

# Government Polytechnic for Women, Faridabad

## Lesson Plan

**Name of Faculty** : VF-II(Theory / Practical)

**Discipline** : Mechanical Engineering

**Semester** : 4<sup>th</sup>

**Subject** : Materials and Metallurgy

**Lesson Plan Duration** : 15 weeks (from January 2020 to April 2020)

**Work Load (Lectures / Practical) per week (in hours):** Lectures-03, Practicals-02

| WEEK            | THEORY          |                                                                                                                                                            | PRACTICAL       |                                                                                                                                                                                                                                                                          |
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|                 | Lecture Day     | Topic (Including Assignment / Test)                                                                                                                        | Practical Day   | Topic                                                                                                                                                                                                                                                                    |
| 1 <sup>st</sup> | 1 <sup>st</sup> | <b>1.Introduction</b> <ul style="list-style-type: none"> <li>• Material</li> <li>• History of material origin</li> </ul>                                   | 1 <sup>st</sup> | <b>1.Classification</b> of about 25 specimens of materials/machine parts into <ul style="list-style-type: none"> <li>• Metals and non metals</li> <li>• Metals and alloys</li> <li>• Ferrous and non ferrous metals</li> <li>• Ferrous and non ferrous alloys</li> </ul> |
|                 | 2 <sup>nd</sup> | <ul style="list-style-type: none"> <li>• Scope of material science</li> <li>•</li> </ul>                                                                   |                 |                                                                                                                                                                                                                                                                          |
|                 | 3 <sup>rd</sup> | <ul style="list-style-type: none"> <li>• Overview of different engineering materials and applications</li> <li>•</li> </ul>                                |                 |                                                                                                                                                                                                                                                                          |
| 2 <sup>nd</sup> | 4 <sup>th</sup> | <ul style="list-style-type: none"> <li>• Classification of material</li> <li>• Present and future needs of materials</li> </ul>                            | 2 <sup>nd</sup> | Do                                                                                                                                                                                                                                                                       |
|                 |                 |                                                                                                                                                            | 3 <sup>rd</sup> | Do                                                                                                                                                                                                                                                                       |
|                 | 5 <sup>th</sup> | <ul style="list-style-type: none"> <li>• Thermal</li> <li>• Chemical</li> <li>• Electrical</li> <li>• Mechanical</li> </ul> Properties of Various material | 4 <sup>th</sup> | Do                                                                                                                                                                                                                                                                       |

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|                 | 6 <sup>th</sup>  | Overview of biomaterials and semiconducting materials <ul style="list-style-type: none"> <li></li> </ul>                    |                  |                                                                                                                                                                      |
| 3 <sup>rd</sup> | 7 <sup>th</sup>  | Various issues of material usage<br>Economical, Environment and social                                                      | 5 <sup>th</sup>  | 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 |
|                 | 8 <sup>th</sup>  | <b>2. Crystallography</b> <ul style="list-style-type: none"> <li>Fundamentals: Crystal, unit cell, space lattice</li> </ul> |                  |                                                                                                                                                                      |
|                 | 9 <sup>th</sup>  | Arrangement of atoms in <ul style="list-style-type: none"> <li>Simple cubic crystals,</li> <li>BCC crystals</li> </ul>      |                  |                                                                                                                                                                      |
| 4 <sup>th</sup> | 10 <sup>th</sup> | <ul style="list-style-type: none"> <li>FCC crystals</li> <li>HCP crystals</li> </ul>                                        | 6 <sup>th</sup>  | Do                                                                                                                                                                   |
|                 | 11 <sup>th</sup> | Number of atoms per unit cell<br>Atomic packing factor                                                                      | 7 <sup>th</sup>  | Do                                                                                                                                                                   |
|                 | 12 <sup>th</sup> | Deformation <ul style="list-style-type: none"> <li>Overview of behavior</li> <li>Mechanisms</li> </ul>                      | 8 <sup>th</sup>  | Do                                                                                                                                                                   |
| 5 <sup>th</sup> | 13 <sup>th</sup> | <ul style="list-style-type: none"> <li>Behavior of material under load and stress</li> </ul>                                | 9 <sup>th</sup>  | 3. Study of heat treatment furnace.                                                                                                                                  |
|                 | 14 <sup>th</sup> | Failure mechanism: failure modes, fracture, fatigue and creep                                                               | 10 <sup>th</sup> | Do                                                                                                                                                                   |
|                 | 15 <sup>th</sup> | <b>3. Metals and Alloys</b><br>Introduction: History and development of iron and steel                                      |                  |                                                                                                                                                                      |
| 6 <sup>th</sup> | 16 <sup>th</sup> | Different iron ores                                                                                                         | 11 <sup>th</sup> | Do                                                                                                                                                                   |
|                 | 17 <sup>th</sup> | Raw material in production of iron and steel                                                                                | 12 <sup>th</sup> | do                                                                                                                                                                   |
|                 | 18 <sup>th</sup> | Basic process of making <ul style="list-style-type: none"> <li>Iron</li> <li>Steel</li> </ul>                               |                  |                                                                                                                                                                      |
| 7 <sup>th</sup> | 19 <sup>th</sup> | Classification of iron and steel                                                                                            | 13 <sup>th</sup> | 4. Study of a metallurgical microscope and a specimen polishing machine.                                                                                             |
|                 | 20 <sup>th</sup> | Cast iron<br>Different types of cast iron                                                                                   |                  |                                                                                                                                                                      |
|                 | 21 <sup>st</sup> | Manufacturing and their Usage                                                                                               | 14 <sup>th</sup> | Do                                                                                                                                                                   |
| 8 <sup>th</sup> | 22 <sup>nd</sup> | Steels : steels and alloy steel                                                                                             | 15 <sup>th</sup> | do                                                                                                                                                                   |
|                 | 23 <sup>rd</sup> | Classification of plain carbon steel <ul style="list-style-type: none"> <li>Availability</li> </ul>                         | 16 <sup>th</sup> | do                                                                                                                                                                   |

