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M.Tech (ME) (2017 Batch) (Sem.–1)

FINITE ELEMENT ANALYSIS

Subject Code : MTME-102

Paper ID : 74716]

Time : 3 Hrs. Max. Marks : 100

INSTRUCTIONS TO CANDIDATES :

1. Attempt any FIVE questions in all.
2. Each question carries TWENTY marks.
3. Assume any missing data.

1. a) What do you understand by isoparametric mapping? What are the convergence criteria for the isoparametric element?

   b) Discuss any one technique used for solving three-dimensional integration problems, by taking a suitable example. (10, 10)

2. a) What is a shape function? What are the different types of shape functions used in finite element analysis?

   b) Differentiate between a truss element and a flexure element. Discuss the elementary beam theory used for developing flexure elements. (10, 10)

3. a) Derive an equation to find the displacement at node 2 of a beam, fixed at both ends and subjected to axial load P at node 2, using Rayleigh-Ritz method.

   b) What are constitutive equations? Discuss the two independent material constants required to completely specify constitutive relations for homogeneous, isotropic, linearly elastic materials. (15, 5)

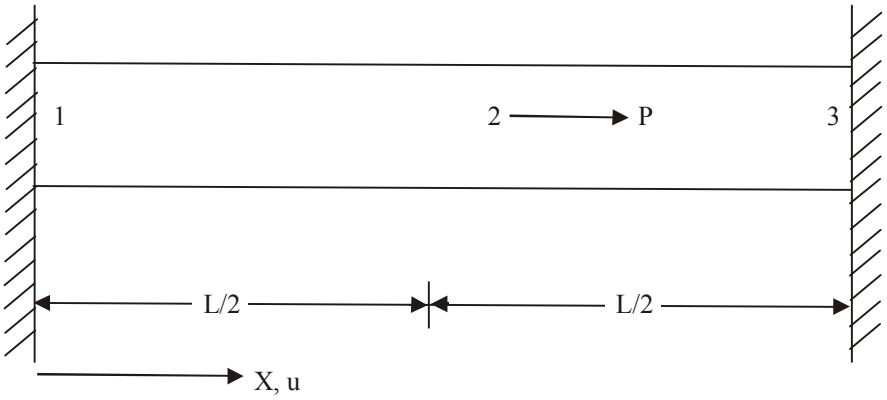

Fig.

4. Derive shape functions in natural coordinates and obtain Jacobian matrix for four- noded isoparametric quadrilateral element. (20)

5. The differential equation for a phenomenon is given by $(d^2y/dx^2) + 500x^2 = 0$; $0 \leq x \leq 5$. The boundary conditions are $y(0) = 0$ and $y(5) = 0$. Find the approximate solution using any classical technique. Start with minimal possible approximate solution. (20)

6. Derive finite element heat transfer model for a 2-node linear element considering both conduction and convection. (20)

7. Derive the governing equations for a general three dimensional flow. How will you modify this equation for steady flow of an incompressible fluid? (20)

8. Write short notes on :

   a) Difference between boundary value and initial value problems. (5)

   b) Pre and Post processing in FEA. (5)

   c) Weighted residual's method. (5)

   d) Stream functions. (5)