

LESSON PLAN

INTRODUCTION TO MATERIALS ENGINEERING

MTPC201 | Th-1 | 45 Syllabus Hours | 3P/Week | Teaching Plan: 06 August 2026 – 05 November 2026

Name of the Teaching Faculty	Tushar K. Das Pattanayak	Branch	Metallurgical Engineering
Semester	3rd	Category of Course	PC

Course Outcomes

After completing this course, the student should be able to:

CO	Course Outcome
CO1	Understand material structure: Understanding how the atoms of a material are arranged.
CO2	Understand Crystal defects: To know the crystal defects, present in material and differentiate them.
CO3	Understand material properties: Understanding the properties of materials, such as strength, conductivity, and density.
CO4	Knowledge of Engineering Materials: To know various types of engineering materials and their application.

CO Mapping: CO1 – Material Structure | CO2 – Crystal Defects | CO3 – Material Properties | CO4 – Engineering Materials.

Period-wise Lesson Plan with CO Mapping

Period	Date	Day	Unit	Topic / Integrated Coverage	Key Content / Learning Focus	Suggested Method	CO Mapping
1	06-08-2026	Thursday	UNIT –1	Introduction + Historical Perspective + Scope	Introduction; historical perspective; scope of Materials engineering.	Timeline + engineering examples	CO1
2	07-08-2026	Friday	UNIT –1	Processing / Structure / Properties / Performance Correlations	Processing/Structure/Properties/Performance correlations; how material structure influences properties and performance.	Case study + concept map	CO1, CO3
3	13-08-2026	Thursday	UNIT –1	Atomic Structure & Fundamental Concepts on Atoms	Atomic structure; fundamental concepts on atoms; atomic number, mass number, isotopes and subatomic particles.	Atomic model + board work	CO1
4	14-08-2026	Friday	UNIT –1	Bonding Forces and Energies	Bonding forces and energies; interatomic distance and potential-energy concept.	Energy–distance graph	CO1

	20-08-2026	Thursday	UNIT -1	Interatomic Bonds: Covalent, Metallic, Ionic, Hydrogen & van der Waals + Revision	Covalent bond, metallic bond, ionic bond, hydrogen bond and van der Waals bond; comparison and applications; Unit-1 revision.	3D bonding models + comparison quiz	CO1, CO3
6	21-08-2026	Friday	UNIT -2	Crystal & Crystallography; Bravais Lattices; Unit Cells	Crystal and crystallography; Bravais lattices; unit cells; lattice parameters.	3D crystal visualization	CO1
7	28-08-2026	Friday	UNIT -2	Crystal Structures: SC, FCC, BCC & HCP	Crystal structures of simple cubic, face-centered cubic, body-centered cubic and hexagonal close-packed structures; atoms/unit cell and coordination.	3D unit-cell models + comparison	CO1
8	03-09-2026	Thursday	UNIT -2	Point Coordinates + Crystallographic Directions	Point coordinates; crystallographic directions [uvw]; construction and notation.	3D directions + exercises	CO1
9	05-09-2026	Saturday	UNIT -2	Crystallographic Planes + Linear & Planar Densities	Crystallographic planes (hkl); Miller-index/intercept method; linear density and planar density.	3D planes + numerical problems	CO1, CO3
10	05-09-2026	Saturday	UNIT -2	Close-Packed Crystal Structures + Stacking Sequence	Close-packed crystal structures; HCP ABAB and FCC ABCABC stacking sequence.	3D stacking model	CO1
11	10-09-2026	Thursday	UNIT -2	Crystal Planes & Directions + Coordination Number	Crystal planes and directions; coordination number; integrated comparison of SC, BCC, FCC and HCP.	3D comparison + worked examples	CO1
12	11-09-2026	Friday	UNIT -2	Calculation of APF & Density	Atomic packing factor (APF) and theoretical density calculations for crystal structures.	Formula sheet + numericals	CO1, CO3
13	17-09-2026	Thursday	UNIT -2	Imperfections: Point Defects + Dislocations	Imperfections in solids; point defects—vacancies and self-interstitials; dislocations/linear defects.	3D defect models + sketches	CO2
14	18-09-2026	Friday	UNIT -2	Interfacial & Bulk/Volume Defects + Unit Revision	Interfacial defects; bulk or volume defects; differentiation of defect types; Unit-2 revision.	Defect map + assessment	CO2

