

CLEVELAND STATE UNIVERSITY  
Washkewicz College of Engineering

**Materials Science: ESC 270:1 (3-0-3): Spring 2021 (1/20-5/6/2021)**

*Structure of materials and its relationship to the mechanical and physical properties of materials; applications and uses.*

Prerequisite: CHM211 or its equivalent

Instruction: 1:300 PM – 2:20 PM: Mon/Wed/Fri (*off-campus- using ZOOM*)), Office-Hours: M/W: 3:00 PM-4:00 PM (**Prior appointment** using ZOOM)

Home Assignments: I will E-mail the problems to be solved and you will submit them as WORD or PDF file for grading.

Quizzes: There will be short quizzes almost every-other day during the lecture period.

Tests: There will be two exams Mid-Term test (March 3, 2021 (Wednesday) and Final Exam (May 5, 2021 (Wednesday: 12:30 PM to 2:30 PM)

Instructor: Dr. S.N. Tewari ([S.Tewari@csuohio.edu](mailto:S.Tewari@csuohio.edu)), *Professor Emeritus*, Chemical and Biomedical Engineering Department.

Text: William D. Callister, Jr. and David G. Rethwisch, Materials Science and Engineering, an Introduction, John Wiley & Sons, New York (2007), 9<sup>th</sup> edition.

Expected Outcomes: Upon completion of this course, students should be able to:

1. Demonstrate understanding of atomic and crystal structure of solids. Predict solidification microstructure of binary alloys. Understand corrosion and its prevention. Some understanding of semiconductor and polymer materials.
2. Demonstrate use of tensile, fatigue, impact, creep, and fracture toughness properties of solids for appropriate applications. Design and predict steady-state and non-steady state solid-state diffusion effects.

Fulfills the following Engineering Program Objectives and Outcomes:

- (a) Application of Mathematics, Science and Engineering Principles.
- (e) Identification, Formulation and Solution of Engineering Problems.

Topics and tentative schedule:

- (a) Introduction: Materials Science: Type of Materials and their Processing, Structure, Properties Relationships (1 class).
- (b) Atomic Structure and Atomic-Bonding (2 classes).
- (c) Crystal Structures of Solids, Crystallographic directions and planes, Polycrystalline and Non-crystalline Materials (4 classes).
- (d) Point Defects, Line Defects (dislocations), Bulk Defects, Grain Size (3 classes).
- (e) Diffusion in Solids: Steady-state and Non-steady-state. Materials Processing and Diffusion (4 classes).
- (f) Mechanical Properties of Metals: Elastic and Plastic Deformation (5 classes).
- (g) Dislocations and Plastic Deformation, Strengthening Mechanisms in Metals, Recovery-Recrystallization and Grain Growth (3 classes).
- (h) Failure: Fracture, Fatigue and Creep (4 classes).
- (i) Equilibrium Phase Diagrams and Microstructure of Alloys (5 classes).
- (j) Phase Transformations, Microstructure and Property Changes in Iron-Carbon Alloys (Some aspects of Thermal Processing) (3 classes).
- (k) Corrosion and its prevention (3 classes)
- (l) Polymers (2 classes)
- (m) Electrical Properties of Materials: Metals, Semiconductors, Semiconductor devices (3 classes)
- (n) Exams (1 class)

POLICY

INSTRUCTION: We will use ZOOM for on-line instruction. It is mandatory for students to keep their VIDEO ON during the class. After each lecture segment you are expected to ask questions and seek clarifications during the class. There will be short quizzes almost every-other day during the lecture period, and your grade will depend heavily on your performance during these quizzes. A copy of the slides used in lectures will be made available in the Black-Board. Instructor encourages you to ask questions during the class without any hesitation. Attendance will be recorded. Exams must be taken when scheduled. Exceptions will be made only in case of verifiable emergencies. Cheating in the examinations or the home-works will result in an automatic “F”. During tests/exams telephone calls and rest-room breaks will not be permitted. Once the class starts, no talking or texting amongst the students is permitted.

Please check your email daily, as I will send useful information and updates to assignments via E-mail. I will only email to your @vikes.csuohio.edu address; if you are using any other E-mail address then please make sure that your @vikes.csuohio.edu E-mails are getting forwarded to that address. Please use **CSU-authenticated Zoom Account** to “attend the Zoom meetings” not your own “personal Zoom-account”. In order to set-up a CSU-authenticated Zoom account please visit <https://www.csuohio.edu/citdl/zoom>, and Follow the instructions under “How do I download and install Zoom?

## HOMEWORK

There will be 6 to 8 home works. You will submit your solution as a **WORD or PDF** file attachment **before 10 am on the day they are due**. Your name and ID must be printed on the first page of your HW. Late home work will not be accepted. I will present the home-work solution first thing on the day they are due. Homework will be graded by the TA. Please **do not underestimate the importance of home-work** for your success in this course.

## EXAMINATIONS

There will be a **mid-term exam** and a **final**. There will be **6-8 home-works** and **20-25 quizzes**. Lowest 4 quiz score and one homework score will be dropped for final grading. No make-up quizzes/exams will be allowed. In the event that a documented illness causes you to miss an exam, the remaining exam will be averaged to compensate for the missing score. Grading is by the formula: **20% Homework, 25% Quiz, 25% for mid-term, 25% Final, and 5% for attendance**. The final letter grades are determined according to:

### GRADING:

A: 95-100	A_: 90-94.9	B+: 86-89.9	B: 81-85	B_: 75-80	C+: 67-74.9
C: 60-66.9	D: 50-59.9	F: 0-49.9			

***Mid Term Test: March 3, 2021 (Wednesday)***

***Final Exam (May 5, 2021 (Wednesday: 12:30 PM to 2:30 PM)***

## **SCHEDULE OF CLASSES**

	January 20	22
25.	27	29
Feb 1	3	5
8	10	12
15	17	19
22	24	26
March 1	<b>3 (<i>mid term test</i>)</b>	5
8	10	12
<b>15</b> (President's day)	17	19
22	24	26
29	31	April 2
5	7	9
12	14	16
19	21	23
26	28	30