R09

Code No: 56017

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year II Semester Examinations, November/December - 2015

FINITE ELEMENT METHODS

(Common to ME, AE, MSNT)

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

Answer any five questions

All questions carry equal marks

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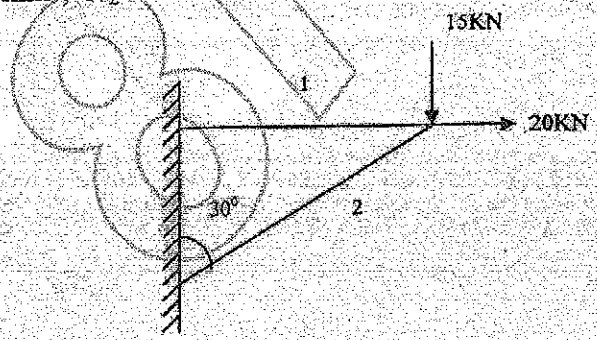
1 a) State the principle of minimum potential energy.

b) Solve the differential equation using Raleigh-Ritz method and Galerkin's method. Compare the solution. $(d^2\phi / dx^2) + \phi + x = 0$, $0 \le x \le 1$ subjected to the boundary conditions $\phi(0) = \phi(1) = 0$. [7+8]

2. A stepped bar fixed at both ends rigidly. Starting from left first step of the bar is of 300 mm length, cross sectional area of 2400 mm^2 and young's modulus is 70 GPa. Second step immediately follows first step and is of length 400 mm, cross sectional area is 600 mm^2 and young's modulus is 200 GPa. Determine nodal displacement.[15]

3. For the pin jointed truss as shown in the figure. Determine: Element stiffness matrices, Global stiffness matrix, Stresses in the elements 1 and 2, Displacements at all nodes, and Support reactions. Assume E = 200 GPa, L_1 = 750 mm, L_2 = 900 mm, A_1 = 100mm^2, A_2 = 1250mm^2. [15]



Figure

4. Derive shear force and bending moment relations for beam element. [15]

5. A triangular element is specified with the nodal coordinates 1(1, 1), 2(5, 2), 3(3, 6), for a point 'P' located inside the triangle. The shape functions N_1 and N_3 are 0.2 and 0.45, respectively. Determine:
a) The x, y coordinates of the point P.
b) Determine the shape function N_1, N_2, N_3 at a point Q (3,3). [15]
c) Determine the Jacobian matrix.

6. Derive the shape functions for the following:
a) 6 noded triangular element.
b) 8 noded quadrilateral element.
c) 4 noded isoparametric quadrilateral element. [15]

7. A composite slab consists of 3 materials of different conductivities i.e. 20W/m K, 30 W/m K, 50 W/m K of thickness 0.3 m, 0.15 m and 0.15 m, respectively. The outer surface is 20^0 C and the inner surface is exposed to the convective heat transfer coefficient of 25 W/m^2 K, 800^0C. Determine the temperature distribution within the wall. [15]

8. Write short notes about the following.
a) Skyline assembly
b) Higher order elements
c) Eigen values and eigen vectors. [5+5+5]

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