Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER–I(New course)• EXAMINATION – WINTER- 2015

Subject Code: 2710801 **Date: 02/01/2016**

Subject Name: ADVANCED MACHINE DESIGN

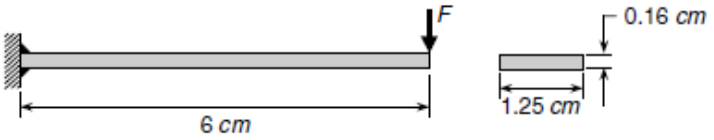
Time:2:30 pm to 5:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Discuss the various material selection factors and process.	**07**
	(b)	Define creep and describe the creep curve in detail.	**07**
Q.2	**(a)**	Explain the various factors for correcting endurance limit.	**07**
	(b)	Explain the concept of DFM along with guidelines for implementing a DFM strategy.	**07**
		OR	
	(b)	(1) For plain strain case, the strains are specified as under. State whether they are compatible. $\varepsilon_x = 3x^2y \quad \varepsilon_y = 4y^2x \quad \varepsilon_{xy} = yx + x^3$	**04**
		(2) In a biaxial tension test, the ratio of σ_1 to $\sigma 2$ is two, and σ_3=0. If the octahedral shear stress for the material to produce yielding is 1500kgf/cm^2. Find the value of σ_1 and σ_2 at biaxial yielding.	**03**
Q.3	**(a)**	A 15-mm-diameter, 20-mm-long steel roller is subjected to a load of 150 N per axial millimeter, as it runs on the inside of a steel ring of inside diameter 75 mm. Determine the value of the maximum contact pressure and the width of the contact zone with suitable assumption. (For steel material E=207 GPa and v=0.30).	**07**
	(b)	Explain Adhesive and abrasive wear in details and enlist design precaution to avoid Surface failure.	**07**
		OR	
Q.3	**(a)**	A pin-on-disk friction testing apparatus involves the unlubricated rounded end of a copper pin of 80 Vickers hardness being pressed with a force of 20 N against the surface of a rotating steel disk of 210 Brinell hardness. The rubbing contact is at a radius of 16 mm; the disk rotates 80 rpm. After 2 hours the pin and disk are weighed. It is determined that adhesive wear has caused weight losses equivalent to wear volumes of 2.7 mm^3 and 0.65 mm^3 for the copper and steel, respectively. Compute the wear coefficients.	**07**
	(b)	Explain briefly the Hydrodynamic, hydrostatic and elsatohydrodynamic lubrication.	**07**
Q.4	**(a)**	(1) Explain the fatigue design under combined stresses.	**03**
		(2) Sketch and explain the S-N curve for steel material.	**03**

(b) For the cantilevered beam shown in following figure, which is acted upon by a fluctuating tip force *(F)* of between (10.8 N) and (25.2 N), determine the factor-of-safety using the Goodman theory. The beam is made of cold-drawn steel, ground to the dimensions shown, and then welded to the vertical support at its left end. The beam operates at room temperature. Also, S_{ut} is 595 MPa and K_f is 1.2. Assume surface finish factor 0.92. **08**



OR

Q.4 **(a)** Explain fatigue design of helical spring. **06**

(b) The work cycle of mechanical component is subjected to a complete reversed bending stresses consisting of the following three elements: **08**

1) ± 350N/mm^2 for 85% of time.
2) ± 500N/mm^2 for 3% of time.
3) ± 400N/mm^2 for remaining time.

The component is made of plain carbon steel 50C4 (ultimate strength 660N/mm^2). If the endurance limit of the component is 280N/mm^2, determine its life.

Q.5 **(a)** Show that distortion Energy at the location of principal stresses is given by **07**

$$U_d = \frac{(1+\upsilon)}{6E}\left[(\sigma_1-\sigma_2)^2+(\sigma_2-\sigma_3)^2+(\sigma_1-\sigma_3)^2\right]$$

Where, υ = Poisson's ratio for the material, E = Modulus of elasticity for the material, U_d = Distortion energy in the element at the location of principal stresses.

(b) Discuss Griffith's approach for crack problem. **07**

OR

Q.5 **(a)** For the given state of stress, determine the principal stress and their directions. **07**

$$[\tau_{ij}] = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$$

(b) Derive the relationship between stress intensity factor & energy release rate. **07**

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