



Material Science and Engineering

(Autumn 2025)

Instructor: [H. Golpira](#)

Course Description and Objectives

It introduces students to the structure and fundamentals of polymers, metals, and ceramics. Mechanical properties of metals, imperfections, and alloy structure are also discussed. The iron-carbon phase diagram is an introduction to martensite, pearlite, and other structures and properties. The course provides fundamentals for the strength of materials and machine design elements.

Topics Covered

1. Crystalline structure
2. Imperfection in solids
3. Mechanical properties (stress and strain, elastic and plastic deformation, endurance limit, ductility, resilience, toughness, and hardness)
4. Strengthening mechanisms (grain size and growth, cold work, alloys)
5. Failure and fatigue (ductile and brittle materials, cyclic stress, and creep)
6. Phase diagram and transformation
7. Heat treatment (quenching, annealing)

Homework/Assignments

The course assignments will be performed throughout the semester. You will provide a written report.

1. Homework: In each section, two or three problems will be provided to the students.



References

- [1] *Callister Jr., W. D., & Rethwisch, D. G. (2020). Materials science and engineering: an introduction. John wiley & sons.*

Grading

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| • Homework: | 25% |
| • Final Exam: | 50% |
| • Midterm: | 25% |