

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VIII(NEW) EXAMINATION – SUMMER 2019

Subject Code: 2182115
Date: 13/05/2019
Subject Name: Alloy Design
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.

		MARKS
Q.1	(a) Draw flow chart of interrelationship among design, materials and processing.	03
	(b) What is degree of freedom? Write the formula for degree of freedom for unary and binary phase diagram along with the justification.	04
	(c) Explain the different steps involved in the engineering design process?	07
Q.2	(a) Explain briefly the effect of size, shape and distribution of second phase on mechanical properties of alloys	03
	(b) Discuss the various advantages offered by Dual Phase Steel compared to Plain Carbon steel.	04
	(c) Stent manufacturer has contacted you to design a bio-degradable metallic alloy. Give your recommendations based on properties required at the application level and justify the choice of materials.	07
	OR	
	(c) Stent manufacturer has contacted you to design a non-degradable metallic alloy. Give your recommendations based on properties required at the application level and justify the choice of materials.	07
Q.3	(a) What are the driving force behind Recovery, Recrystallization and Grain Growth?	03
	(b) Draw a labeled diagram of cooling curves of: <ol style="list-style-type: none"> 1) Eutectic alloy and 2) Hyper eutectic alloy 	04
	(c) What is precipitation hardening? Explain different stages and mechanisms of precipitation hardening by coherent particles using Al – 2wt%Cu alloy.	07
	OR	
Q.3	(a) What are the prerequisites for an alloy to be age-hardenable?	03
	(b) Draw a labeled diagram of cooling curves of: <ol style="list-style-type: none"> 1) Pure metal and 2) Hypo eutectic alloy 	04
	(c) Explain Recovery, Recrystallization and Grain Growth. Schematically show the effect of this phenomenon on the mechanical properties of a material.	07

- Q.4** (a) What is Fatigue? Show S-N diagram for various ferrous & non ferrous alloys. **03**
- (b) Explain constitutional supercooling in an alloy. **04**
- (c) What do you understand by creep failure? Explain the mechanisms involved in creep failure of a material? **07**

OR

- Q.4** (a) With help of flow chart give detailed classification of phase transformations. **03**
- (b) Draw labeled diagram of: **04**
- 1) Stress Strain Diagram and
- 2) Creep Curve
- (c) What are the ways to reduce wear of material? What are the fundamental criteria for selection of the material for wear applications? **07**
- Q.5** (a) Suggest the materials for high dynamic loading conditions. **03**
- (b) Explain the strengthening mechanism behind the high temperature strength of Nickel based Superalloys. **04**
- (c) List the computer-based methods used for designing of alloys. Explain any one in detail. **07**

OR

- Q.5** (a) State the difference between Alloy & Composites. **03**
- (b) Which are the principal alloying elements of group-M HSS? List the effects of these elements on properties of group-M HSS. **04**
- (c) Explain the advantages of designing a component from lightweight and high strength aluminium based alloy made using powder metallurgical route? List probable applications for the same. **07**

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