***U.S.N*** | | | | | | | | | | |

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

***(An Autonomous Institution affiliated to VTU, Belagavi)***

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

**Semester End Examination; June - 2017**

**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 suitable data, if any.*

## UNIT - I

1 a. Derive the governing differential equation for a beam-column. 10

b. Derive an expression for deflection of the simply supported beam column subjected to an udl of *q*/unit length and an axial compressive load P. Length of the beam is L. 10

2. Using the fourth order differential equation, determine the first three critical loads for :
i) Pinned-Pinned column 20
ii) Fixed-Fixed column.

## UNIT - II

3. Determine the critical load for a cantilever column subjected to uniformly distribute axial load. 20

4. Determine the expression for the foundation modulus β at which the number of half waves switches over from *m* to *m+1* for a simply supported beam subjected to an axial compressive load P and resting on an elastic foundation. Also plot the variation of critical load and foundation modulus. 20

## UNIT - III

5. Determine the buckling load for the portal frame fixed at the support as shown in Fig.1

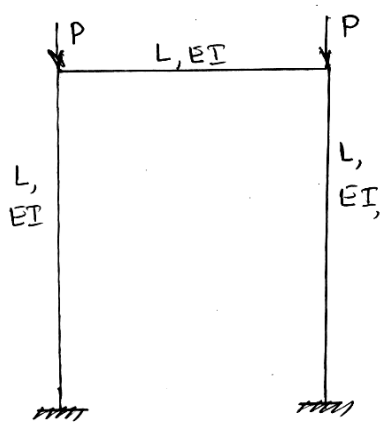


Fig. 1

20

6. Using the shape function of the two noded Euler Bernoulli beam element, derive elastic stiffness coefficient $K_{ij}$ and geometric stiffness coefficient $Kg_{ij}$ for i = 1, 2 and j = 1, 2, 4. 20

Contd…2

**UNIT - IV**

7. Determine the critical moment for an I-section beam subjected to pure bending against lateral buckling. 20

8. Derive an 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

**UNIT - V**

9. Determine the buckling load for a rectangular plate under the action of shearing stresses. 20

10. Derive the expression for the critical loads for rectangular plate subjected to in-plane loads in two directions. Assume the plates are simply supported along its four edges. 20

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