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 25specimens 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 ofBiomaterials and semi-conducting materials | **2** | Classification of about 25 specimens of materials/machineparts into1. Ferrous and non ferrous metals
2. Ferrous and non ferrous alloys
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| **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 metalsand alloys (copper, brass, aluminium, cast iron, HSS, Gun metal); identify and indicate thevarious 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 ofspecimen 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 microscopeand 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 ofplain carbon steels |  | To prepare specimens of followingmaterials for microscopic |
| **7TH** | **20** | Availability, Properties and usage of differenttypes 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, stainlesssteel, spring steel, silicon steel) |  | To prepare specimens of followingmaterials for microscopic |
| **8TH** | **23** | Stainless steel: Definition, importance and criticality | **8** | examination and to Examine themicrostructure 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 givenspecimen 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 - hardeningand tempering, |
| **11TH** | **31** |  Non Ferrous Materials: Properties and uses of Copper, Aluminium and their alloys | **11** | To measure hardness of a givenspecimen 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 inhardness 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 givenspecimen 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** |