

Model Question Paper-1 with effect from 2019-20 (CBCS Scheme)

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**Fourth Semester B.E. Degree Examination
Material Science and Metallurgy**

TIME: 03 Hours

Max. Marks: 100

Note: Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.

Module -1			*Bloom's Taxonomy Level	Marks
Q.01	a	Define Atomic packing factor (APF) and calculate the APF for HCP crystal structure.	L2	08
	b	Identify the four types of imperfections in the crystal structure and explain the point defects with neat sketches.	L3	08
	c	Define diffusivity. List out the factors influencing diffusion.	L1	04
OR				
Q.02	a	Define unit cell and explain BCC and FCC unit cell with a neat sketch.	L5	08
	b	State and explain the Fick's 1 st and 2 nd Law of diffusion.	L2	08
	c	Differentiate between line and screw dislocation.	L4	04
Module-2				
Q. 03	a	Develop an expression for critically resolved shear stress with a neat sketch.	L6	08
	b	Explain stages of fracture with a neat sketch.	L5	08
	c	Briefly explain the ductile to brittle transition temperature.	L2	04
OR				
Q.04	a	List the various types of fractures in materials and briefly explain the same.	L4	06
	b	Explain various stages of creep deformation with a neat figure.	L5	08
	c	Briefly explain the factors influencing fatigue failure.	L2	06
Module-3				
Q. 05	a	Explain the Hume Rothery rules for solid solution formation with example.	L2	08
	b	Construct Iron-Carbon equilibrium diagram and label all regions, phase temperature and mention the invariant reactions.	L6	08
	c	State and briefly explain the Lever rule with a neat figure.	L2	04
OR				
Q. 06	a	Define solid solution. With a neat sketch explain substitution and interstitial solid solution with example.	L1	06
	b	Construct a phase diagram using the following data and label all the fields. Melting point of Ag = 961°C, Eutectic temperature=780°C, Min. Solubility of Cu in Ag = 9% at 780 °C, Min. Solubility of Ag and Cu =9% at 780 °C, Melting point of Cu= 1083 °C, Eutectic composition =28% Cu, Max Solubility Cu in Ag = 2 % at 0 °C, Max Solubility Ag in Cu = 0 % at 0 °C. Determine the following: i. Solidification start and end of temperature for 30% Ag alloy ii. Temperature at which a 15% Cu alloy has 50% liquid phase and 50% solid phase iii. % composition of liquid and solid phase in 20% Ag alloy at 900 °C.	L6	08

	c	What are TTT curves. Explain martensitic transformation of austenite.		06
Module-4				
Q. 07	a	Define and list the objectives of heat treatment process.	L1	06
	b	Distinguish between stress relief annealing and process annealing with a neat diagram.	L4	08
	c	What is hardening? Explain with a neat diagram	L1	06
OR				
Q. 08	a	Explain tempering process with a neat sketch.	L5	06
	b	With a neat sketch, explain Jominy End Quench test.	L5	06
	c	With a neat explain the induction hardening process.	L2	06
Module-5				
Q. 09	a	Outline the composition, properties and application of Low carbon steels.	L2	08
	b	Explain the role of types of matrix and reinforcement materials in composites.	L2	08
	c	Define ceramic and list out its application.	L1	04
OR				
Q. 10	a	Outline the composition, properties and application of grey cast iron.	L2	08
	b	Explain the mechanical properties and applications of composite material.	L5	08
	c	List the advantages and limitations of composite materials.	L4	04

*Bloom's Taxonomy Level: Indicate as L1, L2, L3, L4, etc. It is also desirable to indicate the COs and POs to be attained by every bit of questions.