

Course Name: Mechanical Engineering Group **Course Code:** ME/PT/PG /MH
Except Automobile Engineering

Semester: Third

Subject Title: Mechanical Engineering Materials

Subject code: 9025

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme						
TH	TU	PR	Paper Hrs	TH	Test	PR	OR	TW	Total
03	--	--	03	80	20	--	--	--	100

Rationale:

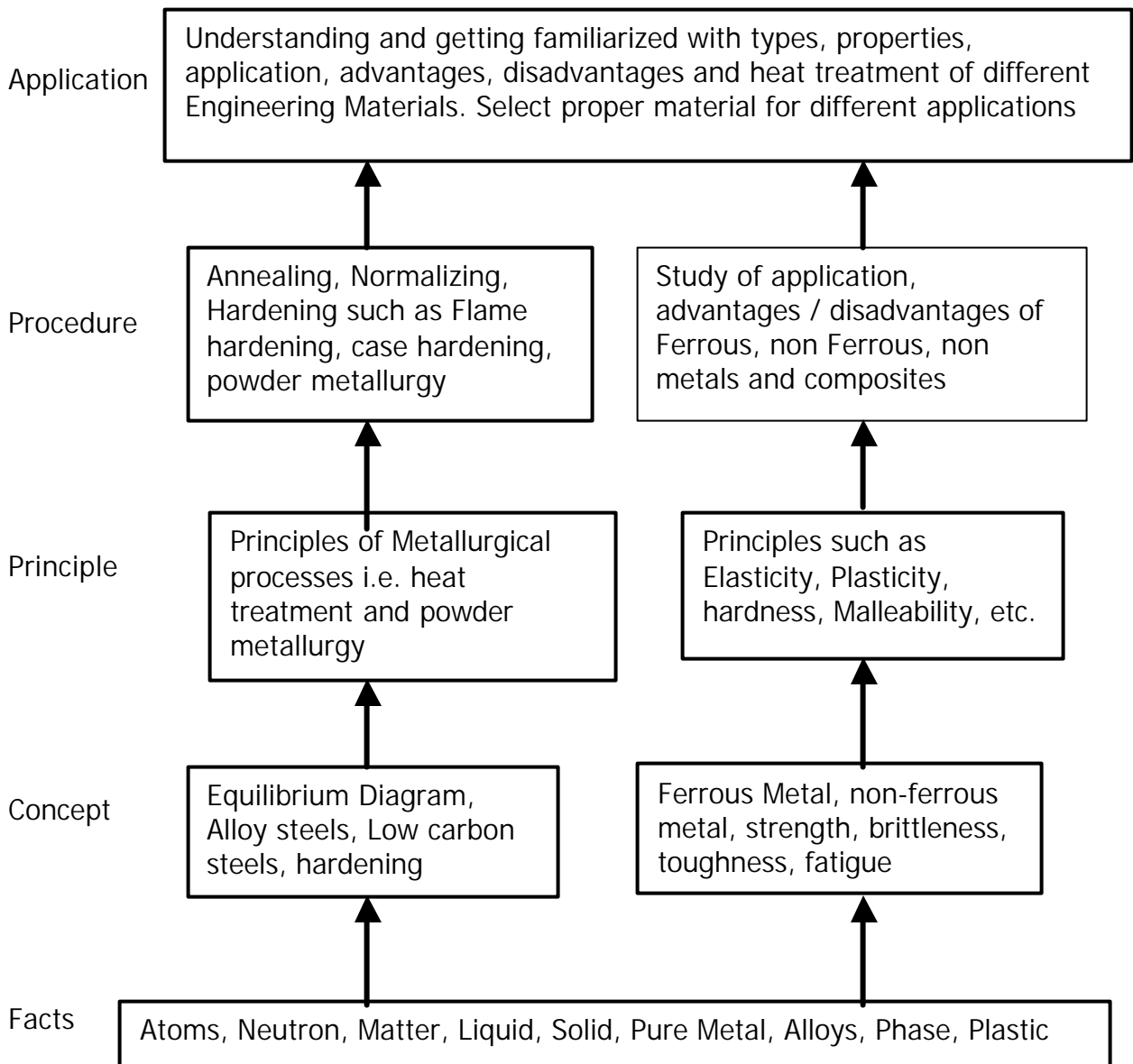
Mechanical Engineering Materials is a core technology subject in Mechanical Engineering Discipline. A Mechanical Engineering diploma holder deals with various materials required for cutting tools, Dies, Gears, Bearings and many other applications. Knowledge of selection of proper tool materials, heat treatments for specific materials, ferrous and non-ferrous materials and their alloys for various engineering application, as well as insulating, refractory and plastic materials as per the requirements is essential.

Objectives:

Students should be able to:

1. know the properties of Engineering Materials like Metals, non-metals, ferrous metals and non-ferrous metals
2. Interpret Iron –Iron Carbide phase equilibrium diagram to find temperatures for heat treatment processes.
3. Select the proper materials for different applications like cutting tools, dies, gears & other applications.
4. Understand various heat – treatment processes & its applications for various. Components to improve its mechanical properties.
5. Understand powder metallurgy process and its applications.
6. Understand Non Destructive testing methods & its applications.

