

ME204 Materials Science for Engineers

Credit: 3-0-0-3

Students intended for: B.Tech

Elective or Core:

Semester: Odd/Even

Course objective:

This is an introductory course which provides key concepts and fundamentals that student needs to understand materials science and make informed decisions. The course is broadly divided into two sections; Materials science and Materials application. First section focuses on the essentials of materials science concepts. Idea is to make student understand that the principles governing the behavior of real materials are grounded in science and are understandable. Knowing structure in materials is important as it controls the various properties, and with various processing techniques structures can be altered, and hence, the properties. This section covers fundamentals of crystal structure, significance of defects, polycrystalline materials, concept of grain and grain boundary, solid state phase diagrams, phase transformation, principles of nucleation and growth etc.

Course content:

The Materials application section focuses on the structural electrical and electronic applications:

a) Structural Applications

- (i) Static structural applications –stress strain diagram, elastic, yielding and plastic behavior, properties to characterize each, application of metals, ceramics, polymers and composites in static structures like buildings, bridges, furnace structure, etc.
- (ii) Dynamic structural applications - fatigue, creep-fatigue interaction; Application of materials in automobiles, hydroelectric and thermal power plants.
- (iii) Manipulation of materials properties through different treatments

(b) Electrical and Electronic Application:

Conductors and conductivity, Capacitors, considerations for choice of materials in different applications; metallic and organic semiconductors, p-n junctions, other devices, I-V characteristics, optoelectronic materials and devices, the considerations for the choice of materials; Magnetic materials, Dielectric materials, electrical and magnetic sensors, read- write heads, spintronic devices; superconducting materials and their applications in magnets.

Suggested Books:

Materials Science

1. Materials Science and Engineering- A first course, V. Raghvan, Prentice Hall of India, NewDelhi (latest edition).

2. Materials Science and Engineering- An introduction, William D. Callister, Jr. John Wiley and Sons, Inc.

Materials Application

1. Engineering Materials: Properties and Selection by Kenneth G. Budinski, Prentice Hall, [New Edition] USA.

2. Principles of Electronic Materials and devices by S. O. Kasap, 2009, Third Edition, Tata-McGraw Hill Education Pvt. Ltd., New Delhi

3. Solid State Electronic Devices by Ben G. Streetman and Sanjay Bannerjee, 2000, Fifth edition, Pearson-Prentice Hall, USA.