

Third Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Material Science and Metallurgy

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

Module – 1				M	L	C
Q.1	a.	List the factors affecting diffusion. State and explain Fick's I Law of diffusion.	10	L1	CO1	
	b.	Derive an expression for Atomic Packing Factor (APF) of BCC structure.	10	L4	CO1	
OR						
Q.2	a.	A 1020 steel is to be gas carburized at 927°C. The carbon content of the surface of the gear is 0.90% and the steel has a nominal carbon content of 0.20%. Calculate the carbon content at 0.5 mm beneath the surface of the gear after 5 hours carburizing time. $D_{927^{\circ}\text{C}} = 1.28 \times 10^{-11} \text{ m}^2/\text{s}$.	10	L4	CO1	
	b.	Differentiate between ductile and brittle materials.	5	L2	CO1	
	c.	Illustrate the mechanism of plastic deformation by slip.	5	L3	CO1	
Module – 2						
Q.3	a.	Illustrate the stages in Cup and Cone fracture with neat sketches.	10	L3	CO2	
	b.	A steel rod of 10 mm diameter and 1.5 m length is subjected to an axial tensile load of 1 KN. Determine : i) Stress ii) Strain iii) Elongation $E = 205 \times 10^6 \text{ KN/m}^2$.	10	L4	CO2	
OR						
Q.4	a.	Write short notes on stages in fatigue failure.	10	L2	CO2	
	b.	Identify the salient points in creep curve with a neat sketch and explain.	10	L2	CO2	
Module – 3						
Q.5	a.	Write short notes on different types of electrolytes used in batteries.	10	L2	CO4	
	b.	Classify the different types of batteries and explain the principle of any one of them.	10	L2	CO4	

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OR

Q.6	a.	What are Super Capacitors? Explain the principle of super capacitors.	10	L2	CO4
	b.	Write short notes on battery safety and abuse tolerance.	10	L2	CO4

Module – 4

Q.7	a.	Analyze the invariant reactions in Iron-carbon equilibrium diagram.	10	L4	CO3
	b.	Write short notes on : i. Normalizing ii. Martempering.	10	L2	CO3

OR

Q.8	a.	Illustrate the properties, composition and application of malleable iron.	10	L3	CO3
	b.	List and explain the application of : i. Flame hardening process ii. Age hardening process.	10	L2	CO1

Module – 5

Q.9	a.	Aluminium alloys are widely used in the automobile industry. Justify the statement.	10	L4	CO3
	b.	Analyze the properties of copper alloys which makes them suitable for various applications.	10	L4	CO3

OR

Q.10	a.	Write short notes on types of matrix and reinforcements in composite materials.	10	L2	CO1
	b.	Explain the advantages and application of Metal Matrix Composites (MMCs).	10	L2	CO1
