

B. E. Semester: III
Automobile Engineering
Subject Name: MATERIAL SCIENCE & METALLURGY (AE304)

Course Objective:

- To present a problem oriented in depth knowledge of MATERIAL SCIENCE & METALLURGY.
- To address the underlying concepts and methods behind MATERIAL SCIENCE & METALLURGY.

Teaching / Examination Scheme:

SUBJECT		Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
		L	T	P	Total		THEORY	IE	CIA	PR. / VIVO		
CODE	NAME	Hrs	Hrs	Hrs	Hrs	Hrs	Marks	Marks	Marks	Marks	Marks	
AE304	MATERIAL SCIENCE & METALLURGY	4	0	2	6	5	3	70	30	20	30	150

Detailed Syllabus:

Topic 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.
2.	Metallic Materials: Types, properties and applications, Structure of Metals, Fracture, Macro-examination, Spark Test, Sculptures Print, Macro-etching, Microscopic examinations, Magnetic Testing, Chemical analysis of steel and iron for Carbon, Sulphur & Phosphorous.
3.	Iron-Carbon diagram, plain carbon steels, Allotropy of iron.
4.	Crystallization of metals, Solidification of an alloy, solid solution types. Thermal Equilibrium diagrams of binary alloys. Effects of Structure on Physical Properties.
5.	Cast Iron: Grades, Alloy Cast Iron, Malleable Iron, S. G. Iron.

6. Wrought Iron: Properties and uses.
7. Steel: Classification of Steels, Properties and uses, Effects of alloying metals.
8. 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.
9. Non-ferrous alloys: alloys of copper, aluminium, magnesium titanium. Other alloys of lead, tin, zinc, nickel, manganese, white metals and bearing alloys.
10. Powder Metallurgy: Application and advantages, Production of powder, Compacting, Sintering, Equipment and process capability.
11. 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.
12. Non-destructive testing such as Radiography Testing, Dye Penetration Testing, Magnetic Particle Testing, Ultrasonic Testing, and Jominy endquench test.

Lesson Planning:

Sr.No.	Date/Week	Unit No.	% Weightage	Topic No:
1	1 st , 2 ^{ed} , 3 ^{ed}	Unit 1	20 % .	1,2
2	4 th , 5 th , 6 th	Unit 2	20 %	3,4,5
3	7 th , 8 th , 9 th	Unit 3	20 %	6,7,8
4	10 th , 11 th , 12 th	Unit 4	20 %	9,10
5	13 th , 14 th , 15 th	Unit 5	20 %	11,12

Instructional Method & Pedagogy:

- At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal weightage should be given to all topics while teaching and conduction of all examinations.
- Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.

- 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.
- 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.
- Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concept being taught in lectures. Suggested list of experiments are as given below.
 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.

Students Learning Outcomes:

- The student can identify different areas of MATERIAL SCIENCE & METALLURGY.
- Can find the applications of all the areas in day to day life.

Recommended Study Materials:

- 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.