Code No: R1941032 **R19** **Set No. 1**

IV B.Tech I Semester Advance Supplementary Examinations, March - 2023

FINITE ELEMENT METHODS

(Common to Mechanical Engineering and Automobile Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any FIVE Questions
ONE Question from Each unit
All Questions Carry Equal Marks

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UNIT–I

1 a) Find the approximate deflection of a simply supported beam of length '*L*' subjected to a point load '*p*' at the centre of the span using the Rayleigh–Ritz method. [10]

b) Discuss about plane stress and plane strain. Give examples for each case. [5]

(OR)

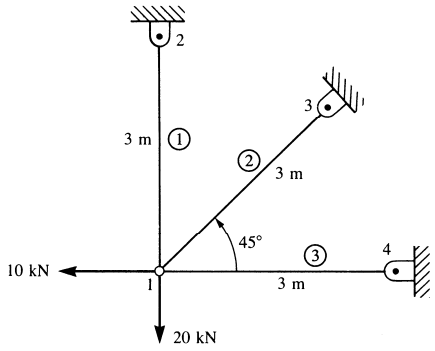
2 a) Explain penalty method for treatment of boundary conditions. [7]

b) Explain the factors to be considered in selecting interpolation functions. [4]

c) Write a note on local and global node numbering. [4]

UNIT–II

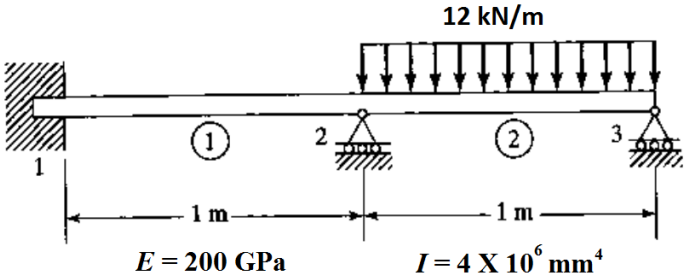
3 For the plane trusses shown in Figure, determine the horizontaland vertical displacements of node 1, stresses in each element and support reactions. All elementshave E = 210 GPa and A = 4 x 10^{-4} m^2.



[15]

(OR)

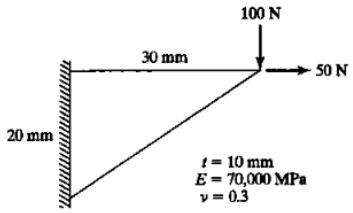
4 For the beam shown in the figure, determine the slopes at node 2 and node 3 and vertical deflection at the midpoint of the distributed load.



[15]

UNIT–III

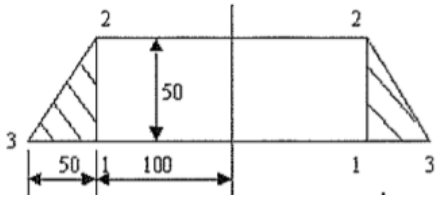
5 Determine the deflection at the point of load application and element stress using one element model. Consider plane stress condition.



[15]

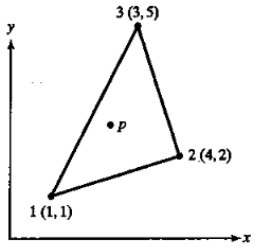
(OR)

6 a) An axi-symmetric ring element is shown in the figure. Derive the matrices [B] and [D]. Take E= $2X10^5$ N/mm^2 and μ=0.3. All dimensions are in mm.



[10]

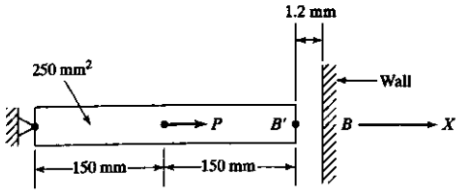
b) For a point P located inside the triangle, the shape functions N1 and N2 are 0.15 and 0.25 respectively. Determine x and y coordinates of point P.



[5]

UNIT–IV

7 A load P = 60 x 10^3 N is applied as shown. Determine the displacement field, stress and support reactions in the body. Take E = 20 x 10^3 N/mm^2. Use two 1D Quadratic elements for discretization and solve the problem.



[15]

(OR)

8 a) Derive the shape functions of 1D cubic element in natural coordinates. [4]

b) Derive the shape functions of two dimensional four noded quadrilateral element. [5]

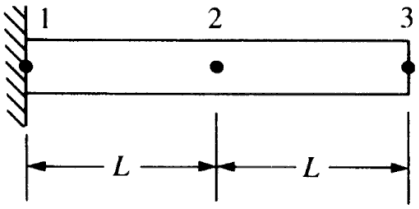
c) Evaluate the integral by two and three point gauss quadrature rule.

$$I = \int_{-1}^{1} x^3 - 2x^2 + 5x - 7 \; dx$$

[6]

UNIT – V

9 Determine the Eigen values and Eigen vectors of the bar shown in figure. Take E=200 Gpa, ρ = 7862 kg/m^3, A=6 cm^2 and L=2.5 m.

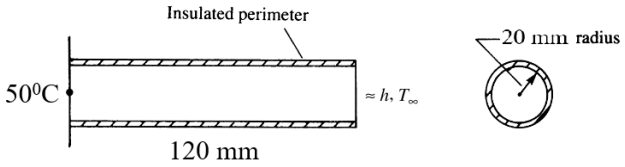


[15]

(OR)

10 a) Define lumped mass and consistent mass. Derive the consistent mass matrix of 2 node bar element. [5]

b) Determine the temperature distribution along the length of the solid rod shown in Figure with an insulated perimeter. The temperature at the left end is a constant 50^{0}C and the free-stream temperature is 20^{0}C.
Let h = 25 W/m^2 ^{0}C and K = 20 W/m ^{0}C. Consider 3 element model.



[10]