

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-IV (NEW) EXAMINATION – SUMMER 2024****Subject Code:3142111****Date:03-07-2024****Subject Name: Phase Transformations****Time:10:30 AM TO 01:00 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) Discuss how phase transformations are classified and give examples of each type.	03
	(b) Explain how phase transformations can be utilized to enhance material properties in industrial applications.	04
	(c) State Fick's second law of diffusion. Why is it important in materials science?	07
Q.2	(a) Define heterogeneous nucleation and its role in phase transformations.	03
	(b) Define- Crystal, Crystal structure, Grains & Grain boundary with neat schematics.	04
	(c) Draw Fe-Fe ₃ C diagram and label it properly. Mention Peritectic, eutectic and eutectoid transformation on it.	07
	OR	
	(c) Define the following phases in Fe-C System, 1. δ ferrite 2. α ferrite 3. Austenite , 4. Bainite 5. Pearlite 6. Cementite 7. Martensite .	07
Q.3	(a) Define Nucleation and Growth phenomena.	03
	(b) Draw phase diagram of Al-Cu alloy system and discuss the solution and ageing process with neat schematics.	04
	(c) Discuss about Kirkendal's experiment and outcome of it .	07
	OR	
Q.3	(a) State the fundamental difference between self-diffusion and inter diffusion process.	03
	(b) State the characteristics of diffusion transformation & diffusion less transformation giving suitable examples	04
	(c) Describe the similarities between martensitic transformations and deformation twinning.	07
Q.4	(a) Discuss the effect of alloying elements-C, Mn, B & Co on position of TTT diagram.	03
	(b) What is the fundamental difference between T-T-T and C-C-T diagrams?	04
	(c) With respect to Fe-Fe ₃ C diagram, draw the microstructure of eutectoid, hypoeutectoid and hypereutectoid steels obtained under equilibrium conditions?	07
	OR	
Q.4	(a) State the importance of austenitic grain size prior to its transformation into Martensite phase.	03
	(b) Explain Bain distortion and its role in martensitic transformations.	04
	(c) State the purpose and process of obtaining the tempered martensite structure.	07

- Q.5** **(a)** Justify with a reason as why fine grain size is preferred over coarse grain size? **03**
 (b) Explain the difference between upper Bainite and lower Bainite in terms of their microstructure. **04**
 (c) Explain the conditions under which spinodal decomposition occurs. **07**
- OR**
- Q.5** **(a)** Give examples of Order-disorder Transformation in alloy system with suitable example . **03**
 (b) Write a short note on solid state phase transformation process. **04**
 (c) Critically compare Long-range diffusion and Short-range diffusion transformations with suitable examples of each. **07**
