

## MECH 2606 - Engineering Materials

Fall 2026 Syllabus, Section 03, CRN 43983,

Credit hours: 3

### Instructor

**Jae Joong Ryu**

Associate Professor

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### Public Instructor Information

Instructor Title: Associate Professor

Instructor Professional Qualifications:

PhD, Mechanical Engineering, Iowa State University

MS, Mechanical Engineering, Iowa State University

BS, Mechanical Engineering, Iowa State University

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### Course Description

2606. Engineering Materials. Properties and uses of engineering materials, manufacturing processes, including heat treatments and forming operations. Introduction to mechanical testing methods. Listed also as MTEN 2606. Prereq.: MATH 1571 or MATH 1585H. 3 s.h.

### Course Readings

| Group    | Title                                              | Author               | ISBN |
|----------|----------------------------------------------------|----------------------|------|
| Required | Materials Science and Engineering: An Introduction | William D. Callister |      |

Supplemental readings and resources will be provided throughout the course.

The course readings are subject to change in the event of extenuating circumstances, research developments, current events, and/or to ensure better learning.

### Tentative Course Schedule (subject to change)

| Day | Date | Reading(s) | Proposed Topic                                                         | Due/To Prepare for Class |
|-----|------|------------|------------------------------------------------------------------------|--------------------------|
| Tue | 8/25 | Chap 1     | Introduction to materials science; material classes                    |                          |
| Thu | 8/27 | Chap 2     | processing–structure–properties–performance; atomic structure; bonding |                          |
| Tue | 9/1  | Chap 3     | Crystal structures; unit cells; BCC, FCC, HCP                          |                          |
| Thu | 9/3  | Chap 3     | coordination number; APF; theoretical density                          |                          |
| Tue | 9/8  | Chap 3     | Crystallographic directions and planes; Miller indices                 |                          |
| Thu | 9/10 | Chap 4     | point defects; vacancies; solid solutions                              |                          |
| Tue | 9/15 | Chap 4     | Dislocations; grain boundaries; microscopic examination                |                          |
| Thu | 9/17 | Chap 5     | introduction to diffusion; diffusion mechanisms                        |                          |

|     |       |                  |                                                                            |
|-----|-------|------------------|----------------------------------------------------------------------------|
| Tue | 9/22  | Chap 5           | Fick's laws; temperature dependence of diffusion                           |
| Thu | 9/24  | Chap 6           | introduction to mechanical properties; stress and strain                   |
| Tue | 9/29  | Chap 6           | Elastic deformation; modulus; Poisson's ratio                              |
| Thu | 10/1  | Chap 6           | plastic deformation; yielding; tensile testing                             |
| Tue | 10/6  | Chap 6           | UTS, ductility, toughness, resilience; true stress-strain                  |
| Thu | 10/8  | Chap 6           | hardness; property variability and design concepts                         |
| Tue | 10/13 | Chap 7           | Dislocations and plastic deformation; slip systems                         |
| Thu | 10/15 | Chap 7           | strengthening by grain-size reduction, solid solution and strain hardening |
| Tue | 10/20 | Chap 8           | Fracture; ductile vs. brittle fracture                                     |
| Thu | 10/22 | Chap 8           | fracture mechanics; fatigue; S-N behavior; creep                           |
| Tue | 10/27 | Chap 9           | Phase-equilibrium concepts; binary phase diagrams                          |
| Thu | 10/29 | Chap 9           | phases and compositions; tie lines and lever rule                          |
| Tue | 11/3  | Chap 9           | Eutectic systems; microstructure development                               |
| Thu | 11/5  | Chap 9           | Fe-Fe#C phase diagram; steels and cast irons                               |
| Tue | 11/10 | Chap 10          | Phase transformations; kinetics; nucleation and growth                     |
| Thu | 11/12 | Chap 10          | Isothermal transformation diagrams; pearlite, bainite and martensite       |
| Tue | 11/17 | Chap 10          | Heat treatment of steels; tempering; hardenability; alloying               |
| Thu | 11/19 | Chap 11          | introduction to engineering metal alloys                                   |
| Tue | 11/24 | Chap 11          | Ferrous/nonferrous alloys, processing and applications                     |
| Thu | 11/26 |                  | Thanksgiving                                                               |
| Tue | 12/1  | Chap 11          | integrated materials selection/application problems                        |
| Thu | 12/3  | Review materials | Comprehensive review                                                       |
| Tue | 12/8  |                  | Final Week                                                                 |
| Thu | 12/10 |                  | Final Week                                                                 |

The course schedule, policies, procedures, and assignments in this course are subject to change in the event of extenuating circumstances, by mutual agreement, and/or to ensure better learning.