

SATYABAN KOPE

GOVERNMENT POLYTECHNIC, MALKANGIRI DEPARTMENT OF MECHANICAL ENGINEERING

LESSON PLAN

| Discipline: Mechanical Engineering | Semester 3rd | Name of the Teaching Faculty: SATYABAN KOPE | |
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| MATERIAL SCIENCE & ENGG | No. of days/week class allotted 3 | Semester From date: 14.07.2025 No. of Week: 15 | To date: 15.11.2025 |
| PRE-REQUISITE | MATERIAL SCIENCE & ENGINEERING | | |
| Course Outcomes | 1. Explain about crystal structures and atomic bonds. 2. Describe about classification of ferrous metals and their properties. 3. Explain about non-ferrous metals, cutting tool materials and composites along with their properties. 4. Describe about the various metallic failures and knowledge in testing of materials. 5. Explain the principle of corrosion, their types, its prevention methods along with the various surface engineering processes. | | |
| Week | Class Day | Theory/Practical Topics | |
| 1st | 1st | Unit cell and space lattice: Crystal system: The seven basic crystal systems | |
| | 2nd | Crystal structure for metallic elements: BCC, FCC and HCP; Coordination number for Simple Cubic | |
| | 3rd | BCC and FCC; Atomic radius: definition, atomic radius for Simple Cubic | |
| 2nd | 1st | BCC and FCC; Atomic Packing Factor for Simple Cubic, | |
| | 2nd | BCC, FCC and HCP; | |
| | 3rd | Simple problems on finding number of atoms for a unit cell. | |
| 3rd | 1st | Classification - primary or chemical bond, secondary or molecular bond | |
| | 2nd | Types of primary bonds: ionic, Covalent and Metallic Bonds | |
| | 3rd | Types of secondary bonds: Dispersion bond | |
| 4th | 1st | Dipole bond and Hydrogen bond | |
| | 2nd | Isomorphs, eutectic and eutectoid systems | |
| | 3rd | Iron-Carbon binary diagram; Iron and Carbon Steels; flow sheet for production of iron and steel | |
| 5th | 1st | Iron ores - Pig Iron: classification, composition and effects of impurities on iron; | |
| | 2nd | Cast Iron: classification, composition, properties and uses; Wrought Iron: properties, | |
| | 3rd | uses/applications of wrought Iron; comparison of cast iron | |
| 6th | 1st | wrought Iron and mild steel and high carbon steel; standard commercial grades of steel as per BIS and AISI | |
| | 2nd | Alloy Steels - purpose of alloying; effects of alloying elements - important alloy steels: Silicon steel | |
| | 3rd | High Speed Steel (HSS); heat resisting steel. | |
| 7th | 1st | Stainless Steel (SS); types of SS, applications of SS - magnet steel - composition, properties and uses | |
| | 2nd | Properties and uses of aluminum, copper, tin, lead, zinc, magnesium and nickel | |
| | 3rd | Copper alloys: Brasses, bronzes - composition, properties and uses | |
| 8th | 1st | Aluminum alloys: Duralumin, magnalium, magnesium - composition | |
| | 2nd | properties and uses; Nickel alloys: Inconel, monel | |
| | 3rd | nickelPerome - composition | |
| 9th | 1st | Anti-friction/Bearing alloys | |
| | 2nd | Various types of bearing bronzes - Standard commercial grades as per BIS/ASME. | |
| | 3rd | Various types of bearing bronzes - Standard commercial grades as per BIS/ASME. | |
| 10th | 1st | Various types of bearing bronzes - Standard commercial grades as per BIS/ASME. | |
| | 2nd | Introduction to failure analysis; Fracture: ductile fracture | |
| | 3rd | brittle fracture; cleavage; notch sensitivity; fatigue | |
| 11th | 1st | endurance limit; characteristics of fatigue fracture | |
| | 2nd | variables affecting fatigue life; creep; creep curve | |
| | 3rd | creep fracture; Destructive testing: Tensile testing | |
| 12th | 1st | compression testing; Hardness testing: Brinell, Rockwell | |
| | 2nd | bend test; torsion test; fatigue test; creep test | |
| | 3rd | Non-destructive testing: Visual inspection; magnetic particle inspection | |
| 13th | 1st | liquid penetrant test; ultrasonic inspection; radiography | |
| | 2nd | Nature of corrosion and its causes: Electro chemical re-actions: Electrolytes | |
| | 3rd | Factors affecting corrosion: Environment, Material properties and physical conditions; | |
| 14th | 1st | Types of corrosion; Corrosion control: Material selection, environment control and design | |
| | 2nd | Surface engineering processes: Coatings and surface treatments | |
| | 3rd | Cleaning and mechanical finishing of surfaces; Organic coatings; Electroplating and Special metallic plating | |
| 15th | 1st | Electro polishing and photo-etching - Conversion coatings: Oxide | |
| | 2nd | phosphate and chromate coatings; Thin film coatings: PVD and CVD; Surface analysis; Hard-facing | |
| | 3rd | thermal spraying and high-energy processes; Process/material selection, Pollution norms for treating effluents as per standards. | |

Learning Resources:

1. R.K. RAJPUT, - MATERIAL SCIENCE
2. R.S. KHURMI, - MATERIAL SCIENCE
3. D.S. NUTT-S.K. KATARIYA, - MATERIAL SCIENCE AND METALLURGY
4. V. RAGHAVAN, - MATERIAL SCIENCE AND ENGINEERING

Satyaban Kope
Signature of Faculty

Satyaban Kope
Signature of HOD/

Satyaban Kope
Signature of Principal

Satyaban Kope
Signature of Academic Coordinator