GUJARAT TECHNOLOGICAL UNIVERSITY

B.E Semester: 3

Automobile Engineering

Subject Code 131904
Subject Name MATERIAL SCIENCE & METALLURGY

Sr.No	Course content
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 counter-acting 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 end-quench test.

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.