

REVISED SYLLABUS OF B.Tech 1st YEAR
MSE-101- Basic Material Science and Engineering:

Dated: 10.2.2011

1. STRUCTURE OF MATERIALS:

Space lattice and unit cells, crystal system, **Symmetry operation**, Structures of common metallic, Semiconductor ceramic and superconductor materials, Miller Indices, Representation of Directions and planes, Packing fractions, Structure determination using X-ray diffraction, Braggs law, and lattice parameter determination. Bonding in solids, coordination number, ceramics, silicates and clay structures, glass transition temperature, non-crystalline materials.

2. IMPERFECTION IN SOLIDS:

Point defects: Impurities, **Colour Centre, Polariton and exciton**, dislocation: edge and screw dislocation, Stacking faults, grain boundaries, twins/ twist boundaries, volume defects, concentration of point defects, effect of defects on material properties.

3. PHASE DIAGRAMS AND PHASE TRANSFORMATION:

Definition of diffusivity, concept of activation energy, Fick's Law of diffusion, Diffusion mechanism and their applications diffusion process, Solid solution, Intermediate phases and inter metallic compounds, Phase, phase rule, unary, binary phase diagrams, phase diagrams of some important metals and ceramics, microstructure changes during cooling, lever rule, invariant reactions, iron-iron carbide phase diagram. Nucleation and growth of phases, Introduction to TTT curves, heat treatment processes, annealing, hardening, tempering, normalization, embitterment, characterization of materials.

4. MECHANICAL BEHAVIOR:

Elastic behavior of materials, concept of engineering and true stress and true strain, tensile property, yield point phenomenon, elastic modulus, and work hardening, strengthening mechanism, fracture, creep and fatigue, hardness. Atomic model of elastic behavior, plastic deformation in single and polycrystalline crystal, mechanism of slip, critical resolved shear stress, ductile and brittle failure, Griffith's theory of brittle fracture.

5. MAGNETIC AND DIELECTRIC PROPERTIES OF MATERIALS:

Origin of magnetism, dia, Para, Ferro, antiferro and ferrimagnetisms, soft and hard magnetic materials, dielectric properties, Piezo, pyro and Ferro electricity.

6. ELECTRICAL AND ELECTRONICS PROPERTIES.

Electricity conductivity, free electron theory, density of states, Fermi energy, Fermi-Dirac Statistic, Band theory of solids, metals Semiconductors, Insulators, Semiconductors: Intrinsic and Extrinsic semiconductors, structure of elements and compounds, conductivity as a function of temperature, doping, hall effect, carrier concentration of semiconductors.

TEXT BOOKS:

1. Materials Science and Engineering, William D Callister Jr.
2. Elements of Materials science & Engineering, L.H.Van Vlack.

REFERENCE BOOKS:

1. Askeland, Donald R; Pradeep p. Phule (2005). The science & Engineering of materials, 5th edition, Thomson Engineering.
2. Solid state Physics: Properties of Materials, M.A. Wahab, Narosa Publishing.
3. Fundamentals of materials Science & Engineering, William F Smith.