

## **MSE 2001: Principles and Applications of Engineering Materials**

Class period: TBD

Location: TBD

**Course Description:** Materials science and engineering is based on the unifying principle that the performance of materials is controlled by their structure, properties, and processing. In this course we will first learn how to describe and quantify the structure of materials. The structure will then be related to specific materials properties and how temperature, deformation, and other processing parameters can be used to change the structure and properties of materials.

**Instructor:** Prof. Faisal Alamgir,  
Tel: (201) 240-9367  
e-mail: [faisal@mse.gatech.edu](mailto:faisal@mse.gatech.edu)

**Office Hours:** Office hour: TBD

**Email Policy:** You must use your Georgia Tech issued email address or the messaging option in Canvas when contacting the instructor. Email originating from outside the Georgia Tech network may be ignored to protect your personal information and comply with Federal and Georgia Tech policies.

**Textbook:** The Science and Design of Engineering Materials, 2<sup>nd</sup> Edition, by J. P. Schaffer, A. Saxena, S. D. Antolovich, T. H. Sanders and S. B. Warner.

**Course Website:** Canvas will be used to post the course syllabus, problems and problem solutions, and assignments. Important announcements will also be sent to your Canvas account so please check it multiple times daily.

**Quizzes and Exams:** The midterm exams will take place during the class period as online assignments. There will be 3 midterm exams. The final exam will be comprehensive in its content. It will also be administered during finals week.

**Grades:** Your grade in the course will be determined based on your performance on three written examinations, and the final exam.

<b>Exam</b>	<b>Percentage of Final Grade</b>
Exam I	2%
Exam II	25%

Exam III	25%
Final Exam	30%

**Homework:** Homework problems will be given periodically. Homework is not to be turned-in, and you are responsible for using the provided solutions to gauge your understanding of the material. Students are strongly encouraged to work on the homework. Students are allowed/encouraged to study together (including working together on the homework assignments). You can ask question regarding your homework, although you should try to think about the problems before asking me.

**Make up policy:** Those with Institute sanctioned activity excuses will be allowed to take missed exams, per Institute policy. Make-up exams will only be permitted when absences are due to legitimate reasons such as illness, religious observance, or other events recognized by the Institute as a valid excuse. In all non-emergency and non-illness cases, you must contact the instructor in advance of the test in writing (email is fine) to schedule a make-up exam. If you do not contact the instructor in advance, it may not be possible to schedule a make-up test. Whenever possible, make-ups will be administered during the week following the scheduled date of the exam. Make-up exams may be different from those administered during the regular examination period.

**Extenuating Circumstances:** Please be sure to meet with the Dean of Students if you encounter extenuating circumstances that interfere with your ability to attend class and/or prepare for exams. The Dean's office is your best resource when you would prefer to not discuss the details of your personal situation.

**Grade Accuracy:** Errors in grading and/or recording of scores of exams must be addressed within 7 days of posting on Canvas by contacting the instructor in writing via email. Disputes after this one-week period will not be considered.

**Final Exam Conflicts:** The Institute has established the policies for final exam scheduling conflicts that are summarized in the list below. If you need to request an accommodation, please contact the instructor via email and include a list of all of your courses (course numbers and sections) and their exam periods on the day in question. If you have additional questions about the Institute's policies, please refer to the regulations in the course catalog (<http://catalog.gatech.edu/rules/12/> ([Links to an external site.](#))) and the Office of the Registrar's website at <https://registrar.gatech.edu/info/exam-guidelines> ([Links to an external site.](#)). Please note the following Institute policies:

- "All students should check the Final Exam Schedule against their own class schedule and report any conflicts to the instructor(s) as soon as possible. It is the responsibility of each student to see that all possible conflicts are resolved by the instructor and the proper authorization received no later than 2 weeks before the Monday of exam week. A special period is provided as a conflict period in which to reschedule conflicting examinations. Refer to the Final Exam Schedule for the conflict date. Other periods within the exam week may also be used for conflicting examinations provided no student is forced to take more than two examinations in one day."

- “Any course that is offered outside the normal scheduling format must make arrangements to give way to courses offered in the normal time slot. If a conflict arises between two courses that offer finals outside the normal scheduling format, the conflict will be resolved by the instructor rescheduling the examination for the course with the lower number. The common final for any course may not take up more than one exam period.”
- “Time Conflict#1: Two examinations scheduled for the same period, neither course being examined at other hours, or no available hour on the student's schedule to take the exam with another section. Resolution#1: This conflict may be resolved by the instructor rescheduling the examination, for the course with the lower number, to the conflict period stated on the Final Exam Schedule, or to another period mutually agreed on by the instructor and the student.”
- “Time Conflict #2: Three examinations scheduled in one day. Resolution #2: To resolve this conflict, the examination scheduled for the middle period will be rescheduled to the conflict period stated on the Final Exam Schedule or to another period mutually agreed on by the instructor and student.”

**Academic Integrity:** All students in this class are expected to respect the *Georgia Tech honor code* and behave in a professional manner when it comes to academic integrity. Any students violating the honor code or suspected of academic misconduct will be turned over to the office of Academic Integrity, Dean of Students to investigate the incident(s). Cheating off of another person’s test is unethical and unacceptable. Cheating off of anyone else’s work is a direct violation of the GT Academic Honor Code, and will be dealt with accordingly. *For any questions involving any Academic Honor Code issues, consult me, my teaching assistants, or <http://www.policylibrary.gatech.edu/student-affairs/academic-honor-code> (Links to an external site.).*

**Special Needs:** The Georgia Institute of Technology encourages qualified persons with disabilities to participate in its programs and activities. If you anticipate needing any type of accommodation in this course or have questions about physical access, please tell the instructor as soon as possible.

**Course Objectives:** Students will learn the fundamentals of structure-property-processing-performance relationships of engineering materials; be prepared to undertake more in-depth courses in specialized areas within materials science and engineering.

**Course Outcomes:** Students should be able to demonstrate their understanding by qualitatively and quantitatively describing: 1. the five microstructural elements- atomic/molecular structure, defects, solute, precipitates, and grain boundaries and how they manifest themselves in each class of material; 2. how the key microstructural elements are controlled by composition, temperature and time; 3. how material structure relates to their properties; 4. the structure, chemistry, and phase fractions in solids; 5. how materials properties are calculated from empirical data.

## Tentative Schedule:

<u>Week</u>	<u>Topics</u>
(1-3: Organization of Material Structure)	
1	Syllabus, Atomic Structure Bond-force and bond-energy curves
2	Atomic Bonding and Atomic Packing Crystal Structures
3	Crystal Structures, practice problems Exam 1
(4-6: Defects in Material Structure)	
4	Imperfections in Solids- Point Defects Point defects and Diffusivity, line defects
5	Line defects and plastic deformation
6	Line defects and plastic deformation Line defects, plastic deformation
(7-10: Material transformations)	
7	Exam 2 Time-temperature-transformation plot, glass structures Thermodynamics and kinetics of phase transformations
8	Phase diagrams Phase diagrams
9	Recitation <b>EXAM 3</b>

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Select topics on Electrical Conductivity in Materials

**Final Exam**