

**INDEX****UNIT I****Chapter 1 : Basics of Engineering Materials****1-1 to 1-19**

Syllabus : Classification of engineering materials, Crystal structure, Unit cell and space lattice, Microstructure, types of microscopes, Sample preparation, etching process, types of etchant, Properties of metals Physical Properties, Mechanical Properties, Hardness testing procedure on Brinell and Rockwell tester.

1.1	Classification of Engineering Materials	1-1
1.1.1	Classification of Materials as Amorphous and Crystalline, Ferrous and Non Ferrous	1-1
1.2	Crystal Structure	1-2
1.2.1	Unit Cell and Space Lattice	1-4
1.2.2	Concept of Packing Efficiency	1-4
1.3	Metallography	1-5
1.4	Sample Preparation	1-7
1.5	Properties of Metals	1-9
1.5.1	Physical Properties	1-10
1.5.2	Mechanical Properties	1-11
1.6	Hardness Testing Procedure	1-14
➔	Multiple Choice Questions for Online Examination	1-15

UNIT II**Chapter 2 : Steel and its Alloys****2-1 to 2-19****Syllabus :**

Concept of phase, pure metal, alloy and solid solutions, Iron Carbon Equilibrium diagram various phases : I) Critical temperatures and significance, II) Reactions on Iron carbon equilibrium diagram, Broad Classification of steels : I) Plain carbon steels: Definition, Types and Properties, Compositions and applications of low, medium and high carbon steels, II) Alloy Steels: Definition and Effects of alloying elements on properties of alloy steels, III) Tool steels: Cold work tool steels. Hot work

tool steels, High speed steels (HSS), IV) Stainless Steels: Types and Applications, V) Spring Steels: Composition and Applications, VI) Specifications of steels and their equivalents, Steels for following: Shafts, axes, Nuts, bolts, Levers, crank shafts, camshafts, Shear blades, agricultural equipments, house hold utensils, machine tool beds, car bodies, Antifriction bearings and gears.

2.1	Introduction to Equilibrium Diagrams	2-1
2.2	Concept of Phase, Pure Metal, Alloy and Solid Solutions	2-1
2.2.1	Types of Solid Solution	2-2
2.2.2	Solid Solubility	2-2
2.2.3	Solidification of Pure Metal and Alloys	2-3
2.3	Iron Carbon Equilibrium Diagram	2-3
2.3.1	Study of Various Phases	2-4
2.3.2	Critical Temperatures and Significance	2-4
2.3.3	Reactions on Iron Carbon Equilibrium Diagram	2-5
2.4	Classification of Steels	2-6
2.4.1	Plain Carbon Steels	2-6
2.4.2	Types and Properties of carbon steel	2-9
2.4.3	Compositions and Applications of Low, Medium and High Carbon Steels	2-9
2.5	Alloy Steels	2-10
2.5.1	Effects of Alloying Elements on Properties of Alloy Steels	2-10
2.5.2	Effects of Individual Alloying Elements on Properties of Alloy Steels	2-10
2.6	Tool Steels : Cold Work Tool Steels, Hot Work Tool Steels, High Speed Steels (HSS), HCHC and OHNS	2-12
2.7	Stainless Steels	2-14
2.8	Spring Steels	2-14
2.9	Specifications of Steels and their Equivalents	2-14
2.9.1	Alloy Steels Specifications and their Equivalents	2-15
2.10	Ferrous Metals Selection Chart	2-15
➔	Multiple Choice Questions for Online Examination	2-15

**UNIT III****Chapter 3 : Cast Iron 3-1 to 3-10**

Syllabus : Types of cast irons as white, gray, nodular, malleable, Specifications of cast Iron, Selection of appropriate cast iron for engineering applications, Designation and coding (as per BIS, ASME, EN, DIN, .TIS) of cast iron, plain and alloy steel.

