

THE KAVERY ENGINEERING COLLEGE*(An Autonomous Institution)***B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, APRIL/MAY 2026***Third Semester**Mechanical Engineering***ME3392 - Engineering Materials and Metallurgy***Regulations - 2021**Duration : 3 Hrs**Maximum : 100 Marks***PART - A (ANSWER ALL QUESTIONS) (Marks 10*2=20)**

<i>Q.No</i>	<i>Questions</i>	<i>BTL</i>	<i>CO</i>	<i>Marks</i>
1.	Define substitutional and interstitial solid solutions with one example each.	L1	1	2
2.	What is a eutectic reaction? Give one example.	L1	1	2
3.	Define full annealing and state its purpose.	L1	2	2
4.	What is the purpose of the Jominy end-quench test?	L1	2	2
5.	Name four alloying elements in steel and state one effect of each.	L1	3	2
6.	What is precipitation hardening? Mention one suitable aluminium alloy.	L1	3	2
7.	Differentiate between thermoplastics and thermosetting plastics.	L2	4	2
8.	Write two important properties and applications of aluminium oxide and silicon carbide.	L1	4	2
9.	Define fatigue and creep.	L1	5	2
10.	What is 0.2% proof stress and how is it obtained from a tensile test curve?	L1	5	2

PART - B (ANSWER ALL QUESTIONS) (Marks 5*16 = 80)

<i>Q.No</i>	<i>Questions</i>	<i>BLT</i>	<i>CO</i>	<i>Marks</i>
11.	a Explain the construction of a binary isomorphous phase diagram. With a neat sketch, describe the phases formed during solidification of a 60 % Cu - 40 % Ni alloy.	L3	1	16
	Or			
	b Draw the Fe-Fe ₃ C equilibrium diagram and explain the eutectoid transformation. Discuss microstructures of pearlite, bainite and martensite with temperature ranges.	L3	1	16
12.	a i Draw and explain a typical TTT diagram for eutectoid steel showing pearlite, bainite and martensite regions.	L3	2	8
	ii Differentiate between TTT and CCT diagrams and explain the influence of cooling rate on microstructure and hardness.	L3	2	8
	Or			
	b i Explain the principles and steps of the Jominy End-Quench Test for determining hardenability.	L2	2	8
	ii Compare carburizing, nitriding, cyaniding and carbonitriding with suitable applications.	L2	2	8

13.	a	i	Discuss the effect of alloying elements Mn, Cr, Ni and Mo on steel properties.	L3	3	8
		ii	Explain composition, properties and uses of stainless steels and tool steels.	L3	3	8
	Or					
	b	i	Describe types of cast irons – grey, white, malleable, spheroidal – with neat sketches.	L2	3	8
ii		Explain precipitation hardening in Al–Cu alloys with a labelled diagram.	L2	3	8	
14.	a	i	Classify polymers and explain the properties and applications of PE, PP, PVC and PMMA.	L2	4	8
		ii	Explain differences between thermoplastics and thermosetting plastics with examples.	L2	4	8
	Or					
	b	i	Explain properties and applications of engineering ceramics – Al ₂ O ₃ , SiC and Si ₃ N ₄ .	L4	4	8
ii		Define composite materials and explain any two matrix–reinforcement systems used in aerospace or automotive fields.	L4	4	8	
15.	a	i	Explain slip and twinning as mechanisms of plastic deformation. Compare slip systems in FCC, BCC and HCP crystals.	L3	5	8
		ii	Derive Griffith's theory of brittle fracture and discuss its significance.	L3	5	8
	Or					
	b	i	With a neat stress–strain diagram, explain how to determine yield strength, UTS, % elongation and Young's modulus.	L4	5	8
ii		Discuss fatigue and creep failure mechanisms, and suggest methods to improve their resistance.	L4	5	8	