

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER-IV (NEW) EXAMINATION – WINTER 2024****Subject Code:3142111****Date:27-11-2024****Subject Name: Phase Transformations****Time:02:30 PM TO 05:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		Marks
Q.1	(a) How do phase transformations influence the microstructure of metals?	03
	(b) Explain Fick's laws of diffusion and discuss their significance in phase transformations.	04
	(c) Define the terms with necessary schematics- Crystal, Crystal structure, Grains, Grain boundary, Phase & phase transformation.	07
Q.2	(a) Describe the role of crystal defects in atomic diffusion.	03
	(b) Explain the significance of the Kirkendall effect in the context of phase transformations in alloys.	04
	(c) With reference to Fe-Fe ₃ C Phase diagram, draw and explain the austenite to pearlite transformation process for 0.8% C steel.	07
	OR	
	(c) Define the following phases in Fe-C System, 1. delta ferrite 2. alpha ferrite 3. Austenite , 4. Bainite 5. Pearlite 6. Cementite 7. Martensite	07
Q.3	(a) Explain the difference between homogeneous and heterogeneous nucleation.	03
	(b) Briefly discuss the process of age hardening and its significance in Al-4% Cu alloy systems with labeled diagram.	04
	(c) Differentiate between diffusional and diffusion-less transformations in solids.	07
	OR	
Q.3	(a) Compare the impact of grain growth on the mechanical properties of materials.	03
	(b) Draw a TTT diagram & state the information available from it	04
	(c) Using the CCT diagram, label the coarse pearlite, fine pearlite, upper / lower bainite, and martensite phase transformations	07
Q.4	(a) What is Bain distortion in the context of martensitic transformations?	03
	(b) Draw and compare microstructure and properties of Martensite and tempered martensite structure.	04
	(c) Describe the general characteristics of martensitic transformations and their similarities to deformation twinning.	07
	OR	
Q.4	(a) Under equilibrium conditions, Draw and label the microstructures of eutectoid, hypoeutectoid, and hypereutectoid steels?	03
	(b) State the requirements of uniform martensite production before its transformation into other products. How it is achieved.	04
	(c) How does spinodal decomposition differ from nucleation and growth mechanisms?	07

- Q.5** (a) State the factors that affect the overall transformation rates in phase transitions. **03**
(b) Why martensitic transformation is called as diffusion-less transformation. **04**
(c) In terms of the solid state phase transformation process, define coherent, semi-coherent, and incoherent precipitates. **07**

OR

- Q.5** (a) What is the difference between long-range and short-range order in materials? **03**
(b) Draw and discuss microstructure and properties of upper bainite and lower bainite. **04**
What is the effect of retained austenite into tempered martensitic structure ? How **07**
(c) to deal with retained austenite ?
