

Construction & Building Engineering Courses (CB)

Construction Materials & Reinforced Concrete Structures Courses Group

CB 251 – Testing of Materials

COURSE INFORMATION

Course Title: Testing of Materials

Code: CB 251

Hours: Lecture – 2 Hrs. Tutorial – 2 Hrs. Credit –3.

Prerequisite: None

GRADING

Class Performance/Attendance: 10%

Midterm # 1/Assignments – (7th Week): 30%

Midterm # 2/Assignments – (12th Week): 20%

Final Exam: 40%

COURSE DESCRIPTION

Codes and Specifications, Classification of Engineering Materials, The Architecture of Solids, Mechanical Properties of Engineering Materials, Testing materials machinery, Axial static tension: stress- strain relationship, Static compression: test, static bending, static torsion, mechanical properties and testing, Hardness of metals, Dislocations and Strengthening Mechanism in Metals, Fracture, impact testing, Fatigue, Creep.

TEXT BOOK

Materials Science and Engineering: An Introduction by W. D. Callister Jr. Publisher: John Wiley & Sons, Inc, Canada, 1994.

REFERENCE BOOKS

Mechanics of Engineering Materials by BENHAM,P. and CRAWFORD,Z.R., Publisher: Longman Group, 1981.

The Science and Technology of Civil Engineering Materials by J. F. Young, S. Mindess, R. J. Gray and A. Bentur, Publisher: Prentice Hall, Upper Saddle River, NJ USA, 1998.

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Materials for Civil and Construction Engineers by M.S. Mamlouk, J. P. Zaniewski, Publisher: Pearson Education, Inc., Pearson Prentice Hall, Upper Saddle River, NJ USA, 2006.

Mechanics of Materials by BEER, F. and JOHNSTON, E.R. Publisher: McGraw-Hill, New York, USA, 1986.

Mechanics of Materials by POPOR, E.P. Publisher: Prentice-Hall Englewood cliffs.

Mechanics of Materials by R.C.HIBBELER Publisher: McMillan, New York, 1991.

Strength of Materials by R.S.KHURMI. Publisher: S.Chand & Company, NewDelhi, 1986.

Mechanics of Materials by GERE & TIMOSHENKO. Publisher: PWS-KENT Publisher, 1990.

COURSE AIM

This course aims to provide an introduction to the students to architecture, performance and properties of different engineering materials and the relation between the structure of Engineering materials and their properties. The course also aims to enable the students to have a good understanding and hand-on experience with the usage and testing of engineering materials.

SPECIFIC OUTCOMES OF INSTRUCTION

- The student should be familiar with the structure of different engineering materials and the relation between that and their mechanical properties.
- The student should be familiar with the mechanical properties of engineering materials. This includes stress-strain relations, load-resistance theories and assumptions and design concepts.
- The student should be able to perform tests for determining mechanical properties of engineering materials.

COURSE OUTLINE

Week Number 1: Introduction
– Historical Perspective – Material Science and Engineering – Codes and Specs. – Classification of Materials – Modern Materials Needs

Week Number 2: Atomic Bonding
– Atomic structure – Atomic bonding in solids - Bonding Forces and Energies – Primary Interatomic Bonds – Secondary Bonds.

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- Week Number 3-4:* The Architecture of Solids
- The Crystalline State – Defects in Crystalline Solids – The amorphous State – the Polymeric State – The Composite Structure
- Week Number 5:* Testing Machines and Laboratory measuring devices
- Testing Machines – Dial Gauge – Linear Variable Deferential Transformer (LVDT) – Strain Gauge – Proving Ring – Load Cell
- Week Number 6-11:* Mechanical Properties of Engineering Materials
- Concept of stress and strain – Tension, Compression and Shear Tests – Stress Strain Behavior – Elastic Behavior of Materials – Elastoplastic behavior of Materials – Work and Energy – Pure Bending – Torsion – Hardness.
- Week Number 12:* Dislocation and Strengthening Mechanisms
- Dislocation and plastic Deformation – Mechanism of Strengthening of Metals.
- Week Number 13:* Fracture
- Fundamentals of Fracture – Ductile Fracture – Brittle Fracture – Principals of Fracture Mechanics – Impact Fracture Testing – Ductile-to-Brittle Transition...
- Week Number 14:* Fatigue
- Cyclic Stress – The S-N Curve – Crack initiation and Propagation – Factors Affecting Fatigue Life.
- Week Number 15:* Creep
- Generalized Creep Behavior – Stress and Temperature Effects
- Week Number 16:* Final Exam.

COURSE COORDINATOR AND DEMAND

Course Coordinator: Dr Adel M.Belal .

Course Demand: *Required*