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
1.	<p>Engineering Materials and their Properties</p> <p>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.</p> <p>1.2 Properties of metals</p> <p>1.2.1 Physical Properties – Structure, Density, Melting point.</p> <p>1.2.2 Mechanical Properties – Strength, elasticity, ductility, malleability, plasticity, toughness, hardness, hardenability, brittleness, fatigue, thermal conductivity, electrical conductivity, thermal coefficient of linear expansion</p> <p>1.3 Introduction to Corrosion, types of Corrosion, Corrosion resisting materials.</p>	06	10
2.	<p>Ferrous Metals and Alloys</p> <p>2.1 Characteristics and application of ferrous metals</p> <p>2.2 Phase equilibrium diagram for Iron and Iron Carbide.</p> <p>2.3 Flow diagram for production of Iron and Steel, Classification, composition and uses of cast iron, effect of sulphur, silicon and phosphorous.</p> <p>2.4 Classification, composition and application of low carbon steel, medium carbon steel and high carbon steel with their chemical composition.</p> <p>2.5 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.</p> <p>2.6 Tool Steels: - High speed Steels (HSS), Hot & cold Working dies, shear, punches etc., properties & applications.</p> <p>2.7 Magnetic materials: - Properties & Applications of commonly used magnetic materials (Permanent magnets and temporary magnets).</p> <p>2.8 Special Cutting Tool Materials – Diamond, Stellites & Tungsten Carbide</p>	12	20
3.	<p>Non Ferrous Metals and Alloys</p> <p>3.1 Properties, applications & chemical compositions of Copper alloys (naval brass, muntz metal, Gun metal & bronzes), Aluminium alloys (Y-alloy & duralumin) & bearing materials like white metals, leaded bronzes & copper lead alloys.</p> <p>3.2 Desired properties of bearing materials.</p>	06	10

4.	<p>Heat Treatment of Steels</p> <p>4.1 Introduction to Heat treatment processes such as Annealing, subcritical annealing, Normalizing, Hardening, Tempering (Austempering & Martempering) - Principle, Advantages, limitations and applications.</p> <p>4.2 Surface Hardening - Methods of surface hardening, i) case hardening ii) Flame Hardening, iii) Induction Hardening, iv) Nitriding, v) Carburizing - Principle, advantages, limitations and applications</p>	08	16
5.	<p>Non Metallic Materials</p> <p>5.1 Polymeric Materials – Introduction to Polymers- types, characteristics, properties and uses of Thermoplastics, Thermosetting Plastics & Rubbers.</p> <p>5.2 Thermoplastic Plastics - characteristics and uses of ABS, Acrylics, Nylons and Vinyls</p> <p>5.3 Thermosetting Plastics - Characteristics and uses of polyesters, Epoxies, Melamines & Bakelites.</p> <p>5.4 Rubbers – Neoprene, Butadiene, Buna & Silicons – Properties & applications.</p> <p>5.5 Properties and applications of following Engineering Materials – Ceramics, Abrasive, Adhesive and Insulating materials such as Cork, Asbestos, Thermocole and Glass Wool</p> <p>5.6 Introduction to Composite Materials – Laminated & Fibre reinforced materials - Structure, Properties & Applications.</p>	08	12
6.	<p>Powder Metallurgy & Nondestructive Testing</p> <p>6.1 Advantages, limitations and applications of Powder Metallurgy for engineering products.</p> <p>6.2 Brief Description of Process of Powder Metallurgy – Powder making, blending, compacting, sintering, infiltration & impregnation.</p> <p>6.3 Applications of Powder metallurgy for tungsten carbide tip tools & porous bearing.</p> <p>6.4 Importance of Non-destructive testing, Difference between Destructive and Nondestructive testing.</p> <p>6.5 Nondestructive testing methods - Radiography (X-Ray & Gamma Ray), Ultrasonic crack detection, Dye penetrant test, Magnaflux test – Comparison & applications.</p>	08	12
Total		48	80

Learning Resources:

Books:

SN	Author	Title	Publication
01	O.P.Khanna	A Text Book of Material Science and Metallurgy	Dhanpat Rai and Sons [1999]
02	Dr.V.D. Kodgire	Material Science And Metallurgy	Everest Publishing House [1990]
03	R.K.Rajput	Material Science and Engineering	S.K.Katari and Sons [2002 reprint 2003]
04	S.K.Hazra and Choudhari	Material Science and Processes	Indian Book Distribution Co. [1982]
05	Kenneth G. Budinski and Micheal K. Budinski	Engineering Materials Properties and Selection	Pearson Education, New Delhi
06	ASME	ASME Material Manuals	
07	Sidney H. Avner	Introduction to Physical metallurgy	Tata Mc Graw Hill edition (2 nd)