GUJARAT TECHNOLOGICAL UNIVERSITY
ME – SEMESTER – I (New)– EXAMINATION – WINTER-2019

Subject Code: 3710909   **Date: 07-01-2020**

**Subject Name: Advance Stress Analysis**

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)** (i). Discuss Von Mises' or distortion energy criteria.   **03**

(ii). Stress analysis of spacecraft structure member gives the state of stress **04** shown in figure. If part is made from 7075-T6 aluminum alloy with $\sigma_0 = 500$ MPa, will it exhibit yielding? If not, what is factor of safety?
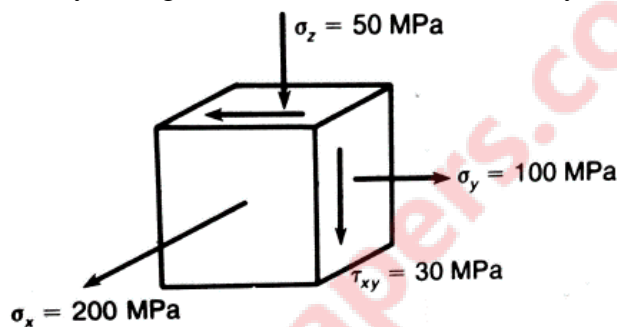

(b) If the state of stress is such that $\sigma_x = \sigma_x = \sigma_x = \tau_{xy} = \tau_{xy} = \tau_{xy} = \rho$, determine **07** principal stresses and their directions. Also interpret the results.

Q.2 **(a)** (i). Represent various ideal stress-strain diagrams.   **03**

(ii). Discuss various stress strain relations for plastic deformation.   **04**

(b) Discuss the first theorem of Castigliano.   **07**

OR

(b) Determine deflection at end A of the cantilever beam shown in figure using **07** elastic energy.
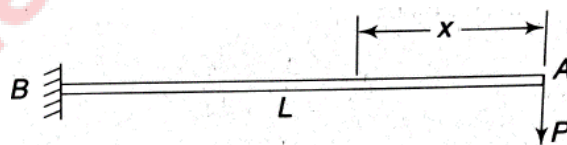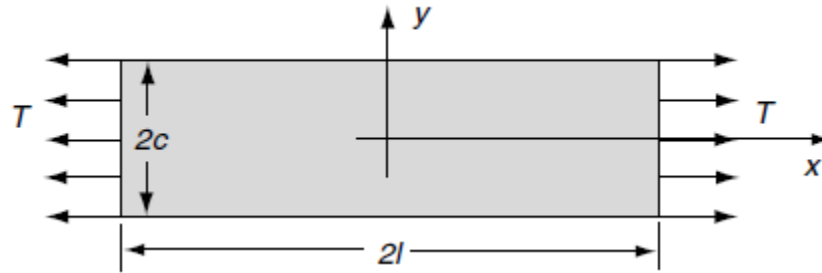

Q.3 **(a)** Derive the Navier equation of displacement equilibrium.   **07**

(b) Express all boundary conditions for each of the problems illustrated in the **07** figures.
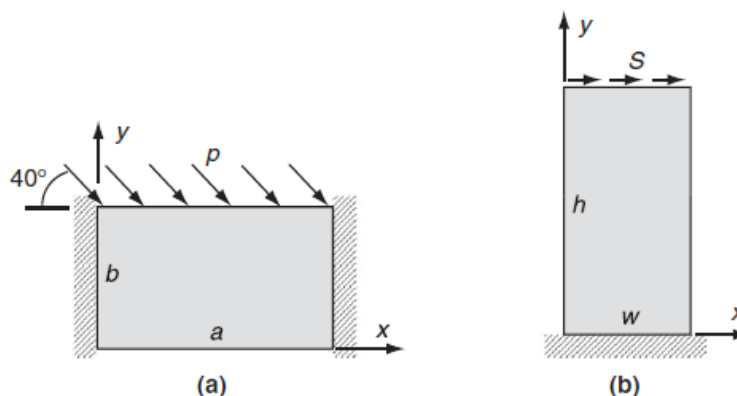

OR

Q.3 **(a)** Derive the biharmonic equation of elasticity considering the body forces. **07**

(b) Determine the two dimensional displacement functions for the following problem. **07**

Q.4 **(a)** Prove that the sum of the curvatures in any two mutually perpendicular directions in a slightly bent plate is constant. **07**

(b) Derive the stress curvature relationship in Cartesian coordinate system. **07**

OR

Q.4 **(a)** Prove that the direction of zero slope and the direction of maximum slope are at right angles to each other. **07**

(b) Determine the deflection and moments at any point in a circular plate supported throughout along its outer edge and subjected to uniform moment. **07**
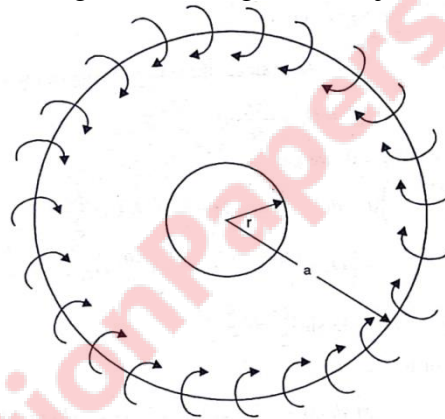
Q.5 **(a)** Explain following relative motions of the surfaces: Rolling, Sliding and Spin. **07**

(b) Derive the stress-optic law. **07**

OR

Q.5 **(a)** Discuss strain-gauge linearity, hysteresis and zero shifts. **07**

(b) Explain the concept of temperature compensation and signal addition in the potentiometer circuit. **07**

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