# Ch. Ranbir Singh State Institute of Engineering & Technology, Jhajjar

**Department of Mechanical Engineering**

II Yr. IV Semester (Mechanical Engineering)

### LESSON PLAN

Program : **B. Tech**

Year & Sem. :  **II / IV**

Course No : **PCC-ME-208 G**

Course Title : **Material Engineering**

Max Marks **: 75**

No. of Total Lecture **: 46**

Schedule : **3L+0T=3**

Lecturer : **Dr. Parveen Kumar**

**Recommended Books:**

1. W. D. Callister, 2006, “Materials Science and Engineering-An Introduction”, 6th Edition, Wiley India.
2. Kenneth G. Budinski and Michael K. Budinski, “Engineering Materials”, Prentice Hall of India Private Limited, 4th Indian Reprint, 2002.

**Lesson Plan:**

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| Lect. No(s) | Ref. No. | Topics to be covered  |
|  |   | Unit I |
| 1 | 1.1 | Introduction |
| 2 | 1.2 | Unit cells, Metallic crystal structures, Ceramics. Imperfection in solids: Point,  |
| 3-4 | 1.3 | line Interfacial and volume defects; dislocation strengthening mechanisms and slip systems, |
| 5 | 1.4 | Critically resolved shear stress. |
| 6-7 | 1.5 | Mechanical Property measurement: Tensile, compression and torsion tests; Young’s modulus,  |
| 8 | 1.6 | Relations between true and engineering stress-strain curves, generalized Hooke’s law,  |
| 9 | 1.7 | yielding and yield strength, ductility, resilience, toughness and elastic recovery |
| 10 | 1.8 | Brinell and Vickers and their relation to strength.  |
| 11 | 1.9 | Problems |
|  |  | Unit II |
| 12 | 2.1 | Static failure theories: Ductile and brittle failure mechanisms, |
| 13 | 2.2 | Tresca, Von-mises, Maximum normal stress, |
| 14 | 2.3 | Mohr-Coulomb and Modified Mohr-Coulomb; |
| 15 | 2.4 | Fracture mechanics: Introduction to Stress intensity factor approach and Griffith criterion. |
| 16 | 2.5 | Fatigue failure: High cycle fatigue, Stress-life approach, |
| 17 | 2.6 | SN curve, endurance and fatigue limits, |
| 18 | 2.7 | effects of mean stress using the Modified Goodman diagram |
| 19 | 2.8 | Fracture with fatigue, |
| 20 | 2.9 | Introduction to non-destructive testing (NDT)  |
| 21 | 2.10 | Problems |
|  |  | Unit III |
| 22 | 3.1 | Phase diagram of cast iron. |
| 23 | 3.2 | Phase diagrams: Interpretation of binary phase diagrams |
| 24 | 3.3 | Microstructure development of eutectic, peritectic,  |
| 25 | 3.4 | Microstructure development of peritectoid and monotectic reactions. |
| 26 | 3.5 | Iron-carbide phase diagram |
| 27 | 3.6 | Microstrctural aspects of ledeburite, austenite |
| 28-29 | 3.7 | Microstrctural aspects of ferrite and cementite |
| 30 | 3.8 | Alloys, substitutional and interstitial solid solutions  |
| 31 | 3.9 | TTT-curve |
| 32 | 3.10 | Problems |
|  |  | Unit IV |
| 33 | 4.1 | Heat treatment of Steel |
| 34 | 4.2 | Annealing, tempering, normalising and spheroidising |  |
| 35 | 4.3 | Isothermal transformation diagrams for Fe-C alloys |
| 36 | 4.4 | Microstructure development of Isothermal transformation diagram |
| 37 | 4.5 | Continuous cooling curves |
| 38 | 4.6 | Interpretation of final microstructures and properties |
| 39 | 4.7 | Austempering, martempering, case hardening, carburizing |
| 40 | 4.8 | Cyaniding, carbo-nitriding, flame and induction hardening |
| 41 | 4.9 | Vacuum and plasma hardening |
| 42-43 | 4.10 | Alloying of steel, properties of stainless steel and tool steels, maraging steels- cast irons; grey, white, malleable and spheroidal cast irons |
| 44 | 4.11 | copper and copper alloys; brass, bronze and cupro-nickel |
| 45 | 4.12 | Aluminium and Al-Cu – Mg alloys- Nickel based superalloys and Titanium alloys |
| 46 | 4.13 | Problems |

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| Week | Exp. No. | Practical Topics to be covered  |
| 1st  | 1 | To study crystal structures of a given specimen.  |
| 2nd  | 2 | To study crystal imperfections in a given specimen.  |
| 3rd  | 3 | To study thermo-setting of plastics.  |
| 4th  | 4 | To study the properties of various types of plastics |
| 5th  | 5 | To study heat treatment processes (hardening and tempering) of steel specimen |
| 6th  | 6 | To study microstructures of metals/ alloys |
| 7th  | 7 | To study microstructure of heat-treated steel |
| 8th  | 8 | To study the mechanism of chemical corrosion and its protection |
| 9th  | 9 | To study Bravais lattices with the help of models |
| 10th  | 10 | To study the creep behavior of a given specimen |

**(Dr. Parveen Kumar)**

Guest Faculty

Department of ME

CRSSIET, Jhajjar