

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER-III (NEW) EXAMINATION – WINTER 2020****Subject Code:3131904****Date:10/03/2021****Subject Name:Material Science and Metallurgy****Time:10:30 AM TO 12:30 PM****Total Marks:56****Instructions:**

1. Attempt any FOUR questions out of EIGHT questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

	Marks
Q.1 (a) An industry is fabricating stainless steel pressure vessel for nuclear power plant steam generator. The butt welded joint of vessel is inspected by RT. Explain why LPT, MPT and UT cannot be performed.	03
(b) Draw Miller indices for planes (0 1 1), (1 0 0), (1 1 1) and (1 $\bar{1}$ 0).	04
(c) Explain solid state transformation from single phase austenitic temperature to room temperature for 0.2% carbon steel and draw room temperature microstructure showing relative percentage of phases present in it.	07
Q.2 (a) Justify that grain boundary is a crystalline imperfection.	03
(b) Explain Austenite to Pearlite transformation for eutectoid steel.	04
(c) Describe sample preparation technique for microscopic examination.	07
Q.3 (a) Outline major mechanical property requirements of bicycle wheel axle.	03
(b) Describe Magnetic Particle Test principle and advantages.	04
(c) List powder making process and describe atomization process with help of neat sketch.	07
Q.4 (a) Outline optical property requirements of window glass in very hot and sunny region.	03
(b) Describe Ultrasonic Test principle and advantages.	04
(c) Outline the process of making powder metallurgy products in brief and discuss advantages of powder metallurgy.	07
Q.5 (a) Define Heat Treatment and classify heat treatment processes.	03
(b) Differentiate Galvanic corrosion and Electrochemical corrosion.	04
(c) With proper justification choose appropriate heat treatment process for gear used in gearbox of car and explain the selected heat treatment process in detail.	07
Q.6 (a) Define hardenability and list three factors affecting it.	03
(b) Identify role of sacrificial anode by appropriate example in corrosion prevention.	04
(c) Choose and explain appropriate heat treatment process to be performed on cold rolled steel plate for further manufacturing easiness.	07

- Q.7 (a)** Calculate % of phases present at T_E temperature and room temperature for alloy-1 shown in **Figure-1** using lever rule principal. **03**
- (b)** Describe step by step solidification of alloy -1 shown in **Figure-1** up to room temperature with aid of appropriate sketch. **04**
- (c)** Explain Homogenous nucleation process **07**
- Q.8 (a)** Draw cooling curves during solidification for pure metal, alloy and hypo-eutectic alloy. **03**
- (b)** How many degrees of freedom does water have at triple point? Justify your answer with valid reason. **04**
- (c)** Describe the conditions that govern formation of solid solution. **07**

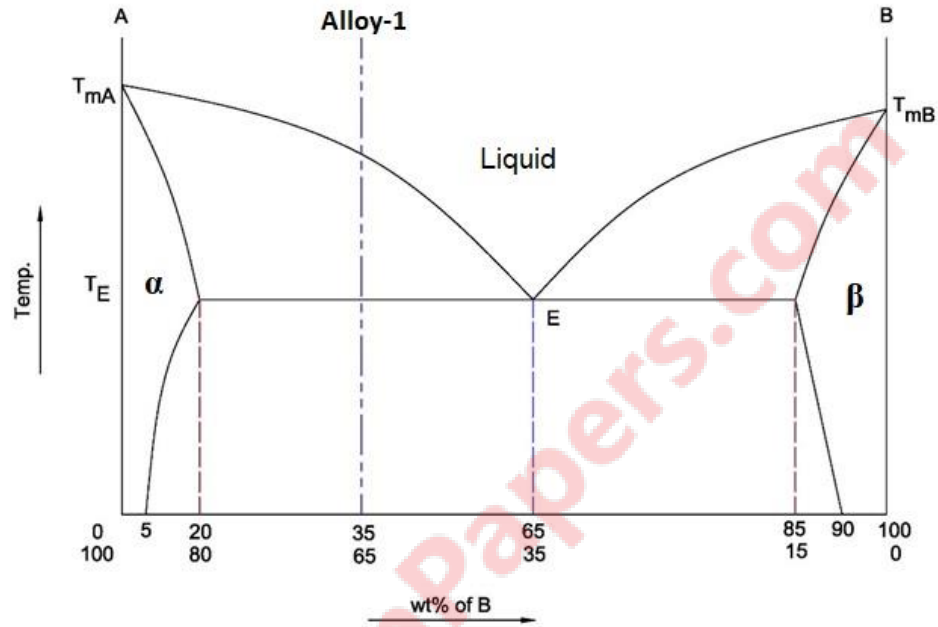


Figure 1: Phase diagram for element A & B having partial solubility in each other