U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

February / March 2023 Semester End Main Examinations

Programme: B.E. **Semester: V**
Branch: Civil Engineering **Duration: 3 hrs.**
Course Code: 20CV5PETOE **Max Marks: 100**
Course: Theory of Elasticity **Date: 03.03.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

B.M.S.C.E. - ODD SEM 2022-23

UNIT - I

1 a) Derive the equation of equilibrium for three dimensional problems in Cartesian coordinates. **10**

b) A body is subjected to three dimensional forces and the state of stress a a point is represented as **10**

$$\begin{bmatrix} 150 & 150 & 150 \\ 150 & 75 & 150 \\ 150 & 150 & -75 \end{bmatrix} MPa$$

Determine the normal stress, shearing stress and resultant stress on the octahedral plane.

UNIT - II

2 a) Define a strain rosette and explain the different types of strain rosette. **03**

b) The displacement components in a strained body are as follows $u = 0.01xy + 0.03y^2$, $v = 0.03x^3y+0.02z^2$ and $w = 0.02xy^2 + 0.06z^3y$, Determine the strain components at the point P(4, 5, -6) **08**

c) Given the equiangular strain rosette measurements are $\varepsilon_1 = 3x10^{-4}$, $\varepsilon_2 = 2.5x10^{-4}$ and $\varepsilon_3 = 2x10^{-4}$. Determine the principal strain and their directions. **09**

UNIT - III

3 a) Explain plane-stress and plane-strain conditions. Derive stress strain relation for plane-stress condition. **10**

b) Derive the compatibility equation for plane stress problem in Cartesian coordinate system **10**

UNIT - IV

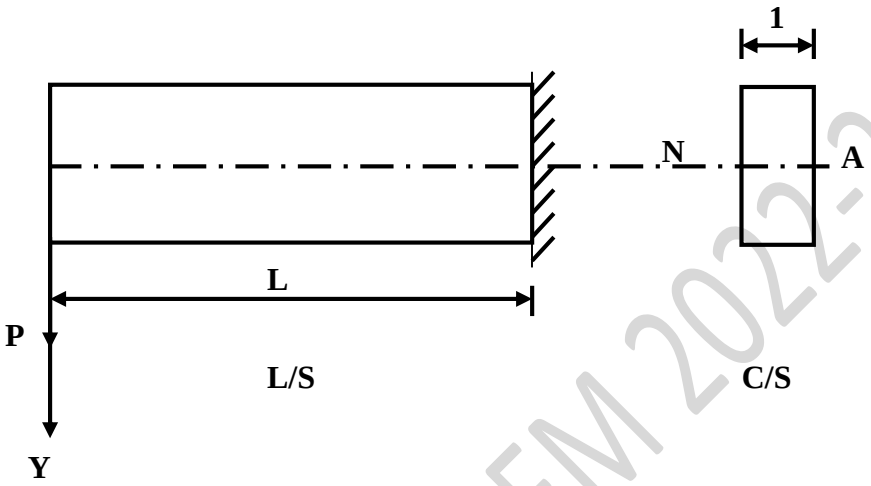
4 A cantilever of uniform rectangular section and depth 2C is subjected to a point load P at its free end, using the following condition **20**

At $x = L \quad y = 0 \quad u = v = 0$

At $x = L \quad y = \pm c$

Show that the deflection is given by

$$v_{\substack{x=0\\y=0}} = \frac{PL^3}{3EI}\left\{1+\frac{1}{2}(4+5\mu)\frac{c^2}{L^2}\right\}$$



OR

5 Derive an expression for radial and hoop stress in a thick cylinder subjected to internal and external pressure. Also derive expression for radial and hoop stresses when the cylinder subjected to only internal pressure. **20**

UNIT - V

6 Show that the maximum stress concentration for an infinite plate with a circular hole $\sigma_\theta = 3\sigma_0$ when the plate is subjected to uniform tension far away from the hole. **20**

OR

7 a) A thick cylinder of inner radius 10 cm and outer radius 15 cm is subjected to an internal pressure of 12 MPa. Determine the radial and hoop stresses in the cylinder at the inner and outer surfaces. **10**

b) Given the stress function in polar coordinates determine the stress components and check for compatibility. **10**

$$\phi = \frac{P}{\pi} r\theta \cos\theta$$

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