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	19-09-2026	Saturday	UNIT -3	Mechanical Properties: Stress & Strain	Mechanical properties; basic concepts on stress and strain.	Tensile specimen + equations	CO3
16	19-09-2026	Saturday	UNIT -3	Deformation and Its Types	Deformation and its types; elastic and plastic deformation.	Stress-strain curve	CO3
17	24-09-2026	Thursday	UNIT -3	Hooke's Law	Hooke's law; stress-strain relationship and basic elastic behaviour.	Worked numerical examples	CO3
18	25-09-2026	Friday	UNIT -3	Electrical Resistivity of Metals + Ohm's Law + Electrical Conductivity	Electrical resistivity of metals; Ohm's law; electrical conductivity and relations among resistance, resistivity and conductivity.	Electrical examples + numericals	CO3
19	01-10-2026	Thursday	UNIT -3	Electronic & Ionic Conduction	Electronic and ionic conduction; charge carriers and conduction mechanisms.	Concept map + examples	CO3
20	03-10-2026	Saturday	UNIT -3	Energy Band Structures in Solids	Energy band structures in solids; valence band, conduction band and band gap; conductor/semiconductor/insulator distinction.	Band diagrams	CO3
21	03-10-2026	Saturday	UNIT -3	Electrical Characteristics of Commercial Alloys + Aluminium Electrical Wires	Electrical characteristics of commercial alloys; materials of importance—aluminium electrical wires.	Material comparison + application	CO3
22	08-10-2026	Thursday	UNIT -3	Semiconductivity + Factors Affecting Carrier Mobility	Intrinsic semiconduction; extrinsic semiconduction; n-type and p-type concepts; factors that affect carrier mobility.	Doping model + conceptual problems	CO3
23	09-10-2026	Friday	UNIT -3	Piezoelectricity + Magnetic Properties	Piezoelectricity and its applications; diamagnetism, paramagnetism and ferromagnetism.	Sensor example + magnetic-moment diagrams	CO3
24	15-10-2026	Thursday	UNIT -3	Antiferromagnetism + Ferrimagnetism + Superconductivity	Antiferromagnetism, ferrimagnetism and superconductivity; comparative magnetic behaviour and superconducting concept.	Comparative chart + applications	CO3

16-10-2026	Friday	UNIT -3	Optical Properties and Applications	Electromagnetic radiation; light interactions with solids; atomic and electronic interactions; reflection, refraction, absorption and transmission; luminescence; photoconductivity; LEDs; lasers; optical fibers in communications.	Optical diagrams + application cases	CO3
26	22-10-2026	Thursday	UNIT -4	Fundamentals of Engineering Materials	Fundamentals of engineering materials; relation of material structure, properties and engineering use.	CO4
27	23-10-2026	Friday	UNIT -4	Classification : Metals & Polymers	Classification of engineering materials: metals and polymers; properties and applications.	CO4
28	29-10-2026	Thursday	UNIT -4	Classification : Ceramics & Composites	Ceramic and composite materials; characteristics and engineering applications.	CO4
29	30-10-2026	Friday	UNIT -4	Electronic Materials	Electronic materials as an engineering-material class; important applications.	CO4
30	05-11-2026	Thursday	UNIT -4	Material Selection + Complete Syllabus Revision	Material selection; application requirements and selection considerations; integrated revision of Units 1-4 and examination practice.	CO4, CO3

CO Coverage Summary

CO	Unit-1	Unit-2	Unit-3	Unit-4
CO1	✓	✓	—	—
CO2	—	✓	—	—
CO3	✓	✓	✓	✓
CO4	—	—	—	✓

CO1: Material structure | CO2: Crystal defects | CO3: Material properties | CO4: Engineering materials.

Assessment & Revision

Timing	Activity	Coverage	CO
End of Unit-1	Short Quiz	Atomic structure, bonding and processing-structure-properties	CO1, CO3
Unit-2	Crystallography & Numerical Practice	Directions, planes, densities, close packing, APF and density	CO1, CO3
End of Unit-2	Defects Assignment / Test	Point, linear, interfacial and bulk/volume defects	CO2
Unit-3	Short Tests / Numericals	Mechanical, electrical, semiconductor, magnetic and optical properties	CO3
Unit-4	Material Selection Activity	Metals, polymers, ceramics, composites and electronic materials	CO4

Nov 2026

Complete Revision

Full syllabus + question-
bank practice

CO1-CO4

Holidays / Non-Teaching Days Considered

Date	Day	Reason	Status
08-08-2026	Saturday	2nd Saturday	Holiday
15-08-2026	Saturday	Independence Day	Holiday
22-08-2026	Saturday	4th Saturday	Holiday
27-08-2026	Thursday	Jhulana Purnima	Holiday
04-09-2026	Friday	Janmashtami	Holiday
12-09-2026	Saturday	2nd Saturday	Holiday
14-09-2026	Monday	Ganesh Puja	Holiday
15-09-2026	Tuesday	Nuakhai	Holiday
16-09-2026	Wednesday	Day following Nuakhai	Holiday
26-09-2026	Saturday	4th Saturday	Holiday
02-10-2026	Friday	Gandhi Jayanti	Holiday
10-10-2026	Saturday	2nd Saturday	Holiday
17-10-2026	Saturday	Maha Saptami	Holiday
19-10-2026	Monday	Maha Navami	Holiday
20-10-2026	Tuesday	Vijaya Dasami	Holiday
24-10-2026	Saturday	4th Saturday	Holiday

Recommended 60-Minute Lesson Architecture

- 0–5 min: Hook / real engineering question.
- 5–10 min: Previous-lesson recap.
- 10–35 min: Integrated core concept and syllabus subtopics.
- 35–45 min: 3D visual / diagram / material example.
- 45–53 min: Worked example or numerical where applicable.
- 53–57 min: Rapid recap.
- 57–60 min: Exit question / short assessment.

Course Flow

ATOM → BONDING → CRYSTAL → DEFECT → PROPERTY → ENGINEERING MATERIAL → MATERIAL SELECTION

Tushar
06/08/2026Tushar
06/08/2026M/S
8.8.26

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