***PH103A Material Science & Technology***

(Revised Syllabus with effect from 2015-16 for B. Tech CSE, ECE, EE and IT)

**L-T-P-Cr: 3-0-0-3**

**Pre-requisite:-** Basic Knowledge of physics is required.

**Expected Outcome:** - Students will able to understand the basic structure of materials and their applications in various field of science and technology.

**Syllabus:**

**GROUP - A**

**Unit 1. Atomic bonding in solids and Crystallography:** Types of bonding, Classification of solids: Crystalline and amorphous solids, Space lattice and unit cell, Crystal systems, Primitive and Non-primitive lattices, Bravais lattices, Close-Packing of spheres, Miller Indices, Introduction to Point and Space groups, Reciprocal lattice concept, Structure by diffraction methods, Bragg’s condition for crystal diffraction, Imperfections in Crystals: Point, Line, Surface and Volume defect.

**Unit 2. Phase diagram:** Basic concepts, Solubility limit, Unary and binary phase diagrams, Fe-C and Cu-Ni phase diagrams and other isomorphous alloys.

**Unit 3. Mechanical properties of Materials:** Concept of stress and strain, Elastic and plastic deformation, Hardness, Creep, Brittle fracture in ceramics and glasses, Toughening of ceramics and composites, Fatigue, Mechanical testing.

**Unit 4. Electrical properties of materials:** Electrical Conduction, Classification of conducting Materials, Energy bands, Temperature dependence of metallic conductivity, Semiconductor materials: Intrinsic, Extrinsic, Compound and amorphous semiconductors, Electrical resistivity and Hall effect measurements, Dielectrics: Types of polarization, Frequency and temperature dependence of polarization, Dielectric loss, dielectric breakdown, uses of dielectric materials, ferroelectricity, piezoelectricity and Applications.

**GROUP - B**

**Unit 5. Magnetic properties of materials:** Basic concepts, Classification of Magnetic materials: dia-, para-, ferro-, antiferro- and ferri-magnetism, Influence of temperature on magnetic behavior, Magnetic domains and hysteresis loop, Magnetostriction, Soft and Hard Magnetic Materials and their Applications. Magnetic anisotropy, Ferrites and its applications, Superconductivity, General properties of superconducting materials, Types of superconductors, Thermodynamic properties of superconductors, BCS theory and applications of supercoductors.

**Unit 6. Thermal and Optical properties of materials**: Heat capacity, Thermal expansion, Thermal conductivity, Thermal stresses, Refraction, Transmission, Reflection, Absorption, Colour, Luminescence, Photoconductivity, Lasers, Optical fiber, and applications.

**Unit 7. Ceramics, Composites and Polymeric materials:** (i) Classification, Structure, Processing, Properties and applications of ceramics and composites, (ii) Polymer: Polymerization, Structure, Feature of polymers, Thermosetting and thermoplastic polymer, Additives and processing of polymer.

**Unit 8. Nano materials**: Basic principles, Types of nanomaterials, Synthesis: Top-Down and Bottom-up Process, Nanotechnology and environment, Properties and possible applications to nano-devices.

**Recommended books**:

1. V. Raghavan, Materials Science and Engineering, Prentice-Hall of India Private Limited (2003).

2. W.F. Smith, Principles of Materials Science and Engineering, McGraw Hill, New York (1994).

3. W.D.Callister, An Introduction to Materials Science & Engineering, John Wiley & Sons (2007).

4. L.H. Van Vlack, Elements of Materials Science and Engineering, Addison Wisley, New York (1985).

5. J.F. Shackelford and M.K. Muralidhara, Introduction to Materials Science for engineers, Pearson Education (2007).

6. Civil Engineering Materials by N Jackson and R K Dhir, ELBS.

7. Civil Engineering Materialsby TTTI Chandigarh.

8. Text book of building construction by S P Bindra and Arora.

9. Materials and Methods in Architecture by S Kumar.

10. Building materials: S C Rangwala by Charotar Publishing House, Ananad, 1993.

11. Architectural Material Science by D Airapetob

12. Construction material by Ghosh