R09

Code: 9A03703

B.Tech IV Year I Semester (R09) Supplementary Examinations, May 2013

FINITE ELEMENT METHODS

(Mechanical Engineering)

Time: 3 hours Max Marks: 70

Answer any FIVE questions
All questions carry equal marks

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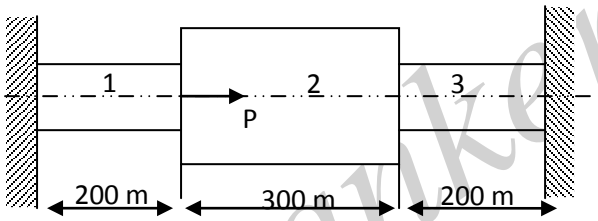
1. (a) Explain the significance of node numbering and element numbering during the discretization Process.

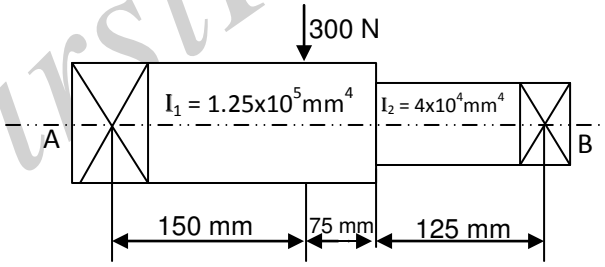
   (b) Define the concept of potential energy.
   (c) List out any five advantages of using FEM.

2. (a) Explain the shape functions used in 1-D problems.
   (b) An axial load P = $200X10^3$ N is applied on a bar shown. Using the penalty approach for handling boundary conditions, determine nodal displacements, stress in each material and reaction forces



(1) $A_1 = 2400\ mm^2$
$E_1 = 70 \times 10^9\ N/m^2$
(2) $A_2 = 600\ mm^2$
$E_2 = 200x10^9\ N/m^2$

3. Find the deflection at the load and the slopes at the ends for the steel shaft shown in figure. Consider the shaft to be simply supported at bearings A and B. Solve by FEM technique. Take E = 200 Gpa.



4. (a) Discuss the significance and applications of triangular elements.
   (b) Two dimensional simple elements are used to find the pressure distribution in a fluid medium. The (x, y) coordinates of nodes i, j and k of an element are given by (2,4), (4,0) and (2,6) respectively. Find the shape functions N_i, N_j and N_k of the element.

5. Derive for strain displacement matrix B (4 x 6) for an axisymetric element.

6. A composite slab consists of three materials of different conductivities is 20 W/mk, 30 W/mk and 50 W/mk of thickness 0.3 m , 0.15m and 0.15m respectively. The outer surface is 20^0C and the inner surface is exposed to the convective heat transfer coefficient of 25 W/m^2k at 300^0C. Determine the temperature distribution within the wall.

7. Write in general the process of formulation of the thermal stresses in engineering problems.

8. Discuss the methodology to solve the Eigen value problem for the estimation of natural frequencies of a stepped bar.

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