GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VII (NEW) EXAMINATION – SUMMER 2024

Subject Code:3171925   **Date:01-06-2024**
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. **Simple and non-programmable scientific calculators are allowed.**

Q.1	**(a)**	Enlist the factors that may affect S-N curves.	**03**
	(b)	Explain the factors for controlling the surface fatigue.	**04**
	(c)	Derive relationship between crack tip opening displacement (CTOD) and stress intensity factor for Mode I (KI) for small scale yielding.	**07**
Q.2	**(a)**	Define the terms creep, creep rupture, and stress rupture.	**03**
	(b)	Explain in detail different types of wear experienced in mechanical systems.	**04**
	(c)	A ball thrust bearing with 7 spherical balls each of 10 mm diameter is loaded axially across its races through the balls. Races are flat. All parts are hardened steel. The axial load is 21.5 lb per ball. Calculate the size of the contact patch on a race. Assume the 7 balls share the load equally. The rotational speed is sufficiently slow that this can be considered a static loading problem.	**07**

OR

	(c)	The load on a bolt consists of an axial pull of 10 kN together with a transverse shear force of 5 kN. The elastic limit in bolt material is reached at 280 MPa. Determine the diameter of bolt using (a) Maximum shear stress theory (b) Distortion energy theory. Take FOS 3 on elastic limit and Poisson's ratio equal to 0.3.	**07**
Q.3	**(a)**	What are the important theories of elastic failures & explain why it is required to consider?	**03**
	(b)	Explain any two modes of the crack displacement with sketch.	**04**
	(c)	Discuss the Palmgren- Miner rule for life prediction for completely reversed variable amplitude loading.	**07**

OR

Q.3	**(a)**	Explain the Maximum Principal strain theory.	**03**
	(b)	Explain the Larson-Miller Parameters for creep deformation with diagram.	**04**
	(c)	Derive the following condition for "failure is predicted to occur if (FIPTOI)".	**07**

$$\sum_{j=1}^{n} \frac{n_j}{N_j} \geq 1$$

Q.4	**(a)**	Describe the usual consequences of surface fatigue.	**03**
	(b)	Why should we evaluate the SIF for a crack in a component?	**04**
	(c)	Explain the terms: (i) Fracture toughness (ii) Stress intensity factor (iii) Fatigue crack propagation.	**07**

OR

Q.4	**(a)**	Distinguish the difference between high-cycle fatigue and low-cycle fatigue.	**03**
	(b)	Draw creep curve "strain versus time" and write three points of discussion on.	**04**
	(c)	Explain contact seals and non-contact seals.	**07**

Q.5 **(a)** Define (1) Fretting fatigue and (2) Fretting wear **03**

(b) Explain three-stage gear deformation under load attached with a foundation with neat sketch. **04**

(c) Discuss different types of materials used for Mechanical Housings. **07**

OR

Q.5 **(a)** What is stress concentration? State the causes for the same. **03**

(b) Differentiate between Split and Non-split Mechanical housing. **04**

(c) Explain housings split at right angle to the axes of the shafts with suitable example. **07**

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