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**Lesson Plan & Work-Done Diary for AY:2024-25, Odd Semester**

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| **Course with Code: Material Science and Engineering [BME303]** | | | | | **Faculty: Prof. Devaraj M R** | | | **Semester & Section: 3rd Sem** | |
| **Class**  **No.** | Date Planned **(DD/MM)** | Topics to be covered | **TLP Planned** | **Class**  **No.** | | **Date of Conduction**  **(DD/MM)** | **Topics Covered** | **TLP Executed** | **Remarks if any deviation** |
| **MODULE-1: Structure of Materials** | | | | | | | | | |
| 1 |  | **Structure of Materials:**  Introduction: Classification of materials, crystalline and non-crystalline solids, | Chalk & Talk PPT |  | |  |  |  |  |
| 2 |  | **Atomic bonding:**  Ionic Bonding and Metallic bonding. | Chalk & Talk PPT |  | |  |  |  |  |
| 3 |  | **Crystal Structure:** Crystal Lattice, Unit Cell, Planes, and directions in a lattice, Planar Atomic Density, Coordination number, | Chalk & Talk PPT |  | |  |  |  |  |
| 4 |  | atomic Packing Factor of all the Cubic structures and | Chalk & Talk PPT |  | |  |  |  |  |
| 5 |  | Hexagonal Close Packed structure. Classification and Coordination of voids, Bragg’s Law. | Chalk & Talk PPT |  | |  |  |  |  |
| 6 |  | **Imperfections in Solids:** Types of imperfections, Point defects: vacancies, interstitials, line defects, | Chalk & Talk PPT |  | |  |  |  |  |
| 7 |  | 2-D and 3D-defects, | PPT |  | |  |  |  |  |
| 8 |  | Concept of free volume in amorphous solids. Slip, Twinning. | Chalk & Talk PPT |  | |  |  |  |  |
| 9 |  | Concept of Slip, Twinning. and Quiz-1 | PPT & Video |  | |  |  |  |  |
| L1 |  | Specimen preparation for macro and micro structural examinations and study the macrostructure and microstructure of a sample metal/ alloys- | Lab Visit | 1 | |  |  |  |  |
| L2 |  | To study the crystal structure of a given Cast Iron, Mild steel, Aluminium and Copper/Brass specimens and study the crystal imperfections in a given Cast Iron, Mild steel and Aluminium specimens. | Lab Visit | 2 | |  |  |  |  |

