LESSON PLAN

Name of Faculty: Pardeep

Discipline: Mechanical Engg.

Semester: 4th

Subject: Materials & Metallurgy Lesson Plan Duration: 15 Weeks

**Work Load: Theory-** 4 Lectures/Week**, Practical -** 1 Turn/Group/Week (2 Periods/ Turn)

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|  | **THEORY** | | |
| **WEEK** | **LECT** | **TOPIC** | **DAT E** |
| **1** | 1 | **UNIT-1 INTRODUCTION**  Material, Engineering materials, History/Timeline of Material Origin, Scope of Material Science. |  |
| **2** | Overview of different engineering materials and applications, Importance, |  |
| **3** | Classification of materials, Difference between metals and non-metals, |  |
| **4** | Physical and Mechanical properties of various materials, |  |
| **2** | **5** | Present and future needs of materials, |  |
| **6** | Various issues of Material Usage-Economical, Environment and Social, |  |
| **7** | Overview of Biomaterials and semi-conducting materials. |  |
| **8** | **Revision** |  |
| **3** | **9** | **UNIT-2. CRYSTALLOGRAPHY** Fundamentals: Crystalline solid and amorphous solid, Unit Cell, Space Lattice |  |
| **10** | Arrangement of atoms in Simple Cubic Crystals, BCC, FCC and HCP Crystals |  |
| **11** | Number of atoms per unit Cell, Atomic Packing Factor, coordination number (without derivation), |  |
| **12** | Defects/Imperfections, types and effects in Solid materials. |  |
| **4** | **13** | Deformation: Overview of deformation behavior and its mechanisms, Elastic and Plastic deformation, Behavior of material under load and stress-strain curve |  |
| **14** | Failure Mechanisms: Overview of failure modes, fracture, fatigue and creep |  |
| **15** | **Revision** |  |
| **16** | **UNIT-3. METALLURGY:** Introduction, Cooling curves of pure metals, |  |
| **5** | **17** | dendritic solidification of metals,effect of grain size on mechanical properties, |  |
| **18** | Binary alloys, Thermal equilibrium diagrams, |  |
| **19** | Lever rule, Solid Solution alloys |  |

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|  | **20** | **Revision** |  |
| **6** | **21** | **UNIT-4. METALS AND ALLOYS:** Ferrous Metals: Different iron ores |  |
| **22** | Flow diagram for production of iron and steel |  |
| **23** | Allotropic forms of iron- Alpha, Delta, and Gamma. |  |
| **24** | Basic process of manufacturing of pig iron |  |
| **7** | **25** | Basic process of steel-making |  |
| **26** | Cast Iron: Properties, types of Cast Iron, manufacture and their use. |  |
| **27** | Manufacture of Cast Iron |  |
| **28** | Steels: Plain carbon Steels and alloy steel |  |
| **8** | **29** | Classification of plain carbon steels |  |
| **30** | Properties and application of different types of Plain Carbon Steels |  |
| **31** | Effect of various alloying elements on properties of steel, uses of alloy steel |  |
| **32** | Non Ferrous Materials : properties and Uses of Copper, Aluminum and their alloys |  |
| **9** | **33** | **Revision** |  |
| **34** | **UNIT-5.HEAT TREATMENT :**Definition and objectives of heat treatment |  |
| **35** | Iron carbon equilibrium diagram different microstructures of iron and steel |  |
| **36** | Formation and decomposition of Austenite, Martensitic Transformation. |  |
| **10** | **37** | Various heat treatment processes- hardening, tempering |  |
| **38** | Annealing, normalizing. |  |
| **39** | Surface hardening , carburizing, |  |
| **40** | nitriding, cyaniding , hardenability of steels |  |
| **11** | **41** | Types of heat treatment furnaces (only basic idea) |  |
| **42** | Measurement of temperature of furnaces. |  |
| **43** | **Revision** |  |
| **44** | **UNIT-6. PLASTICS** : Importance of plastics, Classification |  |
| **12** | **45** | Thermoplastic and thermoset, plastic and their uses |  |
| **46** | Various trade names of plastics, Plastic coatings |  |
| **47** | Food grade plastics. Applications of plastics in automobile and domestic use. |  |
| **48** | Rubber classification – Natural and synthetic. Selection of rubber |  |
| **13** | **49** | **Revision** |  |
| **50** | **UNIT-7.ADVANCED MATERIALS:** Heat Insulating materials- Asbestos, glass  wool, thermocole |  |
| **51** | Ceramics-Classification, properties, applications. |  |
| **52** | Refractory materials –Dolomite, porcelain. Glass – Soda lime, borosil. |  |
|  | **53** | Abrasive materials, |  |
| **14** | **54** | Joining materials / Adhesives – Classification, properties and applications |  |
| **55** | Composites-Classification, properties, applications |  |
| **56** | Materials for bearing metals, |  |
| **57** | Materials for Nuclear,Energy |  |

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| **15** | **58** | Smart materials- properties and applications |  |
| **59** | **Revision** |  |
| **60** | **Revision** |  |

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| **PRACTICAL** | | |
| **TUR N** | **EXPERIMENT** | **DAT E** |
| **1** | **1**  Classification of about 25 specimens of materials/machine parts  **(i)** Metals and non metals **(ii)** Metals and alloys  **iii)** Ferrous and non ferrous metals **iv)** Ferrous and non ferrous alloys |  |
| **2** | **Repeat of Experiment-1** |  |
| **3** | **2.**  Given a set of specimen of metals and alloys (copper, brass, aluminum, cast iron, HSS, Gun metal) Identify and indicate the various properties possessed by them |  |
| **4** | **Repeat of Experiment-2** |  |
| **5** | **3**   1. Study of heat treatment furnace. 2. Study of a thermocouple/pyrometer. |  |
| **6** | **4**  Study of a metallurgical microscope and a specimen polishing machine. |  |
| **7** | **5**  To prepare specimens of following materials for microscopic examination and to Examine the microstructure of the specimens of following materials. At least any two: i) Brass ii) Copper iii) Cast Iron , iv) Mild Steel v) HSS, vi) Aluminium |  |
| 8 | **Repeat of Experiment-5** |  |
|  | **6**  To anneal a given specimen and find out difference in hardness as a result |  |
| **10** | **Repeat of Experiment-6** |  |
| **11** | **7**  To normalize a given specimen and to find out the difference in hardness as a result of Normalizing. |  |
| **12** | **Repeat of Experiment-7** |  |
| **13** | **8**  To harden and temper a specimen and to find out the difference in hardness |  |
| **14** | **Repeat of Experiment-8** |  |
| **15** | **VIVA** |  |