Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code: 2710801 Date:14/05/2015

Subject Name: Advanced Machine Design

Time: 10:30 am to 1:00 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)** Define Wear and discuss different mechanism of wear. **07**

(b) Explain plane state of strain along with its mathematical expressions. **07**

Q.2 **(a)** Explain the concept of design for X (DFX) along with steps for implementing a DFX strategy. **07**

(b) What is stress concentration? Explain methods for reducing stress concentration with suitable sketches. **07**

OR

(b) Discuss various factors for material selection. **07**

Q.3 **(a)** Define octahedral normal stress and octahedral shear stress. **07**
Derive;

$$\sigma_{oct} = \frac{1}{3}(\sigma_1 + \sigma_2 + \sigma_3)$$

$$\tau_{oct} = \frac{1}{3}\left[(\sigma_1 - \sigma_2)^2 + (\sigma_2 - \sigma_3)^2 + (\sigma_3 - \sigma_1)^2\right]^{1/2}$$

(b) ñThin plate is tougher in comparison to thick plateò, justify the statement with reference to fracture mechanics. **07**

OR

Q.3 **(a)** Component of strain tensor at a point in a body are given by; $\mathring{U}_{xx}$ = 0.005, $\mathring{U}_{yy}$ = 0.004, $\mathring{U}_{zz}$ = -0.002, $\mathfrak{I}_{xy}$ = 0.001, $\mathfrak{I}_{yz}$ = 0.0005 and $\mathfrak{I}_{zx}$ = 0.002. If E = 2 x 10^5 MPa and ɜ = 0.25, determine components of stress tensor. **07**

(b) Based on Griffithôs analysis derive that stress required to advance a crack of length *2a* for plane stress cases is; **07**

$$\sigma_C \geq \left[\frac{2E\gamma}{\pi a}\right]^{1/2}$$

Where, ɔ is surface energy per unit area of one surface and E is Youngôs modulus.

Q.4 **(a)** A steel bar is subjected to two dimensional stresses; the tensile stress along the X-axis varies from 45 MPa to 100 MPa, whereas the tensile stress along the Y-axis varies from 5 MPa to 75 MPa. The corrected endurance strength of component is 260 MPa. The ultimate tensile strength is 650 MPa. Determine the factor of safety by maximum distortion energy theory. Use the Goodmanôs fatigue criterion for failure. **07**

(b) Define fatigue life, enlist the various fatigue life methods and explain any one. **07**

OR

Q.4 **(a)** The work cycle of a mechanical component is subjected to a complete reversed bending stresses consisting of the following three elements; ± 350 N/mm^2 for 85% of time, ± 500 N/mm^2 for 3% of time and ± 400 N/mm^2 for remaining time. If corrected endurance strength is 280 N/mm^2 and ultimate strength 660 N/mm^2, Determine its life. **07**

(b) Define creep and discuss significance of creep curve in design along with its mathematical representation. **07**

Q.5 **(a)** (i). Define three modes of fracture with the help of neat sketch. **03**

(ii). Discuss R-curve for ductile material and brittle material. **04**

(b) (i). Discuss effect of roughness, velocity and lubrication on friction. **03**

(ii). Explain types of lubrication using Stribeck curve. **04**

OR

Q.5 **(a)** Enlist the various theories of failure and explain any two of them in detail. **07**

(b) (i). Explain curved surface contact stresses in brief. **03**

(ii). The ball and socket joint at the end of a rocker arm is shown in figure 1. **04**
What maximum contact stress will result from a load of 2000 N?
For steel ball material; E = 207 GPa and ɜ = 0.30
For Bronze material; E = 110 GPa and ɜ = 0.33

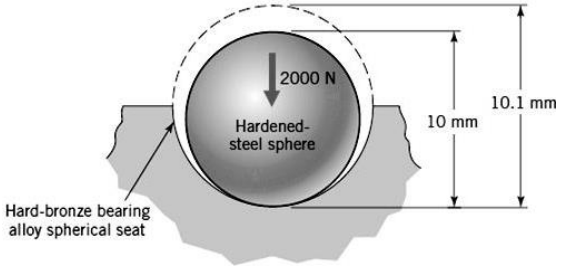

Figure 1

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