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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Second Semester, M. Tech - Civil Engineering (MCAD)

Semester End Examination; June - 2016

Structural Stability Analysis Classical and FE Approach

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer **FIVE** full questions, selecting **ONE** full question from each unit.*
ii) Assume missing data if any.

UNIT - I

1. Derive the expression for lateral deflection of a beam column of length L, subjected to an eccentric concentrated load "Q" and an axial load "P". Assume the deflection curve is represented by a trigonometric series. Also determine the deflection at the centre of the beam. 20

2. Derive the fourth order differential equation for bending of a beam column. In the absence of lateral load, using this fourth order differential equation, determine the critical load for fixed free column. Also check when the column fail first by yield or elastic buckling. E = 210 GPa, y = 260 MPa, L = 3 m and rectangular in cross section b = 230 mm, d = 300 mm. 20

UNIT - II

3 a. Determine the critical load for hinged-hinged column by using energy method. 10

b. Show that the actual strain energy is 1.20 times the average strain energy, due to shear for a rectangular cross section. 10

4. Derive the partial differential equation of motion for a column subjected to an axial pulsating load. Assuming harmonic form of motion. Also derive Mathieu type differential equation. 20

UNIT - III

5. Using shape functions for a two noded Eular Bernoulli beam element in flexure, derive the geometric stiffness coefficient kg_{ij} for i = 1, 2, and j = 2, 3, 4. 20

6. Determine the critical load for a fixed-fixed column by discritising it into two elements and compare the answer with close form solution. Take length of each element is 2 m and flexural rigidity EI = 10 N-m^2. 20

UNIT - IV

7. Determine the critical load for cantilever beam subjected to concentrated load W applied at the centroid of the end cross section. The cross section beam is rectangular against lateral buckling. 20

8. Derive the expression for warping displacement for pure torsion of thin walled open section. Also sketch the variation of warping along the middle line of cross section. 20

Contd…2

UNIT - V

9. Derive the expression for the critical load for rectangular plate subjected to in-plane load N_x in one direction. Assume plates are simply supported along its four edges. 20

10. Derive the characteristic equation for a rectangular plate simply supported along two opposite sides perpendicular to the direction, and support conditions for the other pair of edges is built in. 20

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