

Engineering Materials

L T P
3

Total Theory Hrs 42
FM 100 (80+20) Hrs

Subject Code :- MEC304

1. Engineering Materials and Their Properties 6 hrs

- 1.1** Introduction, Classification and Application of Engineering materials, I.S specification of materials like plain carbon steel, Grey Cast iron, low alloy steels & bearing Materials.
- 1.2 Properties of metals:-** Strength, elasticity, ductility, malleability, plasticity, toughness, hardness, Harden ability, brittleness, fatigue, thermal conductivity, electrical conductivity, thermal coefficient of linear expansion.
- 1.3 Imperfection in Crystals:-** Basic concept of crystal, crystal pattern of unit cells, ideal crystal and crystal imperfection. Classify crystal imperfections or defects such as point defects, line defects, surface defect and volume defects. State types of dislocation.

2. Ferrous Metals and Alloys_ 10 (6+4) hrs

2.1- Ferrous Metals

- 2.1.1 Characteristics and application of ferrous metals , Flow diagram for production of Iron and Steel, Classification, composition and uses of cast iron, effect of alloying elements like sulphur, silicon and phosphorous on cast iron.
- 2.1.2 Classification, composition and application of low carbon steel, medium carbon steel and high carbon steel with their chemical composition.
- 2.1.3 Magnetic materials: - Properties & Applications of commonly used magnetic materials (Permanent magnets and temporary magnets).
- 2.1.4 Fe-C Phase Equilibrium Diagram – Critical temperature lines, study of micro constituents of iron and steel.
- 2.1.5 Introduction of TTT curves.

2.2 - Alloy Steels

- 2.2.1 **Alloy Steels:** - Low alloy steel, high alloy steel, tools steel & stainless steel. Effect of various alloying elements such as – Chromium, nickel, manganese, molybdenum, tungsten, vanadium, etc.
- 2.2.2 **Tool Steels:** - High speed Steels (HSS), Hot & cold Working dies, shear, punches etc., properties & applications.
- 2.2.3 **Special Cutting Tool Materials** – Diamond, Stellites & Tungsten Carbide.

3. Non Ferrous Metals and Alloys 6 hrs

- 3.1** Properties, applications & chemical compositions of Copper alloys (naval brass, muntz metal, Gun metal & bronzes), Aluminum alloys (Y-alloy & duralumin)
- 3.2** Various Lead and Zinc alloys. Alloys used for high temperature services.
- 3.3** Bearing materials like white metals, leaded bronzes & copper lead alloys and their desired properties.

4. Heat Treatment of Steels 8 hrs

- 4.1 Basic concept of Heat treatment processes - Annealing, Normalizing, Hardening, Tempering. Aus tempering & Mar tempering.
- 4.2 Basic concept of Surface Hardening Processes - Flame Hardening, Induction Hardening, Nitriding, Cyaniding, Carburizing, Carbonic trading.

5. Non Metallic Materials 6 hrs

- 5.1 Polymeric Materials – Introduction to Polymers- types, characteristics, properties and uses.
- 5.2 Thermoplastic Plastics & Thermosetting Plastics - characteristics and uses of, Acrylics, Nylons polyesters, Epoxies, Melamine's & Bakelite's.
- 5.4 Rubbers – Neoprene, Butadiene, Buna & Silicones – Properties & applications.
- 5.5 Properties and applications of following Engineering Materials – Ceramics, Abrasive, Adhesive and Insulating materials such as Cork, Asbestos, Thermocole and Glass Wool
- 5.6 Introduction to Composite Materials – Laminated & Fiber, reinforced materials - Structure, Properties & Applications.

6. Destructive & Nondestructive Testing 6 hrs

- 6.1 Destructive Testing – Types, Concept and processes of Hardness & Toughness.
- 6.2 Importance of Non-destructive testing, Difference between Destructive and Nondestructive testing.
- 6.3 Nondestructive testing methods - Radiography (X-Ray & Gamma Ray), Ultrasonic crack detection, Dye penetrate test.

Books Recommended :

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| 1 | A Text Book of Material Science & Metallurgy | OP Khanna |
| 2 | Material Science & Metallurgy | R K Rajput |
| 3 | Material Science & Metallurgy | V D Kodgire |
| 4 | Material Science | W. Callister |