

## MSE 213: Structure and Properties of Materials

### General Information:

**Term: 2022 Summer Session**

**Instructor: Staff**

**Language of Instruction: English**

**Classroom: TBA**

**Office Hours: TBA**

**Class Sessions Per Week: 5**

**Total Weeks: 5**

**Total Class Sessions: 25**

**Class Session Length (minutes): 145**

**Credit Hours: 4**

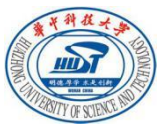
### Course Description

The topics covered in this course include atomic/molecular structure, nanoscale, morphology, principles of phase transformation, structure development during processing, and property dependence on structure. Besides single component systems, advanced materials such as multiphase and/or multi component systems, (e.g. composites and gels) and nanomaterials will also be discussed.

*Prerequisites: MATH 201 Calculus II, PHYS 201 General Physics II, CHEM 201 General Chemistry II.*

### Course Format and Requirements:

Attendance at every lecture is expected. Students are expected to behave in a professional manner while in class. Behaviors that are distracting or that may otherwise impede the learning of other students will not be tolerated. Lectures may contain material that is not in the textbook. Such material may appear in homework and on exams. Additional information, such as changes to the course schedule or due dates, may also be distributed in class. It is the student's responsibility to seek out any and all disseminated information in



the event that he or she misses a scheduled class period. Attendance and promptness are expected. Note that only two unexcused absences will be permitted without penalty.

## Course Material

*Materials Science and Engineering: An Introduction*, 10th edition by William D. Callister, Jr.

## Course Assignments:

### Quizzes

Quizzes will usually consist of True-False, multiple choice and short answer questions. Quizzes cannot be made up and will typically take 10 minutes or less. Five quizzes will be given through the whole semester.

### Exams

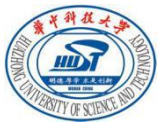
There will be two midterms and a final exam. Most questions will be circuit analysis problems, including numerical as well as symbolic answers; however, there may be a few conceptual questions as well on each exam. All exams (midterms and final) will be in class and closed book. You will be allowed to bring in one sheets of notes (one-sided, 8.5x11 inches) and a calculator.

## Course Assessment:

Quizzes	10%
Attendance	10%
Midterm Exam 1	25%
Midterm Exam 2	25%
Final Exam	30%
<b>Total</b>	<b>100%</b>

## Grading Scale (percentage):

A+: 98%-100%



- A: 93%-97%
- A-: 90%-92%
- B+: 88%-89%
- B: 83%-87%
- B-: 80%-82%
- C+: 78%-79%
- C: 73%-77%
- C-: 70%-72%
- D+: 68%-69%
- D: 63%-67%
- D-: 60%-62%
- F: Below 60%

## Course Schedule

Class 1:

Overview of the course;

Go through syllabus

Structure and Morphology: Introduction;

Class 2:

Atomic structure and bonding;

Periodic table covalent bonds;

Class 3:

Electronegativity;

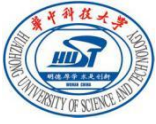
Ionic, Metallic and Weak Bonding;

Metallic crystal structures;

Class 4:

### **Quiz 1**

Crystallography



Ceramic crystal structures;

Class 5:

Structure of solids;

Imperfections in solids

Class 6:

Crystallinity of ceramic materials;

Amorphous ceramic structure;

Topics on glass

Class 7:

**Quiz 2**

Topics on glass

Imaging defects;

Class 8:

Applications of ceramics;

Mechanical properties of different ceramics

Review for Midterm 1

Class 9:

**Midterm Exam 1**

Class 10:

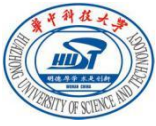
Properties-Phase Transitions: Introduction;

Diffusion;

Class 11:

Mechanical properties of metals

Dislocations and plastic deformation;



Class 12:

Failure;

Phase diagrams - one-component

Phase diagrams - two-component;

Class 13:

**Quiz 3**

Interpret curves, phases and process;

Kinetics of phase transformations

Class 14:

Deformation Mechanism;

Strengthening Mechanism

Class 15:

Steel;

Alloys and their phase behaviors;

Steel alloying elements effects

Review for midterm 2

Class 16:

**Midterm Exam 2**

Class 17:

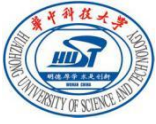
Organic Chemistry Review;

Structure of Polymers;

Properties of Polymers;

Class 18:

Fabrication of materials Synthesis;



## Mechanical Properties of Polymers

Fabrication of Polymers;

Polymer and Composites;

Class 19:

### **Quiz 4**

Property modification with composite materials;

Amorphous Polymers;

Polymer Degradation

Nanocomposites;

Class 20:

Carbon materials;

Nanomaterials;

Biomaterials

Class 21:

Corrosion and Tribology;

Corrosion in metals and ceramics;

Materials processing;

Material Selection

Class 22:

### **Quiz 5**

Process selection;

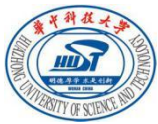
Thermodynamics review;

Thermal Properties of materials;

Application of Thermal Properties in manufacturing

Class 23:

Electrical properties;



Magnetic Properties of Materials;  
Semiconductors

Class 24:  
Mixed and ionic conductors;  
Recycling;  
Economic, Environmental and Social Issues

Class 25:  
Wrap-up  
Review for final exam

***Final Exam (Cumulative): TBA***

### **Academic Integrity:**

Students are encouraged to study together, and to discuss lecture topics with one another, but all other work should be completed independently.

Students are expected to adhere to the standards of academic honesty and integrity that are described in the Huazhong University of Science & Technology's *Academic Conduct Code*. Any work suspected of violating the standards of the *Academic Conduct Code* will be reported to the Dean's Office. Penalties for violating the *Academic Conduct Code* may include dismissal from the program. All students have an individual responsibility to know and understand the provisions of the *Academic Conduct Code*.

### **Special Needs or Assistance:**

Please contact the Administrative Office immediately if you have a learning disability, a medical issue, or any other type of problem that prevents professors from seeing you have learned the course material. Our goal is to help you learn, not to penalize you for issues which mask your learning.