Code: 13A01606

R13

B.Tech III Year II Semester (R13) Regular Examinations May/June 2016

FINITE ELEMENT METHODS IN ENGINEERING

(Civil Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) List out advantages of FEM.
(b) Define plane stress with a suitable example.
(c) Differentiate between global and local axes.
(d) What is geometric invariance?
(e) What are the properties of stiffness matrix?
(f) What is shape function and state their properties?
(g) Define Iso-parametric element and state their purpose.
(h) What is an Axi symmetric element and state usage?
(i) What is static condensation?
(j) Write about solution technique for static loads.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) Explain the different steps involved in FEM.

(b) Find out deflection at centre of a simply supported beam of span length (l) subjected to uniformly distributed load throughout its length of intensity w per unit length. Use Rayleigh Ritz method. Take EI is constant.

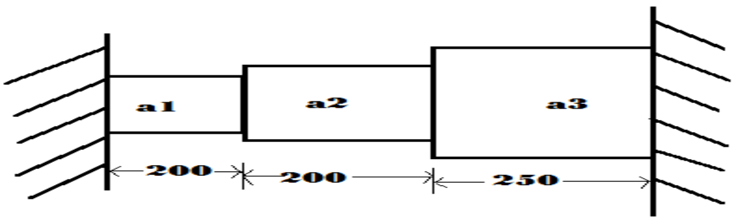
OR

3 (a) Write about stress-strain relationship in matrix form for a plane stress element.

(b) If a displacement field is described by $u = (x^2 - 2y^2 + 6xy)10^{-4}$ and $v = (6x + 3y)10^{-4}$, Determine ε_x, ε_y and γ_{xy} at the point x = 2 and y = 1.

UNIT – II

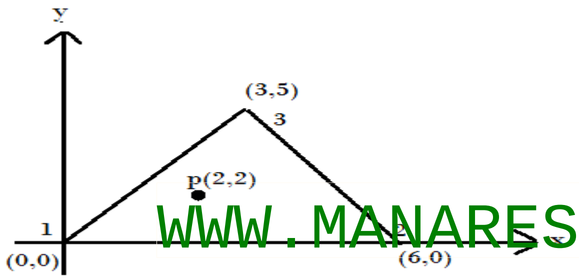
4 For the stepped bar shown in the figure below, determine the nodal displacements, element stress and support reactions. Take P = 500 kN, E = 210 GPa, $a_1 = 200\ mm^2$, $a_2 = 300\ mm^2$ and $a_3 = 500\ mm^2$.



OR

5 (a) Differentiate between CST and LST elements.

(b) Evaluate the shape functions N_1, N_2 and N_3 at the interior point P for the triangular element shown in the figure below.



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UNIT – III

6 Determine the stiffness matrix, for the plane stress element as shown in figure above. Take E = 200 GPa, and μ = 0.3, thickness of element = 10 mm.

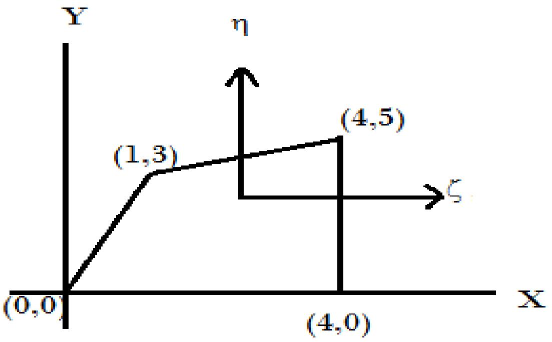
OR

7 (a) Determine the shape functions for a constant strain triangular element using area co-ordinates.

(b) Derive the strain-displacement matrix (B-matrix) for plane stress analysis of three node triangular element.

UNIT – IV

8 Evaluate the Jacobian matrix at the local co-ordinates ζ, η are (0, 0) for the element shown in the below.



OR

9 The nodal co-ordinates for an axisymmetric triangular element are given as: r_1 = 0, r_2 = 25, r_3 = 30, z_1 = 0, z_2 = 0 and z_3 = 40 mm respectively. Determine the strain-displacement matrix for the element.

UNIT – V

10 (a) What is meant by Newton-Cotes Numerical integration?

(b) Write briefly about "Gauss –Quadrature method".

OR

11 Evaluate the Integral $I = \int_{-1}^{1}(3e^x + x^2 + \frac{1}{(x+2)})$ using one point and two point Gauss quadrature. Compare this with exact solution

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