13085 : Theory of Elasticity and Elastic Stability : 1 SFSE 2

P. Pages : 1

Time : Three Hours

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Max. Marks : 80

Notes : 1. Answer **three** question from Section A and **three** question from Section B.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Use of pen Blue/Black ink/refill only for writing the answer book.

SECTION - A

1. a) Explain plane stress and plane strain condition. 7

   b) Differentiate between isotropic and orthotropic materials. 7

2. Derive the compatibility conditions in terms of stress for a general 3D stress analysis. 13

3. Investigate the stress condition represented by the following. 13

   i) $\phi = Ax^3$

   ii) $\phi = By^3$

   iii) $\phi = A(x^4 - 3x^2y^2)$

4. What is Airy's stress function. Derive the expression. 13

$$\frac{\partial^4 \phi}{\partial x^4} + 2\frac{\partial^4 \phi}{\partial x^2 \cdot \partial y^2} + \frac{\partial^4 \phi}{\partial y^4} = 0$$

5. Derive the expression for differential equation for lateral buckling of a beam. 13

SECTION - B

6. a) Derive the expression for Cripling load for a column fixed at one end and free at other end. 9

   b) What is stable, unstable and neutral equilibrium. 5

7. Derive the expression for buckling of a simply supported rectangular plate compressed in one direction. 13

8. Evaluate the expression for strain energy due to saint Venant and warping torsion combination. 13

9. Explain Rayleigh-Ritz method taking shape function as $Y = Cx^2 + Dx^3$ for a one end fixed and other end free column condition. 13

10. Explain Galerkin method to find the critical load that one end fixed and other end hinged column can carry consider $Y = A\left(xL^3 - 3x^3L + 2x^4\right)$ 13

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