Code No: 56017 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, December - 2018
FINITE ELEMENT METHODS
(Common to ME, AE)

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

Answer any five questions
All questions carry equal marks
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1.a) Explain your understanding on following terms:
i) Element, ii) Nodes

b) Consider a uniform rod subjected to a uniform axial load as illustrated in figure 1. It can be readily shown that the deformation of the bar is governed by the differential equation

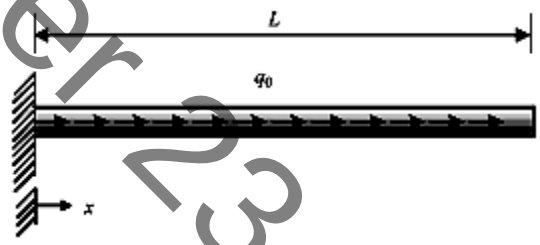

Figure 1

$$AE\frac{d^2u}{dx^2} + q_0 = 0 \quad ,$$

With the boundary condition,

$$u(0) = 0, \quad \left.\frac{du}{dx}\right|_{x=L} = 0.$$

Let us now find an approximate solution to this problem using the method just discussed. Assume a trial or guess solution. [5+10]

$$u(x) \approx \hat{u}(x) = c_0 + c_1 x + c_2 x^2$$

2.a) What do you mean by discretization? Also, differentiate between H-method and P-method.

b) Rod under distributed and concentrated forces and subjected to forces as shown in figure 2.

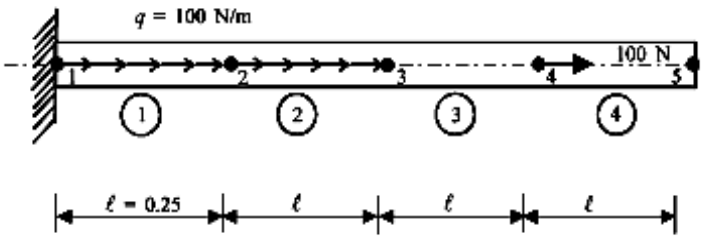

Figure 2

Find nodal displacements. [5+10]

3. For the truss in figure 3, a horizontal load of P = 4000 lb is applied in the x direction at node 2.
a) Write down the element stiffness matrix k for each element.
b) Assemble the K matrix.
c) Using the elimination approach, solve for Q.
d) Evaluate the stress in element 2 and 3.
e) Determine the reaction force at node 2 in the y direction. [15]

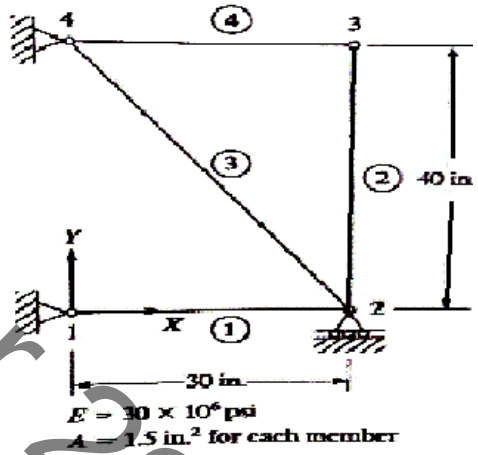

Figure 3

4. The fixed-fixed bar shown in figure 4 has axial forces applied at L/3 and 2L/3. Use the finite element method to compute the axial deflections and support reactions. [15]

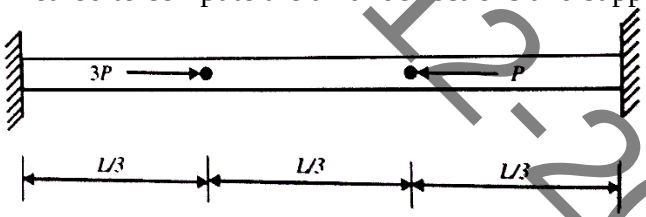

Figure 4

5. Determine the deflection of a thin plate subjected to extensional loads as shown in figure 5. [15]

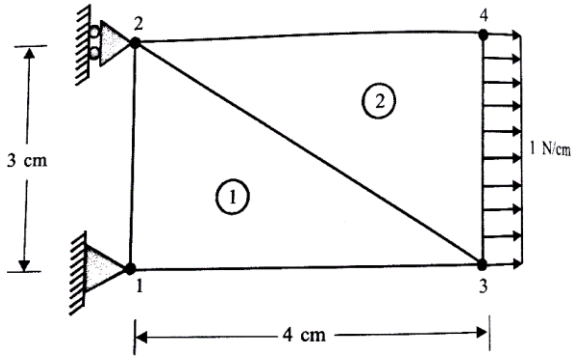

Figure 5

6. Evaluate the shape functions N1, N2 and N3 at the interior point P for the triangular element shown in figure 6. [15]

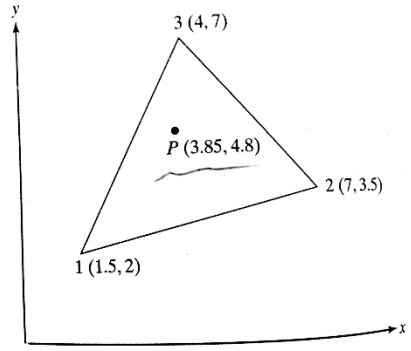

Figure 6

7. The plane wall shown in figure 7. Is 1 m thick. The left surface of wall is maintained at a constant temperature of 500 ^{0}C, and the right surface is insulated. The thermal conductivity k=25W/m^{0}C, and there is uniform heat generation inside the wall of Q = 400 W/m^3. Determine the temperature distribution through the wall thickness using linear elements. [15]

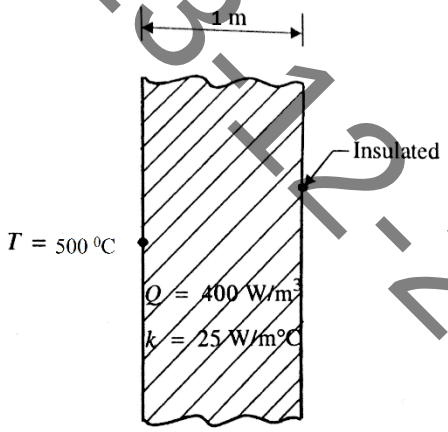

Figure 7

8.a) Difference between forward and inverse iterations.

b) Consider the underdamped, 2 - d.o.f. system shown in figure 8. Find the response of the system when the first mass alone is given an initial displacement of unity and released from rest. [5+10]

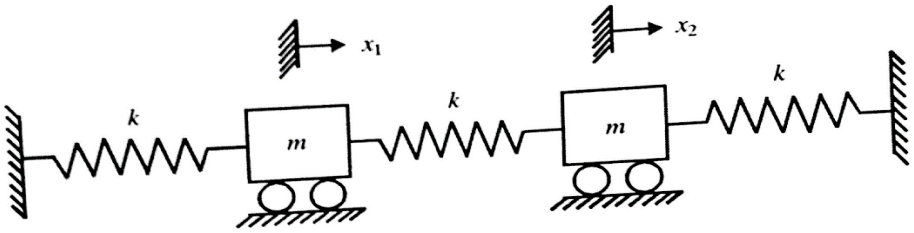

Figure 8

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