



MANIPAL UNIVERSITY JAIPUR

School of Automobile Mechanical and Mechatronics Engineering

Department of Mechanical Engineering

Course Hand-out

Material Science and Engineering | ME 1301 | 3 Credits | 3 0 0 3

Session: July 18 – December 18 | Faculty: Dr. Sanchita Bandyopadhyay -Ghosh | Class: B.Tech
IIIrd Semester

COURSE OUTCOMES: At the end of the course, students will be able to

[1301.1] The aim is to explain the basic fundamentals of materials science and engineering.

[1301.2] Structure of crystalline solids, crystallography, lattice imperfections, and their effects on structure and related properties will be discussed.

[1301.3] Students can able to learn materials acquire knowledge about failure phenomena, mechanical testing, interpretation of test results, concept of phase transformation, phase diagrams and its influence on properties of engineering materials will be highlighted benefitted for improving research skills.

[1301.4] This course will also combine traditional instruction in ceramic, metallurgy, polymer and fibre science and engineering with modern materials, including nano-, bio-, composite, smart materials, their structure-property correlations, and applications.

A. SYLLABUS

Introduction to Materials Science and Engineering: Materials classification. Crystallography SC, FCC, BCC, HCP structures, APF; Miller indices: Crystal structure determination-X-ray diffraction techniques, Microscopic examination; Imperfections in Crystals: Point defects, line defects, surface defects. Plastic Deformation of Metals and Alloys, Mechanisms of plastic deformation, role of Dislocation; slip and twinning, grain growth, Solidification of Metals and Alloys: Solid solution, Hume Rothery's rules, Phase diagrams- Phase and Lever Rules relationship of micro Structure and properties, Iron- Carbon equilibrium diagram, Development of microstructure in Iron Carbon alloys, Phase transformation Mechanical Properties of Metals; Fatigue and Failure of materials: S-N Curve, Fatigue life methods of improving fatigue strength, Fatigue failure Polymers and applications: Types of polymers, structure and applications; Hydrocarbon and polymer molecules, Molecular weight, shape, structure and configurations, Thermosetting and thermoplastic polymers; Characteristics and Applications of Polymers; Mechanical behavior of polymers, mechanisms of deformation; Crystallization, Melting, and Glass transition phenomena, Application and Properties of Ceramics: Types and applications of ceramics; Ceramic manufacturing; Mechanical and other properties. Fabrication of Plastics, Fibres and Films; Composites Materials: FRP, MMC, PMC and other types and applications; Fibre, Particle reinforced composites, Structural composites; Biocomposites, Nanocomposites, Composite micromechanics. Advanced Materials: Smart materials, Biomaterials, Nanomaterials.

B. Text Book

I. Callister William D & R. Balasubramaniam, Materials Science and Engineering, Wiley Student Edition, 7th Edition, 2007.

Reference Books

- I. William F Smith, Javad Hashmi and Ravi Prakash, Materials Science and Engineering, Fourth Edition, Tata Mcgraw Hill Education Private Limited, New Delhi.
- II. George E. Dieter, Mechanical Metallurgy, SI Metric Edition McGraw Hill Book Company, London.

