**RJLB Govt. Polytechnic, Loharu**

***LECTURE PLAN***

**BRANCH:** MECH ENGG **SEMESTER: 4th**

**SUBJECT:** MATERIALS AND METALLURGY

**NAME OF FACULTY**: PARVEEN KUMAR

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| **Lect**  **No.** | **Name of Topic** | **No. of Lectures** |
| **UNIT I : 1. Introduction** | | |
| 1 | Material: Engineering materials, | 1 |
| 2 | Overview of different engineering materials and applications, Importance, | 1 |
| 3 | Classification of materials, | 1 |
| 4 | Difference between metals and non-metals, | 1 |
| 5 | Overview of Biomaterials and semi-conducting materials | 1 |
| **UNIT II : 2. Crystallography** | | |
| 6 | Fundamentals: Crystalline solid and amorphous solid, | 1 |
| 7 | Unit Cell, Space Lattice, Arrangement of atoms in Simple Cubic Crystals, BCC, FCC and HCP Crystals, | 1 |
| 8 | Number of atoms per unit Cell, Atomic Packing Factor, | 1 |
| 9 | coordination number (without derivation), Defects/Imperfections, | 1 |
| 10 | types and effects of defects in Solid materials. | 1 |
| 11 | Deformation: Overview of deformation behaviour and its mechanisms, | 1 |
| 12 | Elastic and Plastic deformation. | 1 |
| 13 | Failure Mechanisms: Overview of failure modes, fracture, fatigue and creep. | 1 |
| **3. Metallurgy** | | |
| 14 | Introduction, Cooling curves of pure metals, | 1 |
| 15 | dendritic solidification of metals, effect of grain size on mechanical properties, | 1 |
| 16 | Binary alloys, Thermal equilibrium diagrams, | 1 |
| 17 | Lever rule, Solid Solution alloys. | 1 |
| **UNIT III : 4. Metals and Alloys** | | |
| 18 | Ferrous Metals: Different iron ores, | 1 |
| 19 | Flow diagram for production of iron ,steel and stainless steel, | 1 |
| 20 | Allotropic forms of iron- Alpha, Delta, Gamma. Basic process of manufacturing of pig iron and steel-making. | 1 |
| 21 | Cast Iron: Properties, types of Cast Iron, manufacture and their use. | 1 |
| 22 | Steels: Plain carbon Steels and alloy steel, Classification of plain carbon steels, Properties and application of different types of Plain Carbon Steels, | 1 |
| 23 | Effect of various alloying elements on properties of steel, Uses of alloy steels (high speed steel, silicon steel, spring steel) | 1 |
| 24 | Stainless steel: Definition, importance and criticality (Life cycle cost, Corrosion impact; difference with Steel, Per Capita consumption; | 1 |
| 25 | growth rate of SS vs other materials, World vs India). Various grades of SS and their nomenclature, | 1 |
| 26 | Effect of alloying elements, Unique characteristics of various grades of SS | 1 |
| 27 | Manufacturing of SS: Process flow, Raw materials for SS manufacturing functions of each processing unit, Downstream facilities, Various finishes of SS. | 1 |
| 28 | Fabrication and testing of SS: Stud welding method, Weldability and effect of welding on various types of SS, Defects like Sensitization and microfissure, | 1 |
| 29 | Relative observations and precautions while performing the processes: cutting,Buffing, Bending, Roll forming, Embossing, Polishing of Stainless steel. | 1 |
| 30 | Chemical treatment like pickling and passivation for SS. | 1 |
| 31 | Applications of SS : Demand of SS in various segments, Overview of SS applications in Automobile, railway, and transport. | 1 |
| 32 | Architectural, building construction applications and Process Industries. | 1 |
| 33 | Non Ferrous Materials: Properties and uses of Copper, Aluminium and their alloys. | 1 |
| **UNIT IV: 5. Heat Treatment** | | |
| 34 | Definition and objectives of heat treatment, | 1 |
| 35 | Iron carbon equilibrium diagram, | 1 |
| 36 | different microstructures of iron and steel. Formation and decomposition of Austenite, Martensitic Transformation. | 1 |
| 37 | Various heat treatment processes- hardening, tempering, annealing, | 1 |
| 38 | normalizing, surface hardening, carburizing, nitriding, cyaniding. Hardenability of Steels. | 1 |
| 39 | Types of heat treatment furnaces (only basic idea), measurement of temperature of furnaces. | 1 |
| 40 | Physical metallurgy of Stainless Steel; Various phases in SS, | 1 |
| 41 | Chromium-Nickel diagram, Schaeffler Diagram. | 1 |
| **UNIT V : 6. Advanced Materials** | | |
| 42 | Heat Insulating materials- Asbestos, glasswool, thermocole. | 1 |
| 43 | Refractory materials –Dolomite, porcelain. | 1 |
| 44 | Glass – Soda lime, borosil. Materials for bearing metals, | 1 |
| 45 | Materials for Nuclear Energy, Smart materials- properties & applications. | 1 |