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Reg. No. : .....

Name : .....

First Semester M.Tech. Degree Examination, March 2014
(2013 Scheme)
Branch : Mechanical Engineering
Stream : Machine Design
MDC 1005 : FINITE ELEMENT METHOD

Time : 3 Hours Max. Marks : 60

(Answer **six** questions, select **two** from **each** Module).

MODULE – I

1. Explain all the steps followed in the finite element method taking any example. **10**

2. Derive the stiffness matrix for a beam element. **10**

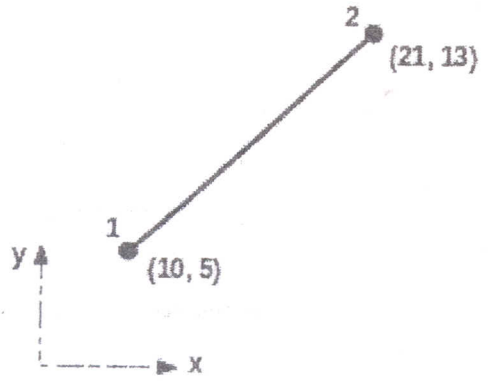
3. A bar element with cross-sectional area of 25 mm^2 and Young's Modulus 210 GPa, is shown along with its global coordinates of the two nodes.

   Find :

   a) the stiffness matrix of the bar in the local coordinate system

   b) the coordinate transformation matrix of the element and

   c) the global stiffness matrix of the element. **10**



P.T.O.

MODULE – II

4. Derive the shape functions for a triangular linear element in global coordinate system ? 10

5. a) Explain the convergence requirements for a polynomial displacement model. 5

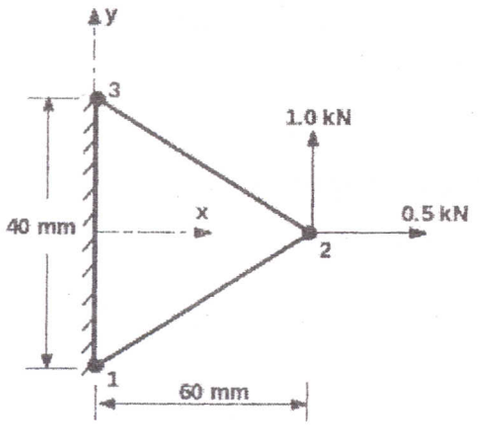
   b) Explain the methods for implementing zero and non-zero displacement boundary conditions in structural problems. 5

6. Using Galerkin weighted residual method, solve the differential equation

$$\frac{d^2y}{dx^2} + y = x^2 \text{ for } 0 < x < 1 \text{ for the boundary conditions } y(0) = 0,\ y(1) = 0.$$ 10

MODULE – III

7. Find the stresses in the plate using one triangular membrane (plate) element. Young's modulus, E = 210 GPa, Poisson's ratio, $\nu = 0.3$, thickness, t = 10mm. 10



8. a) Explain C^0 and C^1 continuity finite elements with examples. 4

   b) Write shape functions for an isoparametric quadrilateral element and sketch its variations. Also show the 2 × 2 and 3 × 3 Gaussian points. 6

9. Find the natural frequencies and mode shapes of a uniform cantilever using one beam element ? 10