Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– IV (New) EXAMINATION – WINTER 2019

Subject Code: 2142106 **Date: 07/12/2019**

Subject Name: Plastic Deformation of Metals

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 a labeled stress strain diagram for ductile and brittle material. Explain yield point phenomena with neat sketch.	**03**
	(b)	Differentiate Slip and Twinning as mechanism of Plastic deformation.	**04**
	(c)	Define the Terms: (i) Young's Modulus (ii) Shear Modulus (iii) True Stress & True strain (iv) Engineering Stress and Engineering Strain v) Ultimate tensile stress vi) Proof stress vii) braking strength.	**07**
Q.2	**(a)**	Discuss the various techniques of observation of dislocation.	**03**
	(b)	Differentiate between plastic deformation by slip and twinning.	**04**
	(c)	Discuss the mechanism of Frank-Read source of dislocation multiplications.	**07**
		OR	
	(c)	What is Schimid's law? Derive the expression of critical resolved shear stress	**07**
Q.3	**(a)**	Write a formula stating relationship between Shear Modulus (G), Elastic Modulus(E), and Possion's ratio of materials	**03**
	(b)	What is Hall petch relationship? Discuss the basis of strengthening of materials by grain –size reduction method.	**04**
	(c)	Define Dislocation? Differentiate Edge and Screw dislocation with neat sketch.	**07**
		OR	
Q.3	**(a)**	What is Slip system? What is the use of Burger Circuit?	**03**
	(b)	Differentiate between the annealing twins and the deformation twins with neat schematics.	**04**
	(c)	Differentiate the following with help of schematic representation (i) Ductile fracture and Brittle fracture (ii) Intergranular fracture and Trans granular fracture	**07**
Q.4	**(a)**	Enlist various strengthening mechanisms in metallic alloys.	**03**
	(b)	Differentiate the climb and the cross slip of dislocation with the help of schematics.	**04**
	(c)	A Large plate is fabricated from a steel alloy that has a plain strain fracture toughness of 45 MPa$\sqrt{m}$. If during service use, the plate is exposed to a tensile stress of 250 MPa, determine the minimum length of a surface crack that will lead to fracture (Assume f=1.0)	**07**
		OR	
Q.4	**(a)**	Explain "Ductile-Brittle Transition Temperature" (DBTT) curve	**03**
	(b)	With a Neat Sketch, explain how dislocation line can end abruptly inside a crystal itself by forming a continuous loop?	**04**
	(c)	Derive a Griffith's equation for a propagation of cracks in brittle material and using equation calculate, of The half-length of cracks in a steel is 3μm. Taking E= 150GNm-2 , Estimate the brittle fracture strength at low temperature, if the surface energy is 1.5 Jm-2	**07**

Q.5	**(a)**	Draw schematic of grain boundary strengthening effect.	**03**
	(b)	What are the pre-requisite for an alloy to be age-hardenable? Explain giving suitable example.	**04**
	(c)	Compare recovery and recrystallisation in terms of (i) driving force (ii) mechanisms, and (iii) effects on mechanical properties	**07**

OR

Q.5	**(a)**	Define Strain Hardening effect. State the effect of it on the mechanical properties of steels?	**03**
	(b)	What is creep? Draw a typical creep curve and discuss its different regions.	**04**
	(c)	Draw typical S-N Curve for an aluminium alloy and steel . Define the terms: (i) Endurance Limit (ii) Fatigue strength and (iii) Fatigue life.	**07**

****