3.1	Cast Iron	3-1
3.2	Types of Cast Irons	3-1
3.2.1	Gray Cast Irons	3-2
3.2.2	White Cast Irons	3-2
3.2.3	Nodular (Ductile) Cast Irons	3-3
3.2.4	Malleable Cast Iron	3-4
3.3	I. S. Specification of Materials	3-5
3.4	Bureau of Indian Standards BIS, AISI / SAE, British Standard B.S. Specifications of Steels	3-5
3.5	Selection of Appropriate Steels and Cast Irons	3-8
→ Multiple Choice Questions for Online Examination		3-8

UNIT IV**Chapter 4 : Non Ferrous Metals and Alloys 4-1 to 4-10**

Syllabus : Copper and its alloys - brasses, bronzes Chemical compositions, properties and Applications, Aluminium alloys - Y -alloy, Hindalium, duralium with their composition and Applications, Bearing materials like white metals (Sn based), aluminium bronzes. Porous, Self lubricating bearings.

4.1	Copper and its Alloys	4-1
4.1.1	Chemical Compositions, Properties and Applications of Copper Alloys - Brasses, Bronzes	4-1
4.1.2	Alloys of Copper	4-2
4.2	Aluminium Alloys –Y-alloy, Hindalium, Duralium with their Composition and Applications	4-4
4.3	Bearing Materials Like White Metals (Sn based), Aluminium Bronzes	4-5
→ Multiple Choice Questions For Online Examination		4-7

UNIT V**Chapter 5 : Non Metallic Advanced Materials****5-1 to 5-17**

Syllabus : Polymeric Materials :i) Polymers- types, characteristics, ii) Properties and uses of Thermoplastics, Thermosetting Plastics and Rubbers, Thermoplastic and Thermosetting Plastic materials, Characteristics and uses of ABS, Acrylics. Nylons and Vinyls, Epoxides, Melamines and Bakelites, Rubbers: Neoprene, Butadiene, Buna and Silicons - Properties and applications, Ceramics -types of ceramics, properties and applications of glasses and refractories, Composite Materials - properties and applications of Laminated and Fibre reinforced materials, Advanced Engineering Materials - Properties and applications of Nano materials and smart materials.

5.1	Polymeric Materials.....	5-1
5.1.1	Polymers Types and Characteristics	5-1
5.1.2	Properties and uses of Thermoplastics, Thermosetting Plastics and Rubbers	5-2
5.2	Thermoplastic and Thermosetting Plastic Materials	5-2
5.3	Characteristics and uses of ABS, Acrylics. Nylons and Vinyls	5-3
5.4	Rubbers - Neoprene, Butadiene, Buna and Silicons - Properties and Applications.....	5-6
5.5	Ceramics.....	5-7
5.5.1	Typical uses of Ceramics	5-8
5.5.2	Types of Ceramics	5-8
5.5.3	Properties and Applications of Refractories.....	5-8
5.5.4	Properties and Applications of Glasses	5-9
5.6	Composite Material	5-9
5.7	Advanced Engineering Materials	5-12
5.7.1	Nanomaterials.....	5-13
5.7.2	Smart Materials.....	5-14
→ Multiple Choice Questions for Online Examination.....		5-15

**UNIT VI****Chapter 6 : Heat Treatment Processes 6-1 to 6-20**

Syllabus : Annealing : Purposes of annealing, Annealing temperature range, Types and applications, Normalizing Purposes of Normalizing, Temperature range, Broad applications of Normalizing, Hardening : Purposes of hardening, Hardening temperature range, application, Tempering : Purpose of tempering, Types of tempering and its applications, Case hardening methods like Carburizing, Nitriding, and Cyaniding, Heat treatment Furnaces - Muffle, Box type.

6.1	Introduction to Heat Treatment.....	6-1
6.2	Annealing.....	6-2
6.2.1	Purpose.....	6-2
6.2.2	Applications.....	6-2
6.2.3	Types of Annealing.....	6-3
6.3	Normalising.....	6-4

6.4	Hardening (By Quenching).....	6-4
6.5	Tempering.....	6-6
6.5.1	Austempering.....	6-7
6.5.2	Martempering.....	6-8
6.5.3	Patenting.....	6-8
6.6	Surface Heat Treatment.....	6-9
6.6.1	Need of Surface Heat Treatment.....	6-9
6.6.2	Types of Surface Heat Treatments.....	6-9
6.6.3	Case Hardening.....	6-9
6.6.4	Surface Hardening Methods.....	6-10
6.7	Case Hardening Methods.....	6-13
6.8	Heat Treatment Furnaces.....	6-16

➔ **Multiple Choice Questions for Online Examination.....6-17**