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| **MODULE-2: Physical Metallurgy** | | | | | | | | |
| 10 |  | **Physical Metallurgy:**  Alloy Systems: Classification of Solid solutions, Hume- Rothery Rules | Chalk & Talk PPT |  |  |  |  |  |
| 11 |  | **Diffusion:** Diffusion Mechanisms: Vacancy Diffusion and Interstitial Diffusion, | PPT |  |  |  |  |  |
| 12 |  | Fick’s laws of  diffusion, Factors affecting diffusion. | Chalk & Talk PPT |  |  |  |  |  |
| 13 |  | Phase Diagrams: Gibbs Phase Rule, Solubility limit, phase equilibrium and Phase Diagrams: | PPT |  |  |  |  |  |
| 14 |  | Isomorphous systems, Invariant Binary Reactions: Eutectic reaction, Eutectoid reaction and  Peritectic reaction, Lever Rule, | PPT |  |  |  |  |  |
| 15 |  | Iron-Carbon Diagram. | Chalk & Talk PPT |  |  |  |  |  |
| 16 |  | Effect of common alloying elements in steel. | Chalk & Talk PPT |  |  |  |  |  |
| 17 |  | Numerical on Lever rule. | Chalk & Talk PPT |  |  |  |  |  |
| 18 |  | Numerical on Lever rule and  Quiz-2 | Chalk & Talk PPT |  |  |  |  |  |
| L3 |  | Study the heat treatment processes (Hardening and tempering) of steel/Aluminium specimens.-Demo | Lab Visit | 3 |  |  |  |  |
| L4 |  | To determine the hardness values of Mild Steel/ Aluminium by Rockwell hardness/Vickers Hardness. | Lab Visit | 4 |  |  |  |  |
| **MODULE-3: Nucleation and growth,Plastic Deformationand Heat treatment** | | | | | | | | |
| 19 |  | **Nucleation and growth:** Introduction to homogeneous and heterogeneous nucleation, critical  radius for nucleation. | Chalk & Talk PPT |  |  |  |  |  |
| 20 |  | **Heat treatment:** Annealing, | PPT |  |  |  |  |  |
| 21 |  | Normalizing, hardening, Tempering, | PPT |  |  |  |  |  |
| 22 |  | Austempering and Martempering Nitriding, Cyaniding, | PPT & Video |  |  |  |  |  |
| 23 |  | Induction Hardening and Flame Hardening, Precipitation hardening (Solid-Solution Strengthening), Grain refinement. | PPT & Video |  |  |  |  |  |
| 24 |  | Recent advances in heat treat technology. TTT diagram, | PPT |  |  |  |  |  |
| 25 |  | Recovery-Recrystallization-Grain Growth. | PPT |  |  |  |  |  |
| 26 |  | Strengthening mechanisms: Strain hardening, | Chalk & Talk PPT |  |  |  |  |  |
| L5 |  | To determine the hardness values of Copper/ Brass by Brinell’s Hardness testing machine. | Lab Visit | 5 |  |  |  |  |
| L6 |  | To study the creep behavior of a given Cast Iron or Aluminium specimen. | Lab Visit | 6 |  |  |  |  |
| **MODULE-4: Surface Coating Technologies, Powder Metallurgy** | | | | | | | | |
| 27 |  | **Surface coating technologies:** Introduction, coating materials, coating technologies, types of  coating: | Chalk & Talk PPT |  |  |  |  |  |
| 28 |  | Electro-plating, Chemical Vapor Deposition (CVD), | Chalk & Talk PPT |  |  |  |  |  |
| 29 |  | Physical Vapor Deposition (PVD), High Velocity Oxy-Fuel Coating, | Chalk & Talk PPT |  |  |  |  |  |
| 30 |  | Advantages and Disadvantages of surface coating. | PPT |  |  |  |  |  |
| 31 |  | **Powder metallurgy:** Introduction, Powder Production Techniques: | PPT |  |  |  |  |  |
| 32 |  | Different Mechanical  methods: Chopping or Cutting, Abrasion methods, Machining methods, | PPT |  |  |  |  |  |
| 33 |  | Ball Milling and Chemical  method: Chemical reduction method. | PPT |  |  |  |  |  |
| 34 |  | **Characterization of powders** (Particle Size & Shape Distribution), Powder Shaping: Particle  Packing Modifications, Lubricants & Binders, Powder Compaction & Process, Sintering and  Application of Powder Metallurgy. | PPT |  |  |  |  |  |
| L7 |  | To study of microstructure of welding Mild Steel components and Heat affected zone (HAZ) macro and micro examinations. | Lab Visit | 7 |  |  |  |  |
| L8 |  | To determine the tensile strength, modulus of elasticity, yield stress, % of elongation and % of reduction in area of Cast Iron, Mild Steel/Brass/ Aluminium and to observe the necking. | Lab Visit | 8 |  |  |  |  |
| **MODULE-5 Engineering Materials and Their Properties** | | | | | | | | |
| 35 |  | **Engineering Materials and Their Properties***:* Classification, Ferrous materials: Properties, Compositions and uses of Grey cast iron and steel. | Chalk & Talk PPT |  |  |  |  |  |
| 36 |  | Ferrous materials: Properties,  Compositions and uses of Grey cast iron and steel. | PPT |  |  |  |  |  |
| 37 |  | Non-Ferrous materials: Properties, Compositions  and uses of Copper, Brass, Bronze. | PPT |  |  |  |  |  |
| 38 |  | **Composite materials** - Definition, classification, types of matrix materials & reinforcements, | PPT |  |  |  |  |  |
| 39 |  | Metal Matrix Composites (MMCs), Ceramic Matrix Composites (CMCs) | Chalk & Talk PPT |  |  |  |  |  |
| 40 |  | Polymer Matrix Composites (PMCs), Particulate-reinforced and fiber- reinforced composites, Applications of composite materials.  Mechanical and functional properties of Engineering Materials | PPT |  |  |  |  |  |
| 41 |  | **The Design Process and Materials Data:** Types of design, design tools and materials data,  processes of obtaining materials data, materials databases. | Chalk & Talk PPT |  |  |  |  |  |
| 42 |  | **Material Selection Charts:** Selection criteria for materials, material property Charts, deriving.  property limits and material indices. | PPT |  |  |  |  |  |
| L9 |  | To conduct a wear test on Mild steel/ Cast Iron/Aluminium/ Copper to find the volumetric wear rate and coefficient of friction.  *Study the chemical corrosion and its protection.* ***Demonstration*** | **Lab Visit** | 9 |  |  |  |  |

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|  | **Activity** | **Planned** | **Actual** | **Remarks** |
| 1 | Theory Classes | 42 |  |  |
| 2 | Demonstrations & Lab Visit/ Experiment conduction | 09 |  |  |
| 3 | Assignments/ Quizzes | 2 / 3 |  |  |
| 4 | Tutorials/ Extra classes | If there is a variation in Planned and covered |  |  |
| 5 | Internal Assessments | 3 |  |  |
| 6 | ICT based Teaching.  (% of usage in Curriculum) | 80 to 85% |  |  |
| **Planning** | | | **Execution** | |
| **Faculty Signature:** | | | **Faculty Signature:** | |
| **HoD Signature:** | | | **HoD Signature:** | |