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|                  |                  | <ul style="list-style-type: none"> <li>• Properties</li> <li>• Usage</li> </ul>                                                                                        |                  |                                                                                                                                                                                                             |
|                  | 24 <sup>th</sup> | Effects of various alloys on properties of steel                                                                                                                       |                  |                                                                                                                                                                                                             |
| 9 <sup>th</sup>  | 25 <sup>th</sup> | Uses of alloys steels <ul style="list-style-type: none"> <li>• High speed steel</li> <li>• Stainless steel</li> <li>• Spring steel</li> <li>• Silicon steel</li> </ul> | 17 <sup>th</sup> | 5. To prepare specimens of following materials for microscopic examination and to examine the microstructure of the following materials:<br>i) Brass ii) Cu iii) Grey iv) Malleable v) LCS vi) HCS vii) HSS |
|                  | 26 <sup>th</sup> | Non ferrous materials                                                                                                                                                  |                  |                                                                                                                                                                                                             |
|                  | 27 <sup>th</sup> | Properties and uses <ul style="list-style-type: none"> <li>• Light metals and their alloys</li> </ul>                                                                  | 18 <sup>th</sup> | do                                                                                                                                                                                                          |
| 10 <sup>th</sup> | 28 <sup>th</sup> | White metals and their alloys                                                                                                                                          | 19 <sup>th</sup> | do                                                                                                                                                                                                          |
|                  | 29 <sup>th</sup> | <b>4.Theory of heat treatment</b><br>Purpose of heat treatment,                                                                                                        |                  |                                                                                                                                                                                                             |
|                  | 30 <sup>th</sup> | Solid solutions and its types                                                                                                                                          | 20 <sup>th</sup> | do                                                                                                                                                                                                          |
| 11 <sup>th</sup> | 31 <sup>st</sup> | Iron carbon diagram: formation and decomposition of austenite,                                                                                                         | 21 <sup>st</sup> | 6. To anneal a given specimen and find out difference in hardness as a result of annealing                                                                                                                  |
|                  | 32 <sup>nd</sup> | Martensitic Transformation <ul style="list-style-type: none"> <li>• Cooling curves</li> </ul>                                                                          |                  |                                                                                                                                                                                                             |
|                  | 33 <sup>rd</sup> | Various heat treatment process <ul style="list-style-type: none"> <li>• Hardening</li> </ul>                                                                           | 22 <sup>nd</sup> | do                                                                                                                                                                                                          |
| 12 <sup>th</sup> | 34 <sup>th</sup> | <ul style="list-style-type: none"> <li>• Tempering Annealing Normalizing</li> </ul>                                                                                    | 23 <sup>rd</sup> | do                                                                                                                                                                                                          |
|                  | 35 <sup>th</sup> | Case hardening and surface hardening <ul style="list-style-type: none"> <li>•</li> </ul>                                                                               |                  |                                                                                                                                                                                                             |

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|                  |                  |                                                                                                                                                                                    | 24 <sup>th</sup> | 7. To normalize a given specimen and to find out the difference in hardness as a result of normalizing |
|                  | 36 <sup>th</sup> | Types of heat treatment furnaces required for above operations <ul style="list-style-type: none"><li>•</li></ul>                                                                   |                  |                                                                                                        |
| 13 <sup>th</sup> | 37 <sup>th</sup> | <b>5 Engineering Plastics</b><br>Importance and sources of plastics <ul style="list-style-type: none"><li>•</li></ul>                                                              | 25 <sup>th</sup> | do                                                                                                     |
|                  | 38 <sup>th</sup> | Classification and uses of plastics <ul style="list-style-type: none"><li>• Thermoplastic</li><li>•</li></ul>                                                                      | 26 <sup>th</sup> | do                                                                                                     |
|                  | 39 <sup>th</sup> | Thermosetting Various trades of engineering <ul style="list-style-type: none"><li>• Plastics</li></ul> Plastic coating                                                             |                  |                                                                                                        |
| 14 <sup>th</sup> | 40 <sup>th</sup> | <b>6. Advanced Materials</b><br>Composites<br>Classification, properties and application <ul style="list-style-type: none"><li>•</li></ul>                                         | 27 <sup>th</sup> | 8. To harden and temper a specimen and to find out the difference in hardness due to tempering         |
|                  | 41 <sup>st</sup> | Ceramics <ul style="list-style-type: none"><li>• Classification, properties and application</li></ul> Overview of tool and die materials                                           | 28 <sup>th</sup> |                                                                                                        |
|                  | 42 <sup>nd</sup> | Heat insulating materials<br>Materials for bearing metals                                                                                                                          |                  |                                                                                                        |
| 15 <sup>th</sup> | 43 <sup>rd</sup> | <b>7.Miscellaneous Materials</b><br>Properties and uses of <ul style="list-style-type: none"><li>• Asbestos and glass wool</li></ul> Thermocole, cork and mica<br>Spring materials | 29 <sup>th</sup> | do                                                                                                     |
|                  | 44 <sup>th</sup> | Materials for nuclear energy                                                                                                                                                       | 30 <sup>th</sup> | do                                                                                                     |
|                  | 45 <sup>th</sup> | Refractory materials                                                                                                                                                               |                  |                                                                                                        |