R09

Code No: 56017

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, May - 2019
FINITE ELEMENT METHODS
(Common to ME, AE)

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

Answer any five questions
All questions carry equal marks
- - -

1.a) Explain in detail about different weighted residual methods with examples.
b) Use the Rayleigh-Ritz method to find the displacement of the mid-point of the rod shown in figure 1. [7+8]

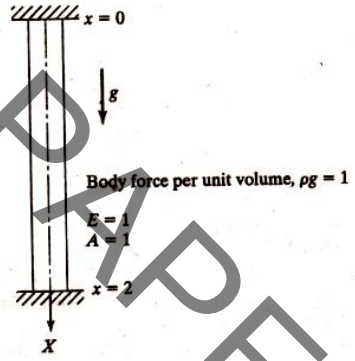

Figure 1

2.a) Distinguish between local, natural and global coordinates.
b) An elastic bar is having a uniform cross sectional area of A mm^2 and length L mm. It is fixed at one end and other end is allowed to move along the axis of the elastic bar. A force F kN is acting at the free end and the Young`s modulus is E N/mm^2. Calculate the displacement at the free end. [6+9]

3. Determine the stiffness matrix, stresses and reactions in the truss structure shown in Figure 2. [15]

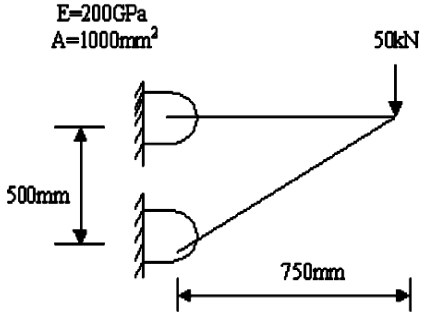

Figure 2

4.a) Derive the Hermit shape functions for the 1-D two noded beam element from first principles.
b) What are the assumptions used for the analysis of beam element? Explain. [7+8]

5.a) What is a CST element? State its properties and applications?

b) Explain in detail how the element stiffness matrix and load vector are evaluated in iso-parametric formulations. [6+9]

6. Compute the strain displacement matrix and also the strains of an Axi-symmetric triangular element with the coordinates r_1 = 3 cm, z_1 = 4 cm, r_2 = 6 cm, z_2 = 5 cm, r_3 = 5 cm, z_3 = 8 cm. The nodal displacement values are u_1 = 0.01 mm, w_1 = 0.01 mm, u_2 = 0.01 mm, w_2 = -0.04 mm, u_3 = -0.03 mm, w_3 = 0.07 mm? [15]

7. Heat is entering into a large plate at the rate of $q_0 = 300 W/m^2$ as shown in the figure 3. The plate is 25 mm thick. The outside surface of the plate is maintained at temperature of 10^0 C, using two finite elements, solve for the vector of nodal temperatures T. Thermal conductivity k=1.0 W/m ^{0} C. [15]

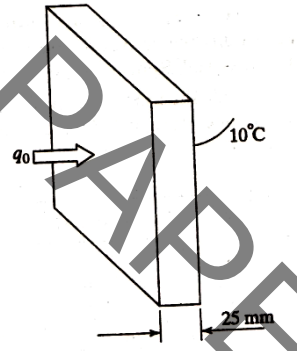

Figure 3

8.a) Explain consistent mass matrix model with examples.

b) Evaluate the eigen values, eigen vectors and natural frequencies of a beam of cross section 360 cm^2 of length 600 mm. Assume young's modulus as 200 GPa, density 7850 kg/m^3 and moment of inertia of 3000 mm^4. Make into two elements of 300 mm length each? [6+9]

---ooOoo---