.

“On a border” means 79.9, etc., not 78.5 = middle of C+ range

### Homework:

Assigned weekly on Monday, due the following Monday at midnight.

**NO LATE HOMEWORK**; graded; **MUST** be submitted to Canvas; late homework = 10% reduction in points. Homework assignments will be posted on Canvas (assignments section).

### SCHEDULE

|     |        |                                           |                |
|-----|--------|-------------------------------------------|----------------|
| Mon | Aug 28 | Course introduction; policies             | Ch. 1          |
| Wed | Aug 30 | Bonding                                   | Ch. 2          |
| Fri | Sep 1  | Bonding                                   | Ch. 2          |
| Mon | Sep 4  | <i>No class – Labor Day</i>               |                |
| Wed | Sep 6  | Crystal Geometry <b>flipped classroom</b> | Ch. 3          |
| Fri | Sep 8  | Crystal Geometry <b>flipped classroom</b> | Ch. 3          |
| Mon | Sep 11 | Defects                                   | Ch. 4          |
| Wed | Sep 13 | Defects; Diffusion                        | Ch. 5          |
| Fri | Sep 15 | Diffusion                                 | Ch. 5          |
| Mon | Sep 18 | Mechanical properties                     | Ch. 6          |
| Wed | Sep 20 | Quiz preparation and practice             | Ch. 2-5        |
| Thu | Sep 21 | <b>QUIZ 1</b>                             | <b>Ch. 2-5</b> |
| Fri | Sep 22 | Mechanical properties                     | Ch. 6          |
| Mon | Sep 25 | Dislocations                              | Ch. 7          |
| Wed | Sep 26 | Dislocations and plastic deformation      | Ch. 7          |
| Fri | Sep 29 | Strengthening mechanisms and Annealing    | Ch. 7          |
| Mon | Oct 2  | Annealing                                 | Ch. 7          |
| Wed | Oct 4  | Quiz preparation and practice             | Ch. 6,7        |
| Thu | Oct 5  | <b>QUIZ 2</b>                             | <b>Ch. 6,7</b> |
| Fri | Oct 6  | Failure                                   | Ch. 8          |
| Mon | Oct 9  | Failure                                   | Ch. 8          |
| Wed | Oct 11 | Fatigue                                   | Ch. 8          |
| Fri | Oct 13 | Phase Diagrams                            | Ch. 9          |
| Mon | Oct 16 | <i>No class – Fall break</i>              |                |
| Wed | Oct 18 | Quiz preparation and practice             | Ch. 7,8        |
| Thu | Oct 19 | <b>QUIZ 3</b>                             | <b>Ch. 7,8</b> |

|            |               |                                  |                        |
|------------|---------------|----------------------------------|------------------------|
| Fri        | Oct 20        | Phase diagrams                   | Ch. 9                  |
| Mon        | Oct 23        | Phase diagrams                   | Ch. 9                  |
| Wed        | Oct 25        | Phase diagrams                   | Ch. 9                  |
| Fri        | Oct 27        | Phase transitions                | Ch. 10                 |
| Mon        | Oct 30        | Phase transitions                | Ch. 10                 |
| Wed        | Nov 1         | Quiz preparation and practice    | Ch. 9,10               |
| Thu        | Nov 2         | <b>QUIZ 4</b>                    | <b>Ch. 9,10</b>        |
| Fri        | Nov 3         | Ceramics                         | Ch. 12                 |
| Mon        | Nov 6         | Ceramics                         | Ch. 12,13              |
| Wed        | Nov 8         | Ceramics                         | Ch. 12,13              |
| Fri        | Nov 10        | Polymers                         | Ch. 14,15              |
| Mon        | Nov 13        | Polymers                         | Ch. 14,15              |
| Wed        | Nov 15        | Quiz preparation and practice    | Ch. 12,13,14,15        |
| Thu        | Nov 16        | <b>QUIZ 5</b>                    | <b>Ch. 12,13,14,15</b> |
| Fri        | Nov 17        | Polymers                         | Ch. 14,15              |
| Mon        | Nov 20        | Hydrogels                        |                        |
| Wed        | Nov 22        | <i>No class – Thanksgiving</i>   |                        |
| Fri        | Nov 23        | <i>No class – Thanksgiving</i>   |                        |
| Mon        | Nov 27        | Composites                       | Ch. 16                 |
| Wed        | Nov 28        | Composites                       | Ch. 16                 |
| Fri        | Dec 1         | Corrosion                        | Ch. 17                 |
| Mon        | Dec 4         | Corrosion                        | Ch. 17                 |
| Wed        | Dec 6         | Materials degradation            |                        |
| Fri        | Dec 8         | Exam preview                     |                        |
| <b>Tue</b> | <b>Dec 12</b> | <b>FINAL EXAM 4 p.m.- 6 p.m.</b> | <b>comprehensive</b>   |