Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER – I (New)– EXAMINATION – WINTER-2019

Subject Code: 3710801 **Date: 09-01-2020**

Subject Name: Advanced Machine Design

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.**
4. **Any machine design data book is not allowed.**

Q.1	(a)	With reference to Griffith's analysis discuss variation of energy release rate and surface energy.	07
	(b)	Define fatigue life, enlist the various fatigue life methods and explain any one.	07
Q.2	(a)	Explain Adhesive and abrasive wear in details and enlist design precaution to avoid Surface failure.	07
	(b)	Explain the types of creep and factor affecting the creep.	07
		OR	
	(b)	Explain Sherby-Dorn and Larson-Miller Parameters for creep deformation	07
Q.3	(a)	For the state of strain given at a point P, determine the principal strains and the directions of maximum and minimum principal strains. $[\varepsilon_{ij}] = \begin{bmatrix} 0.02 & -0.04 & 0 \\ -0.04 & 0.06 & -0.02 \\ 0 & -0.02 & 0 \end{bmatrix}$	07
	(b)	The state of stress is given by $\sigma_x = 25p$ and $\sigma_y = 5p$ plus shearing stress τ_{xy}. On plane at 45^0 counterclockwise to the plane on which σ_x act the state of stress is 50 MPa tension and 5 MPa shear. Determine the values of σ_x, σ_y and τ_{xy}.	07
		OR	
Q.3	(a)	Derive that volumetric strain $\Delta = \frac{\Delta V}{V} = \varepsilon_{xx} + \varepsilon_{yy} + \varepsilon_{zz}$.	07
	(b)	Define octahedral plane. Derive equation of normal and shear stress acting on octahedral plane.	07
Q.4	(a)	Name the various theories of failure. Discuss energy of distortion theory for ductile materials.	07
	(b)	What is Hartz's contact stress theory? Explain in detail for spherical and cylindrical contact with suitable example.	07
		OR	
Q.4	(a)	Define crack resistance. Discuss R-curve for ductile material and brittle material.	07
	(b)	Explain the various modes of lubrication.	07
Q.5	(a)	Draw and explain the modified Soderberg diagram for Spring design.	06
	(b)	Explain (1) Miner's rule for cumulative damage in fatigue. (2) The strain based approach to determine fatigue life	08
		OR	
Q.5	(a)	Define the following terms with reference to fatigue failure: Corrected endurance strength, stress amplitude, Notch sensitivity, Repeated loads, Reversed loads, stress concentration factor.	06

(b) A round steel shaft (having S_{ut} = 90 kg/mm^2 and S_e = 25 kg/mm^2) is carrying a static tensile stress of 10 kg/mm^2. The shaft is also subjected to a variable stress of ±40 kg/mm^2. 08

a) Determine the stress components.
b) Draw stress-time diagram, and specify the type of stress state.
c) Calculate the fatigue life of this shaft.

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