

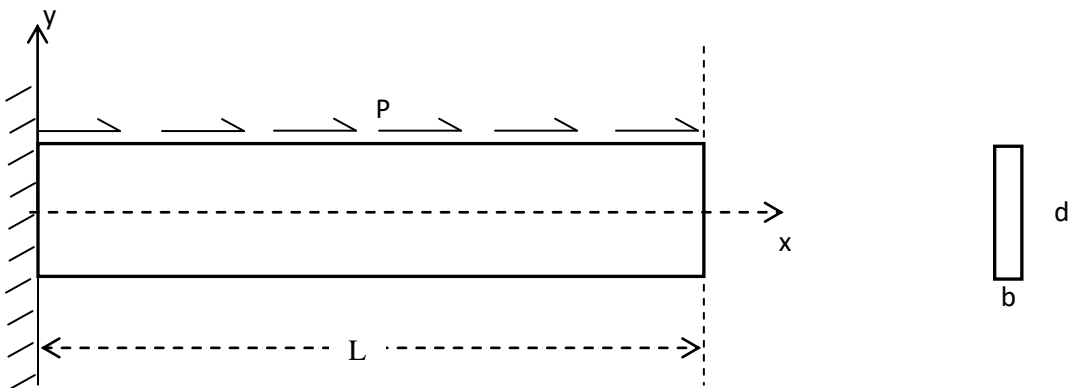
BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI  
 First Semester (2016-2017), Mid-Semester Examination  
 Course: Advanced Structural Mechanics and Stability(CE G552)

Date: 3<sup>rd</sup> Oct. 2016(Room:2204)

Max. Marks: 50

Duration: 9:00AM-10:30AM

- Q.1. The cantilever shown in the **Fig.1** below is loaded with a tangential shear pressure ( $p$ ) at the top boundary. The Airy's stress function is proposed as  $\phi(x, y) = C_1xy + C_2xy^2 + C_3xy^3 + C_4y^2 + C_5y^3$ . Find out the constants of the stress function which satisfy the compatibility condition and the traction boundary conditions. Find the displacement functions of the cantilever. [15]



**Fig.1** Cantilever loaded with tangential shear pressure at the top boundary

- Q.2. The state of stress at a point in an operating structural component with respect to xyz-coordinate system is given as,

$$[\sigma] = \begin{bmatrix} 350 & 200 & 100 \\ 200 & 0 & -50 \\ 100 & -50 & 0 \end{bmatrix} \text{ Mpa.}$$

Find, the octahedral shear stress and its orientation with respect to xyz-axes system. [15]

- Q.3. What is meant by plane stress condition and plane strain condition? Derive the material stiffness matrices to be used to solve these kind of problems considering the isotropic case using the generalized Hooke's law. [10]

- Q.4. The nonzero stress distribution in a structural part is given as,

$$\sigma_{xx} = 3x^2 + Axy - 8y^2$$

$$\sigma_{yy} = 2x^2 + xy + By^2$$

$$\tau_{xy} = -0.5x^2 - 6xy - 2y^2$$

$$\tau_{yz} = -x^2 - 20xy - Cy^2$$

$$\tau_{xz} = x^2 - 2.5xy$$

Find the values of A, B and C if the stress distributions are to satisfy the equilibrium condition. [10]