Name of Faculty: MANJEETLESSON PLAN

Semester 4th

Subject: MATERIALS AND METALLURGY

Lesson plan Duration: 15 WEEKS

Work Load (Lecture/Practical) per week: 3/2 PERIODS

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| **Week** | **THEORY** | | **PRACTICAL** | |
|  | **Lecture** | **TOPIC** | **Practical** | **TOPIC** |
|  | **DAY** |  | **DAY** |  |
| **1ST** | **1** | **UNIT 1: Introduction**  Material, Overview of different engineering materials and applications |  | Classification of about 25  specimens of materials/machine parts into |
|  | **2** | Classification of materials, Metal V/s non metals | **1** | 1. Metals and non metals 2. Metals and alloys |
|  | **3** | Overview of Biomaterials and semi-conducting materials |  |  |
| **2ND** | **4** | Overview of  Biomaterials and semi-conducting materials | **2** | Classification of about 25 specimens of materials/machine  parts into   1. Ferrous and non ferrous metals 2. Ferrous and non ferrous alloys |
| **5** | **UNIT 2: Crystallography**  Fundamentals: Crystal, Unit Cell, Space Lattice |
| **6** | Arrangement of atoms in Simple Cubic Crystals, BCC, FCC and HCP Crystals |
| **3RD** | **7** | Number of atoms per unit Cell, Atomic Packing Factor, coordination number | **3** | Given a set of specimen of metals  and alloys (copper, brass, aluminium, cast iron, HSS, Gun metal); identify and indicate the  various properties possessed by |
| **8** | Defects/Imperfections, types and effects in Solid materials. |
|  | **9** | Overview of deformation behaviour and its mechanisms, Elastic and Plastic deformation. Failure Mechanisms |  | them |
|  | **10** | Failure Mechanisms: Overview of failure modes, fracture, fatigue and creep |  | Continued….Given a set of  specimen of metals and alloys |
| **4TH** | **11** | **UNIT 3: Metallurgy** Introduction, Cooling curves of pure metals, dendritic solidification of metals | **4** | (copper, brass, aluminium, cast iron, HSS, Gun metal); identify and indicate the various properties possessed by them |
| **12** | effect of grain size on mechanical properties, Binary alloys, |
| **5TH** | **13** | Thermal equilibrium diagrams, Lever rule, Solid Solution alloys | **5** | Study of heat treatment furnace& thermocouple and pyrometer |
| **14** | **UNIT 4: Metals And Alloys**  Ferrous Metals: Different iron ores, Flow diagram for production of iron |

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|  | **15** | steel and stainless steel, allotropic forms of iron- Alpha, Delta, Gamma | |  |  |
| **6TH** | **16** | **Sessional Test 1** | | **6** | Study of a metallurgical microscope  and a specimen polishing machine |
| **17** | Basic process of manufacturing of pig iron and steel-making | |
| **18** | Cast Iron manufacture and their usage | |
|  | **19** | Steels: Steels and alloy steel, Classification of  plain carbon steels | |  | To prepare specimens of following  materials for microscopic |
| **7TH** | **20** | Availability, Properties and usage of different  types of Plain Carbon Steels | | **7** | examination and to Examine their microstructure (iii) Grey (iv)  Malleable (v)Low carbon steel (vi)High carbon steel (vii) HSS |
| **21** | Effect of various alloys on properties of steel | |
|  | **22** | Uses of alloy steels (high speed steel, stainless  steel, spring steel, silicon steel) | |  | To prepare specimens of following  materials for microscopic |
| **8TH** | **23** | Stainless steel: Definition, importance and criticality | | **8** | examination and to Examine the  microstructure of the specimens of |
|  | **24** | Various grades of SS and their nomenclature, Effect of alloying elements, | |  | (i) Brass (ii) Copper |
| **9TH** | **25** | functions of each processing unit, Downstream facilities, Various finishes of SS. | | **9** | To measure hardness of a given  specimen and anneal it. |
| **26** | Fabrication and testing of SS: Stud welding method, Weldability and effect of welding on various types of SS | |
| **27** | processes: cutting , Buffing, Bending, Roll forming, Embossing, Polishing of Stainless steel | |
| **10TH** | **28** | **Sessional Test- 2** | | **10** | To find out the difference in hardness as a result of annealing |
| **29** | Chemical treatment like pickling and passivation for SS. |  |
| **30** | Various heat treatment processes - hardening  and tempering, | |
| **11TH** | **31** | Non Ferrous Materials: Properties and uses of Copper, Aluminium and their alloys | | **11** | To measure hardness of a given  specimen and normalize it. |
| **32** | **UNIT 4:** Definition and objectives of heat treatment, | |
| **33** | Iron carbon equilibrium diagram, different microstructures of iron and steel. | |
| **12TH** | **34** | Formation and decomposition of Austenite, Martensitic Transformation | | **12** | To find out the difference in  hardness as a result of normalizing |
| **35** | Various heat treatment processes- hardening, tempering, | |
| **36** | annealing, normalizing, | |
| **=**  **13TH** | **37** | surface hardening, carburizing, nitriding, cyaniding. Hardenability of Steels | | **13** | To measure hardness of a given  specimen and harden & temper it. |
| **38** | Types of heat treatment furnaces (only basic idea), measurement of temperature of furnaces. | |
| **39** | Physical metallurgy of Stainless Steel; Various phases in SS, | |
| **14TH** | **40** | Chromium-Nickel diagram, Schaeffler Diagram | | **14** | Welding defects like sensitization and microfissure in SS |
| **41** | **UNIT 5 :** Heat Insulating materials- Asbestos, glasswool, thermocole. | |
| **42** | Refractory materials –Dolomite, porcelain. Glass – Soda lime, borosil. | |
| **15TH** | **43** | Materials for bearing metals Materials for Nuclear Energy | | **15** | Viva voce and final evaluation |
| **44** | Smart materials- properties and applications. | |
| **45** | **Sessional Test- 3** | |