Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code: 2131904 Date: 07/06/2019

Subject Name: Material Science and Metallurgy

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.**

			MARKS
Q.1	**(a)**	Answer the following questions. 1) What is Embryo? 2) What is strain hardening? 3) Define austenite. 4) Define critical cooling rate. 5) Define phase. 6) Mention any one etchant used for mild steel along with its chemical composition. 7) Write basic composition of SS304 (Austenitic Stainless Steel).	**07**
	(b)	Explain homogeneous nucleation using concept of free energy change.	**04**
	(c)	Calculate proportion of phases present in 0.2% carbon steel at room temperature using lever rule principle as per Fe-C equilibrium diagram.	**03**
Q.2	**(a)**	Draw Miller indices for planes (0 1 1), (1 0 0) and (1 1 1) and directions [0 1 1], [1 0 0] and [1 1 1] in a simple cubic crystal.	**03**
	(b)	What is red hardness? Explain specific purpose of different alloying elements in 18-4-1 HSS tool steel.	**04**
	(c)	What is pro-eutectoid ferrite? With neat sketch explain step by step solid state transformation of 0.4% carbon steel from single phase Austenitic temperature to room temperature under equilibrium condition. Also draw room temperature microstructure and label phases present in it.	**07**
		OR	
	(c)	Write Eutectoid reaction for Fe-C binary alloy system. Calculate proportion of phases present in Pearlite. Also explain Austenite to Pearlite transformation process with neat sketch.	**07**
Q.3	**(a)**	Differentiate between deformation by slip and twinning.	**03**

	(b)	Enlist different methods of preparation of metal powders and discuss characteristics of metal powders used in powder metallurgy.	**04**
	(c)	Draw different heat treatment cooling rate on T-T-T diagram mentioning respective final microstructure for low carbon steel. Write characteristics of Martensite.	**07**

OR

Q.3	**(a)**	Why grain boundary is considered as a crystalline imperfection?	**03**
	(b)	What is sintering? Why is sintering carried out in controlled-atmosphere furnace?	**04**
	(c)	What is the effect of carbon and other alloying elements on T-T-T diagram? Explain in detail with neat sketch. What is the importance of this phenomenon in welding of alloy steels?	**07**
Q.4	**(a)**	Write typical composition and application of: 1) Cartridge Brass 2) Inconel	**03**
	(b)	Why normalizing produces structure having superior strength and hardness compared to annealing?	**04**
	(c)	Explain mechanical properties and applications of Gray Cast Iron.	**07**

OR

Q.4	**(a)**	What are the outstanding properties of cupronickel alloys?	**03**
	(b)	Write purpose of the case hardening heat treatment and explain any one in detail.	**04**
	(c)	Write short note on Malleable Cast Iron and Nodular Cast Iron.	**07**
Q.5	**(a)**	What informations may be obtained from an equilibrium diagram?	**03**
	(b)	Explain various criterions for selection of material for engineering application.	**04**
	(c)	Explain working principle of Eddy Current Test. Mention various applications of Eddy Current Test.	**07**

OR

Q.5	**(a)**	Write limitations of RT and UT.	**03**
	(b)	Explain various methods of magnetization used in MPT.	**04**
	(c)	Calculate density of copper crystal using following data. Atomic Radius of copper is 1.278 Å, Atomic weight of copper is 63.5 gm/mol. Take Avogadro's number = 6.023×10^{23}.	**07**

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