

*Work out all parts of a question in continuous sequence at one place*

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Q1) The stress at a point in a material is given as following:

$$\sigma_x = 150 \text{ MPa}, \sigma_y = -100 \text{ MPa}, \sigma_z = 200 \text{ MPa}$$

$$\tau_{xy} = \tau_{yx} = 75 \text{ MPa}, \tau_{yz} = \tau_{zy} = 30 \text{ MPa}, \tau_{xz} = \tau_{zx} = -50 \text{ MPa}$$

For a plane passing through the point whose normal is coincident with the x-axis, find the magnitude of

- a) Normal stress
- b) Shear stress
- c) Resultant stress

[7+6+7=20]

Q2) Using energy method, determine the y component of deflection of the point B shown for the slender semi-circular cantilever beam shown in Figure Q2. The beam is of square cross section with area  $100 \text{ mm}^2$  and radius of curvature  $R = 100 \text{ mm}$ . The material of the beam is Steel with  $E = 200 \text{ GPa}$  and Poisson Ratio  $\nu = 0.3$

[20]

Q3) A structural Z section is welded to a horizontal reinforcement plate as shown in Figure Q3.

- a) Locate the centroid "C" of the cross section in terms of  $\bar{y}$
- b) Determine  $I_{xx}$ ,  $I_{yy}$ ,  $I_{xy}$  about C for the composite section
- c) Locate orientation of the principal axis of the composite section with respect to the y axis

[6+7+7=20]