Code No: **RT41033** **R13** **Set No. 1**

**IV B.Tech I Semester Supplementary Examinations, February - 2019**

# FINITE ELEMENT METHODS

**(Common to Aeronautical Engineering, Automobile Engineering and Mechanical Engineering)**

**Time: 3 hours** **Max. Marks: 70**

***Question paper consists of Part-A and Part-B***
***Answer ALL sub questions from Part-A***
***Answer any THREE questions from Part-B***
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## PART–A *(22 Marks)*

1. a) Write the advantages and applications FEM. [4]
   b) Discuss the local and global coordinates. [4]
   c) Derive the equivalent load vector of beam element for UDL case. [3]
   d) Discuss the plane stress and plane strain case. [4]
   e) Discuss the axisymmetric formulation. [3]
   f) Discuss the consistent mass matrix and lumped mass matrix. [4]

## PART–B *(3x16 = 48 Marks)*

2. a) By using stress strain relations derive the D matrix for three dimensional case. [8]
   b) Derive the expression to calculate the maximum deflection in a beam of length L with a point load P acting at the center by using Rayleigh Ritz method. Take moment of inertia as I and young's modulus as E. [8]

3. a) Discuss how penalty approach is used in handling specified displacement boundary conditions. [8]
   b) In the figure 3 (b) shown, a load P = 60 X $10^3$ N is applied. Determine the displacement field , stress and support reactions in the body. Take E = 20 X $10^3$ N/$mm^2$.

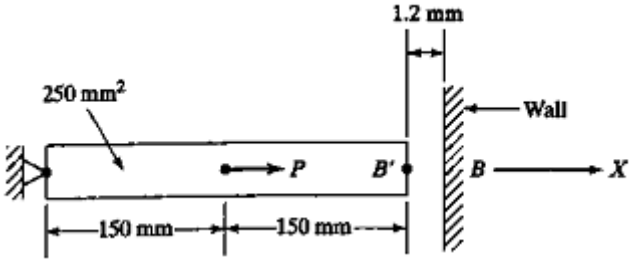


Figure 3 (b)

[8]

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4. For the beam shown in the figure 4, determine the slopes at node 2 and node 3 and vertical deflection at the midpoint of the distributed load.

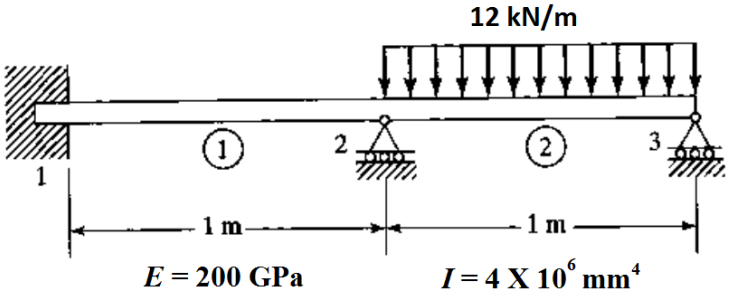


Figure 4 [16]

5. a) Derive the strain displacement matrix of a constant strain triangle element. [8]
   b) For the triangular element shown in the figure 5 (b), obtain the strain – displacement relation matrix and determine the strains $\varepsilon_x$, $\varepsilon_y$ *and* $\gamma_{xy}$.

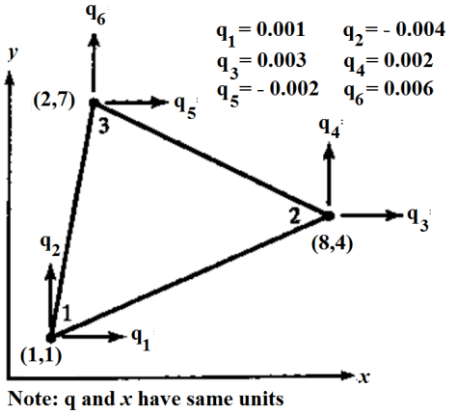


Figure 5 (b) [8]

6. a) Derive the stiffness matrix of one dimension quadratic element. [10]
   b) Discuss the Isoparametric, subparametric and super parametric elements. [6]

7. Determine the Eigen values and Eigen vectors of the bar shown in figure 7 Take E=200 GPa, $\rho$ = 2800 kg/m$^3$, A=0.258 m$^2$, and L=0.4 m.

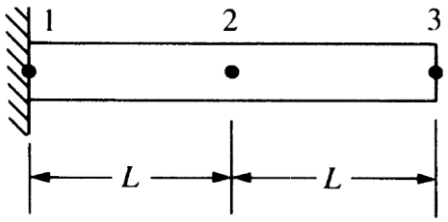


Figure 7 [16]