CE 211 MATERIALS SCIENCE

Required course

Instructor(s):	*Name:*	**Turan Özturan**	**Nilüfer Özyurt Zihnioğlu**
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Course Data: Hours:

Room: Özturan
Özyurt

TA's: Abdullah H. Akca, Anıl Niş, Ahmet O. Pehlivan, Hasan Yıldırım, Onur Öztürk
Office. North Campus KB, Materials Lab.

Course Description (Catalog):

CE211 Materials Science **(3+0+2) 4**

Materials and properties. Atomic bonding and arrangement. Structural imperfections. Atom movements. Elastic and viscoelastic deformation of materials. Phase diagrams. Metals, ceramics, polymers. Mechanical properties and failure. Modification of properties of materials through changes in structure. Composites. Corrosion and degradation of materials.

Prerequisites: Phy 130, Chem 105.

Course Objectives (Learning outcomes) :

- To develop an understanding of the basics of materials science
- To lay a sound foundation for the materials technology
- Provide a connection between empiricism, craft and science in understanding of materials and of their treatment in practice.

Textbook:

- Materials Science and Engineering: An Introduction, 9th Ed., W.D., Callister, Jr. and D.G. Rethwisch, John Wiley & Sons, 2015.

Reference Books:

- Introduction to Materials Science for Engineers, 5th Ed., J.F., Shackelford (Prentice Hall, 2000)
- Elements of Materials Sci. and Eng., 6th Ed., L.H., Van Vlack (Addison – Wesley, 1990)
- Boğaziçi University Library

Curricular context

This course is an introduction to the basics of materials science and engineering materials. Knowledge of various materials and material properties starting from atomic level to macro level is given. Important material phenomena such as elastic and plastic deformations, failure, creep, fatigue, and corrosion are examined.

Laboratory and Computer Usage:

Theoretical information given in the classroom is supported with 5 hours (for entire semester) of lab work. The class is divided into a number of small groups and experiments related to lectures are done to closely associate students with engineering materials and experimental study. Students are encouraged to use computer facilities in evaluating the test results and preparing the laboratory reports.

Class Policies:

- Class Attendance: 10 %
- Quizzes: Two quizzes, 5% of the course grade
- Midterm exams: Two exams, each 25% of the course grade.
- Lab. Reports and attendance : 10%
- Final exam: Comprehensive exam at the end of the semester, 25% of the course grade.

Contribution of the Course to Program Outcomes:

This course is intended to contribute to the following program outcomes.

(a) An ability to apply knowledge of science and engineering.
(b) An ability to conduct experiments, as well as to analyze and interpret data.
(c) An ability to identify, formulate and solve engineering problems.
(d) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Course Assessment:
Course will be assessed on the basis of the achievement of course objectives and contribution to program outcomes by the students at the end of the semester. Procedures will be announced in the last week of the course.

COURSE CONTENT

Weeks	Topics	Course Topics and Objectives
1	Materials for Engineering (Ch. 1)	Historical perspective. Introduction to materials science & engineering. Classification of materials.
2	Atomic structure (Ch. 2)	Fundamental concepts. Interatomic bonds.
3, 4	Crystal structures (Ch. 3)	Introduction to unit cells. Crystallographic planes and directions.
5	Imperfections in solids (Ch. 4)	Introduction to point, linear, and planar defects in crystals.
6	Diffusion in solids (Ch. 5)	Diffusion mechanisms and factors influencing diffusion processes.
7	Mechanical properties (Ch. 6)	Elastic and plastic deformations. Design/safety factors.
8	Dislocations and strengthening mechanisms (Ch. 7)	Types of dislocations and strengthening mechanisms.
9	Failure (Ch. 8)	Fracture, fatigue and creep of materials.
10	Phase diagrams (Ch. 9)	Types of equilibrium phase diagrams. Phases and microstructures.
11, 12	Types and applications of materials (Chs. 11, 13, 14, 15)	Metals, Ceramics, Polymers and their industrial uses.
13	Composites (Ch. 16)	Classes and types of composites. Estimation of composite stiffness and strength. Typical applications.
14	Corrosion (Ch. 17)	Basics. Types and prevention. Superconductivity.