

**B.E Semester: 3 Mechanical Engineering**  
**Subject Name: Material Science And Metallurgy (MA304-N)**

**A. Course Objective:**

- To present a problem oriented in depth knowledge of Material Science And Metallurgy.
- To address the underlying concepts and methods behind Material Science And Metallurgy.

**B. Teaching / Examination Scheme:**

Teaching Scheme				Total Credit	Evaluation Scheme					
L	T	P	Total		Theory		Mid Sem Exam	CIA	Pract.	Total
Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	Marks
4	0	2	6	5	3	70	30	20	30	150

**C. Detailed Syllabus:**

Unit No.	Details
1	Introduction to Material Science and Metallurgy: Classification of Engineering Materials, Engineering requirements of materials, Properties of engineering materials, Criteria for selection of materials for engineering applications. Metallic Materials: Types, properties and applications, Structure of Metals, Fracture Non-ferrous alloys: alloys of copper, aluminium, magnesium titanium. Other alloys of lead, tin, zinc, nickel, manganese, white metals and bearing alloys
2	Iron-Carbon diagram, plain carbon steels, Allotropy of iron. Crystallization of metals, Solidification of an alloy, solid solution types. Thermal Equilibrium diagrams of binary alloys. Effects of Structure on Physical Properties.
3	Cast Iron: Grades, Alloy Cast Iron, Malleable Iron, S. G. Iron. Wrought Iron: Properties and uses. Steel: Classification of Steels, Properties and uses, Effects of alloying metals.
4	Heat Treatment of Steels: Study of Heat-Treatment processes such as Normalizing, Annealing, spheroidizing, hardening, tempering, austempering, martempering, case-hardening, nitriding, cyaniding, induction hardening, flame-hardening, ageing. Application of above processes in mechanical components such as gears, bearing, turbine blades, crankshafts, pistons, cutting tool materials also.
5	Powder Metallurgy: Application and advantages, Production of powder, Compacting, Sintering, Equipment and process capability.
6	Corrosion of metals: meaning, causes and nature. Measures of counteracting corrosion, Metal coatings, Organic coatings, Lining and cladding, Use of Corrosion inhibitors, Cathodic protection against corrosion.
7	Metallic Testing: Macro-examination, Spark Test, Sculptures Print, Macro-etching, Microscopic examinations, Magnetic Testing, Chemical analysis of steel and iron for Carbon, Sulphur & Phosphorous. Non-destructive testing such as Radiography Testing, Dye Penetration Testing, Magnetic Particle Testing, Ultrasonic Testing, and Jominy endquench test.

<b>Total hours (Theory):64</b>
<b>Total hours (Practical):32</b>
<b>Total hours:96</b>

#### D. Lesson Planning:

Sr. No.	Date/Week	Unit	Weight age	Topic No
1	1 <sup>st</sup> ,2 <sup>nd</sup> ,3 <sup>rd</sup>	Unit 1	20%	1
2	4 <sup>th</sup> ,5 <sup>th</sup> ,6 <sup>th</sup>	Unit 2	20%	2
3	7 <sup>th</sup> , 8 <sup>th</sup> ,9 <sup>th</sup>	Unit 3	20%	3,4
4	10 <sup>th</sup> . 11 <sup>th</sup> . 12 <sup>th</sup>	Unit 4	20%	5,6
5	13 <sup>th</sup> , 14 <sup>th</sup> ,15 <sup>th</sup> ,16 <sup>th</sup>	Unit 5	20%	7

#### E. Instructional Method & Pedagogy

1	At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
2	Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal Weight age should be given to all topics while teaching and conduction of all examinations.
3	Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
4	One/Two internal exams may be conducted and total/average/best of the same may be converted to equivalent of 30 marks as a part of internal theory evaluation.
5	Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation.
6	Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.
7	The course includes a laboratory, where students have an opportunity to build an appreciation for the concept being taught in lectures. Suggested list of experiment is given below

#### F. List of Practical:

1	Classification of materials
2	Study of a heat treatment furnace and a thermocouple pyrometer.
3	Heat treatment of plain carbon steel.
4	Study of metallurgical microscope and specimen polishing machine.
5	Micro structural examination of heat treated steel specimens.
6	Microstructure examination of metals and alloys
7	To examine the microstructure of prepared specimens.

#### G. Students Learning Outcomes:

1	The student can identify different areas of Material Science And Metallurgy.
2	Can find the applications of all the areas in day to day life.

#### H. Text Books & Reference Books:

1	Engineering Metallurgy and material science by S. P. Nayak.
2	Materials and Metallurgy by G. B. S. Narang and K. Manchanedy

3	Elements of Metallurgy by Dr. Swaroop and Dr. Saxena.
4	Material science and manufacturing processs by Dharmendrakumar and S. K. Jain.
5	Physical Metallurgy by Robert Read
6	Metallurgy for engineers by V. Raghvan
7	Metallurgy for engineers by Bava.
8	Physical metallurgy by Rollason.
9	Physical metallurgy by Hyegins.
10	Tool steel by Rabert.
11	Material Science by Annver.
12	Material Science by O.P. Khanna.