Register No : _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, APRIL/MAY 2026

Third Semester

Mechanical Engineering

UMET24302 - Engineering Metallurgy

Regulations - 2024

Duration : 3 Hrs *Maximum : 100 Marks*

*PART – A (ANSWER ALL QUESTIONS) (Marks 10*2=20)*

Q.No	*Questions*	*BTL*	*CO*	*Marks*
1.	Define substitutional and interstitial solid solutions.	L1	1	2
2.	Explain the eutectoid reaction with reference to the iron–iron carbide equilibrium diagram.	L2	1	2
3.	Define hardenability and mention the test used to determine it.	L1	2	2
4.	Differentiate between austempering and martempering heat treatment processes.	L2	2	2
5.	List any four alloying elements added to steel and mention their effects.	L1	3	2
6.	Differentiate between brass and bronze based on composition and applications.	L2	3	2
7.	Define thermoplastic and thermosetting polymers with one example each.	L1	4	2
8.	Differentiate between engineering polymers and commodity polymers with suitable examples.	L2	4	2
9.	Define slip and twinning in the mechanism of plastic deformation.	L1	5	2
10.	Differentiate between ductile fracture and brittle fracture with suitable examples.	L2	5	2

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

Q.No			*Questions*	*BLT*	*CO*	*Marks*
11.	a	i	Explain in detail about the different types of solid solutions with neat sketches.	L2	1	8
		ii	Describe the following phase reactions: eutectic, peritectic, eutectoid, and peritectoid with examples.	L2	1	8
			Or			
	b	i	With a neat diagram, explain the iron–iron carbide equilibrium diagram and indicate the critical points and phases formed.	L2	1	8
		ii	Classify steels and cast irons based on carbon content and discuss their microstructure, properties, and applications.	L2	1	8
12.	a	i	Explain the following heat treatment processes of steel: full annealing, normalizing, hardening, and tempering with neat sketches.	L3	2	8
		ii	Describe the process and purpose of stress relieving and recrystallisation heat treatments.	L3	2	8
			Or			

	b	i	With the help of suitable diagrams, explain the construction and working of the Jominy end quench test used to determine hardenability.	L3	2	8
		ii	Compare case hardening methods such as carburizing, nitriding, and cyaniding based on process, temperature, and applications.	L3	2	8
13.	a	i	Explain the effects of following alloying elements: Mn, Si, Cr, Mo, Ni, V, Ti, and W on the properties of steels.	L2	3	8
		ii	Describe the classification, composition, and applications of stainless steels and tool steels.	L2	3	8
			Or			
	b	i	Compare the composition, properties, and applications of following non-ferrous alloys: brass, bronze, cupronickel, and aluminum alloys.	L2	3	8
		ii	Explain the process of precipitation strengthening treatment in Al–Cu alloys with neat sketch.	L2	3	8
14.	a	i	Compare the properties and applications of following common engineering polymers: PVC, PET, PC, PA, and PTFE.	L3	4	8
		ii	Explain the process of manufacturing and applications of thermoset polymers like urea-formaldehyde and phenol-formaldehyde.	L3	4	8
			Or			
	b	i	Analyse the structure, properties, and applications of following advanced ceramics: Al_2O_3, SiC, Si_3N_4, PSZ, and SIALON.	L3	4	8
		ii	Discuss the classification of composite materials based on matrix and reinforcement types, and evaluate their engineering applications.	L3	4	8
15.	a	i	Explain the various mechanical testing methods used to determine the mechanical properties of materials under tension, compression, and shear loads.	L3	5	8
		ii	Describe the principle and procedure of Brinell, hardness test with suitable examples.	L3	5	8
			Or			
	b	i	Evaluate the significance of fracture mechanics and Griffith's theory in predicting the failure of materials.	L3	5	8
		ii	Assess the importance of impact (Izod and Charpy), fatigue, and creep tests in the design and selection of engineering materials.	L3	5	8