Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) - EXAMINATION – SUMMER 2017

Subject Code: 2171916 **Date: 29/04/2017**

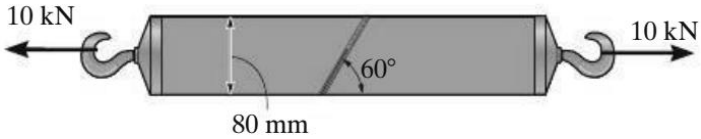
Subject Name: Applied Mechanics of Solid(Department Elective - I)

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.**

Q.1 **(a)** The 25-mm thick rectangular bar is subjected to the axial load of 10 kN. If the bar is joined by the weld, which makes an angle of 60° with the horizontal, determine the shear stress parallel to the weld and the normal stress perpendicular to the weld. **07**



(b) Enlist theory of failures and explain any two. **07**

Q.2 **(a)** The stresses are defined in *xy* system are $\sigma_x = 40MPa$, $\sigma_y = -30MPa$, and $\tau_{xy} = -20MPa$. A new coordinate system *x'y'* is obtained by rotating *xy* system, by 30 degrees @ Z-axis in counter-clockwise direction. Determine $\sigma_{x'}$, $\sigma_{y'}$, and $\tau_{x'y'}$ and stress invariants. **07**

(b) Derive equation of Principal stresses in 2D. **07**

OR

(b) Relative to *xyz* coordinate system, a state of stress at a point in a structure is given by: **07**

$$\sigma = \begin{bmatrix} 25 & 10 & 15 \\ 10 & 0 & 0 \\ 15 & 0 & -20 \end{bmatrix} \text{ MPa. The } x'y'z' \text{ system is defined by: } \frac{1}{9}\begin{bmatrix} 1 & -8 & 4 \\ 4 & 4 & 7 \\ -8 & 1 & 4 \end{bmatrix}$$

Determine: Stress matrix in *x'y'z'* system.

Q.3 **(a)** Explain following terms: Stress Invariants, Octahedral Stresses, Strain Hardening. **07**

(b) Write and discuss incremental constitutive relation for elastic – plastic material. Also state basic assumptions for the theory. **07**

OR

Q.3 **(a)** Derive Biharmonic equation in Polar coordinate. **07**

(b) Derive stress distribution using Airy's stress function in a simply supported beam subjected to pure bending. **07**

Q.4 **(a)** State stress compatibility equations in 2D and explain their significance. **07**

(b) With the help of neat sketch, explain strain measurement using Digital Image Correlation technique. **07**

OR

Q.4	**(a)**	Explain the Principle of virtual work and prove the relation for elastic solids.	**07**
	(b)	Explain convexity, normality and uniqueness for work hardening materials.	**07**
Q.5	**(a)**	Discuss flow rules associated with von Mises yield function for perfectly plastic material.	**07**
	(b)	For nonlinear elastic solid with isotropic behaviour, derive Cauchy stress and Green strain relations.	**07**

OR

Q.5	**(a)**	Explain material stability, convexity, normality and uniqueness for elastic solids.	**07**
	(b)	Explain the procedure of stress transformations using Mohr's circle.	**07**

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