

MECHANICAL ENGINEERING DEPARTMENT

COURSE SYLLABUS

Course No: MECH 390

Course Title: Engineering Materials

Credit Hours: 3

Pre-requisites: CHEM 1701, ENGU 1303

Text Book & Other Course Material

Text Book: Material Science and Engineering, An Introduction, Eighth Edition, 2009, Wiley, USA
By William D. Callister, Jr.

Recommended readings: Introduction to Materials Science for Engineers (7th Edition), James F. Shackelford.

Course Description

This course aims at studying basic concepts and fundamentals of material science and engineering. Topics covered include atomic structure, arrangements, unit cells, types of engineering materials; metallic alloys, polymers, ceramics, composites, nanocomposites, testing, mechanical and electrical properties, processing, in service behavior, corrosion, deformation, material and process selection.

Course Objectives

1. To provide students with concepts and skills required for solving material related engineering problems.
2. To introduce material testing experiments, interpretation of results and analysis of results.
3. To contribute in enhancing students communication skills.

Course Outcomes and Related Student Outcomes

Upon completion of the course, students should be able to:

1. Ability to understand concepts of crystalline, non-crystalline and defects in crystalline materials [a]
2. Ability to use Fick's first and second laws of diffusion in metals [a]
3. Ability to give applications and understand degradation of metals, ceramics, polymers and composite materials [a]
4. Ability to differentiate between different manufacturing methods used in processing of different materials [a]
5. Ability to understand the electrical properties of metals and semiconductors [a]
6. Ability to conduct different types of material testing and to derive mechanical properties from different types of material testing [b]
7. An ability to identify, formulate and solve engineering problems [e]
8. Ability to produce effective technical reports and presentations [g]
9. To have a knowledge of contemporary issues related to engineering materials [j]

Course Content Category

Engineering Science and Design: 100% Engineering Science

Student Evaluation

Exams:	60% (Midterm 25%, Final 35%)
Progress test/quizzes	10%
Lab reports	15%
Assignments	5%
project	10%

Teaching and Learning Methods

- PPT slides
- Laboratory Experiments
- Smart and Black Board
- iPad

Topics to be covered

1. Crystalline and Non-Crystalline Structure
2. Crystal Imperfections
3. Diffusion in Solids
4. Metals, Ceramics, Polymers and Composites
5. Mechanical properties
6. Chemical Stability of Materials in Environment
7. Electrical properties
8. Processing

Experiments:

1. Materials Microstructure
2. Tensile Testing
3. Creep Testing
4. Corrosion Testing
5. Electrical properties

Tentative Weekly Schedule of Course Topics and Contents

Week #	Lecture	Lab
1	Introduction to course contents. Active learning strategy and introduction to Engineering Materials	Lab policies, report writing, project description, guidelines for lab work and term project rules. etc.
2	Structure of Solid Materials: Crystalline and Non-Crystalline Structure.	Pre-lab. Exp. #1 Materials Microstructure: Metallic materials + Composite materials
3	Imperfections in Solids: Point defects, Linear defects, grain boundaries and grain size determination.	Exp.1 Materials Microstructure: Metallic materials + Composite materials ** Project Topic and groups are due
4	Mechanical Properties: Stress-Strain relationships. Tensile properties, hardness, etc.	Tutorials # 1 Crystal Structures + Imperfections in Solids
5	Eid Al Adha	
6	Mechanical Properties: Creep and fatigue.	Pre-lab. for Exp # 2 and Exp. # 2 Tensile Testing Metals : Steel and Aluminium. Polymers: Polypropylene and Polyethylene.
7	Diffusion in Solids: Introduction, diffusion mechanisms and steady state diffusion..	Tutorial # 2 and Tutorial #3 Mechanical Properties, Fatigue & Creep
8	Diffusion in Solids: Nonsteady state diffusion, factors influencing diffusion..	Tutorial # 4 , Diffusion in Solids; steady state diffusion Project progress presentation. Detailed background and outline
9	Metals: - Breif description of ferrous and nonferrous metals plus self reading assignment. - Processing of metals	Tutorial # 5 Diffusion in Solids; Nonsteady state diffusion
10	Polymers: Mer and molecular structure, copolymers, molecular weight, thermoplastic and thermosetting polymers, polymerization, processing.	Exp. # 3 Creep testing Pre-lab + Experiment
11	Ceramics: Glasses, clay products, refractories, abrasives, advanced ceramics and processing.	Tutorial # 6 Polymers and Ceramics
12	Corrosion and Degradation of Materials: Corrosion of metals..	Exp. # 4 Corrosion testing Pre-lab + Experiment
13	Corrosion and Degradation of Materials: Forms of corrosion. Dissolving of ceramics and polymer's degradation.	Tutorial # 7 Corrosion

14	Electrical properties: Electrical resistivity of metals, energy band structures in solids, intrinsic semiconduction .	Exp. # 5 Electrical properties Pre-lab + Experiment Resistivity measurements. Temperature effect on resistivity.
15	Electrical properties: Electrical resistivity of metals, energy band structures in solids, intrinsic semiconduction .	Tutorial # 8 Electrical Properties Tutorial # 9 Composites
16	Composites : Classification, fiber reinforced composites, metal matrix composites, ceramic matrix composites , nanocomposites and processing.	Final Project Presentation + Final Report Submission
17	Final Exam	

Class Policy & Academic integrity

Attendance : Student who misses 15% of classes will be awarded an “FA” Grade.

Academic integrity is a cornerstone of the intellectual life at Universities and of any true learning program. Plagiarism is an academic offense in which a person takes an idea, language, or creative product from another person and submits it as if it was his/her own work. If a student submits a research paper written by somebody else to an instructor, that is plagiarism. If someone “cuts and pastes” a sentence or even few words from another source without giving credit to the original source, that is plagiarism. Students must always cite the original author.

At UAEU, penalties for student misconduct, which includes plagiarism, are explained in the university by-laws (Nos. 136-146) and include such sanctions as a formal letter of warning kept on file; suspension from a course or from the university; exclusion from taking the final examination; dismissal from the university; and the withdrawal of a degree.