

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-VII (NEW) EXAMINATION – WINTER 2018****Subject Code: 2171916****Date: 15/11/2018****Subject Name: Applied Mechanics of Solid****Time: 10:30 AM TO 01:00 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 state of stress at a point. **03**  
(b) Justify the statement “Principal planes are orthogonal.” **04**  
(c) The state of stress at a point is characterized by the components **07**

$$\sigma_x = 100 \text{ MPa}, \sigma_y = -40 \text{ MPa}, \sigma_z = 80 \text{ MPa}, \tau_{xy} = \tau_{yz} = \tau_{zx} = 0$$

Determine the extremum values of shear stresses, their associated normal stresses, octahedral shear stress and its associated normal stress.

- Q.2** (a) Write the use of FOS in design. **03**  
(b) List out the theories of failure and explain any one of them. **04**  
(c) Explain strain deviator and its invariants. **07**

**OR**

- (c) Derive differential equations of equilibrium. **07**  
**Q.3** (a) Define the state of pure shear. **03**  
(b) Explain the plane stress and plane strain. **04**  
(c) Explain Airy stress function in polar coordinates. **07**

**OR**

- Q.3** (a) Explain Circular Polariscopes. **03**  
(b) What do you mean by the principal of virtual work? **04**  
(c) Explain the Mohr's circle for three dimensional state of stress. **07**

- Q.4** (a) Write equilibrium equations for plane stress state. **03**  
(b) Explain stress strain relation in terms of plastic flow **04**  
(c) The cubic element is subjected to the following state of stress **07**

$$\sigma_x = 100 \text{ MPa}, \sigma_y = -20 \text{ MPa}, \sigma_z = -40 \text{ MPa}, \tau_{xy} = \tau_{yz} = \tau_{zx} = 0$$

Assume the material is homogenous and isotropic. Determine the principal shear strains and octahedral shear strain, take  $E = 2 \times 10^5$  MPa and  $\nu = 0.25$ .

**OR**

- Q.4** (a) Explain Bouschinger effect. **03**  
(b) Write a short note on octahedral stresses. **04**  
(c) Explain the stress integration of Drucker - Prager material model **07**

- Q.5** (a) What do you mean by principal of super position? **03**  
(b) Explain the general nature of yield locus. **04**  
(c) Derive Saint Venant's equations of compatibility. **07**

**OR**

- Q.5 (a) Describe the term Strain Hardening. [www.FirstRanker.com](http://www.FirstRanker.com) [www.FirstRanker.com](http://www.FirstRanker.com) 03  
(b) Explain the work hardening of a material. 04  
(c) Explain Normality, Convexity and Uniqueness for an elastic solid. 07

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