

<b>Course Title</b>	<b>MATERIAL SCIENCE AND METALLURGY</b>
<b>Course Code</b>	<b>ME307</b>
<b>Course Credit</b>	Lectures : 03
	Practical : 01
	Tutorial : 00
	Total : 04

**Course Learning Outcomes:**

After Successful completion of the above course, students will be able to:

- **Select** the material according to applications.
- **Choose** the Heat treatment for metal according to requirement.
- **Interpret** phase transformation occurs during solidification.
- **Distinguish** the metal according to different categories.
- **Explain** types of corrosion, causes and remedies.
- **Develop** new alloy metal according to requirement of properties.

**Detailed Syllabus**

**Section – I**

<b>Sr. No.</b>	<b>Name of chapter &amp; Details</b>	<b>Hours Allotted</b>
<b>1</b>	<b>Introduction:</b> Classification of engineering material, Engineering requirements of materials. Mechanical Properties. Mechanical Behavior: Stress-strain diagram showing ductile and brittle behavior of materials, linear and nonlinear elastic.	<b>03</b>
<b>2</b>	<b>Crystal Structure:</b> BCC, FCC and HCP Structures, coordination number and atomic packing factors, crystal plan and direction, crystal imperfections -point line and surface imperfection, changes in properties due to deformation, Re-crystallization, cold working and hot working.	<b>05</b>
<b>3</b>	<b>Fracture and Deformation Mechanics:</b> Mechanisms of plastic deformation, slip and twinning –Types of fracture, basic mechanism of ductile and brittle fracture, Griffith's theory of brittle fracture, Izod and Charpy Impacts tests, Ductile to Brittle Transition, Creep failure and fatigue failure.	<b>04</b>
<b>4</b>	<b>Powder Metallurgy:</b> Powder Metallurgy: Application and advantages. Production of powder, Compacting, Sintering, Equipment and process capability	<b>04</b>

<b>5</b>	<b>Corrosion:</b> Corrosion of metals: Definition, causes and nature, Mechanism of corrosion, Measures of counter acting corrosion, Prevention of corrosion: Metal coatings, Organic coatings, alloy addition, use of Corrosion inhibitors, Cathodic protection against corrosion.	<b>03</b>
<b>6</b>	<b>Introduction to Advanced Material</b> Types and Properties of Composite materials, High temperature materials, Engineering Ceramics & cryogenic materials.	<b>02</b>
	<b>Total</b>	<b>21</b>

**Section – II**

<b>7</b>	<b>Steel:</b> Classification of Steels, types of steel, Properties and uses, Effects of alloying Metals.	<b>04</b>
<b>8</b>	<b>Cast Iron and Their Properties:</b> Cast Iron: Grades, Alloy Cast Iron. Malleable Iron, S. G. Iron, Gray cast iron, White cast iron	<b>04</b>
<b>9</b>	<b>Alloys And Phase Diagrams:</b> Constitution of alloys – Solid solutions- substitutional and interstitial solid solution, phase diagrams-Isomorphous, eutectic, eutectoid and peritectic reactions, Iron – carbon equilibrium diagram, Lever rule.	<b>04</b>
<b>10</b>	<b>Solidification Methodology.</b> Crystallization of metals, Solidification of an alloy, Thermal Equilibrium diagrams of binary alloys. Effects of Structure on Physical Properties, Continuous cooling Transformation curves.	<b>04</b>
<b>11</b>	<b>Heat Treatment</b> Effect of non-equilibrium cooling on microstructure and properties of steel, TTT diagram for 0.8% carbon steel only, Isothermal treatments, Critical Cooling Rate & Heat treatments like Annealing, Normalizing, Hardening and tempering. Hardenability of steels, surface hardening treatments	<b>05</b>
	<b>Total</b>	<b>21</b>

**Instructional Method and Pedagogy:**

- At the beginning of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Minimum two internal exams will be conducted and total of two will be considered as a part of overall evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regularly.
- Surprise tests/Quizzes/Seminar/Tutorials will be conducted.
- The course includes a laboratory, where students have an opportunity to build an appreciate on for the concepts being taught in lectures.



# SYLLABUS

## Reference Books:

1. Sidney H. Avner, "Introduction to Physical Metallurgy", Tata Mcgraw hill.
2. G.K. Narula, "Materials Science", Tata Mcgraw hill.
3. Materials Science and Engineering by William D. Callister, Wiley
4. O.P. Khanna, "Material Science", Dhanpat rai
5. Rollason, "Physical metallurgy", Alibris
6. Dr. Swaroop and Dr. Saxena, "Elements of Metallurgy", Rastogi
7. Robert Read, "Physical Metallurgy", Wadsworth

## Reading Materials, web materials with full citations:

- [http://nptel.iitm.ac.in/courses/Webcourse-contents/IISc-ANG/Material%20Science/New\\_index1.html](http://nptel.iitm.ac.in/courses/Webcourse-contents/IISc-ANG/Material%20Science/New_index1.html)
- <ftp://172.172.98.98/Central%20Library-%20Resource%20Center/Audio-Video/NPTEL%20Videos%20Lecture%20Series/Metallurgy%20and%20Material%20Science/> (NPTEL videos from RKU library)