

Lecture Plan for Materials Engineering

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Institute: Ambala College of Engineering and Applied Research

Discipline: Automation & Robotics /Mechanical

Semester: 4th

Duration: 15 Weeks (JAN 2026–MAY 2026)

Work Load: L-3, T-0, P-2

Lecture Plan (Theory)

Week	Lecture No.	Topics
1st	1	Review of Crystal Structure, Space Lattice
	2	Coordination Number, Number of Atoms per Unit Cell
	3	Atomic Packing Factor; Numerical Problems Related to Crystallography.
2nd	4	Crystal Imperfections and their Classifications
	5	Point Defects, Line Defects
	6	Edge & Screw Dislocations, Surface Defects, Volume Defects.
3rd	7	Introduction to Engineering Materials, Steel Terminology
	8	Indian Standard Specifications for Steels as per BIS
	9	Based on Ultimate Tensile Strength and Based on Composition,
4th	10	AISI-SAE Standard Designation for Steels and Aluminium Alloys.
	11	Basic Concepts and Terms, Alloy Systems
	12	Solid Solutions, Hume-Rothery's Rules
5th	13	Phase Diagrams, Gibbs Phase Rule
	14	Cooling Curves, Binary Phase Diagram
	15	The Lever Rule, Applications of Phase Diagrams
6th	16	Phase Transformation, Allotropic Forms of Iron
	17	Micro-constituents of Fe-C System, Iron-Iron Carbide Phase Diagram
	18	Modified Iron-Carbon Phase Diagrams, Isothermal Transformation
7th	19	TTT Curve, CCT Curve.
	20	Heat Treatment of Steels, Annealing

Week	Lecture No.	Topics
	21	Normalizing, Hardening, Tempering
8th	22	Ageing, Austempering and Martempering
	23	Surface Hardening and Case Hardening Processes
	24	Major Defects in Metals or Alloys due to Faulty Heat Treatment.
9th	25	Elastic and Plastic Deformation, Mechanism of Plastic Deformation
	26	Slip; Critical Resolved Shear Stress, Twinning
	27	Conventional and True Stress-Strain Curves for Polycrystalline Materials
10th	28	Yield Point Phenomenon, Bauschinger Effect, Work Hardening
	29	Fatigue, Fatigue-Failure Models, Fatigue Loads
	30	Mechanism of Fatigue Failure, Theories of Fatigue
11th	31	Factors Affecting Fatigue, SN Diagram
	32	Fatigue Life Calculations, Fatigue Tests
	33	Creep Curve, Types of Creep
12th	34	Factors Affecting Creep, Mechanism of Creep
	35	Creep Resistant Material, Creep Tests, Improving Creep Resistance.
	36	Bio diesel, Bio ethanol, Production Methods of Bio fuels; Overview of Key
13th	37	Various Types of Fuel Cells, Materials for Electrodes, Electrolytes,
	38	and Other Components Working Mechanisms, Hydrogen Generation
	39	Limitations, Recent Progress in Fuel Cells
14th	40	Characterization Techniques such as X-Ray Diffraction (XRD)
	41	Scanning Electron Microscopy (SEM)
	42	Energy Dispersive X-Ray Spectroscopy (SEM-EDX)
15th	43	Transmission Electron Microscopy (TEM)
	44	Atomic Force Microscopy (AFM)
	45	Scanning Tunneling Microscopy (STM)

(Hitesh Vohra)

Assistant Professor

A&R