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Question Paper Code : 51652

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2014.

Sixth Semester

Mechanical Engineering

ME 2353/ME 63/10122 ME 605 — FINITE ELEMENT ANALYSIS

(Common to Automobile Engineering, Mechanical and Automation Engineering,
Industrial Engineering and Management)

(Regulation 2008/2010)

Time : Three hours

Maximum : 100 marks

(Any missing data may be suitably assumed)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is meant by node or joint?
2. What is Rayleigh-Ritz method?
3. Define shape function.
4. What is a truss?
5. How do you define two dimensional elements?
6. What is QST (Quadratic strain Triangle) element?
7. What is meant by transverse vibrations?
8. Define dynamic analysis.
9. Write down the governing equation for two-dimensional steady state heat conduction.
10. Define streamline.

PART B — (5 × 16 = 80 marks)

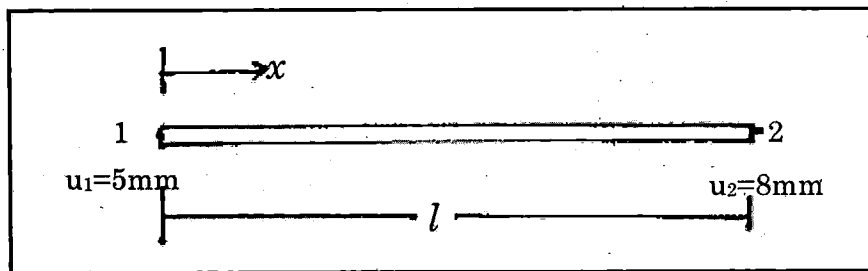
11. (a) List and briefly describe the general steps of the finite element method. (16)

Or

- (b) The differential equation of a physical phenomenon is given by $\frac{d^2 y}{dx^2} + y = 4x, 0 \leq x \leq 1$.

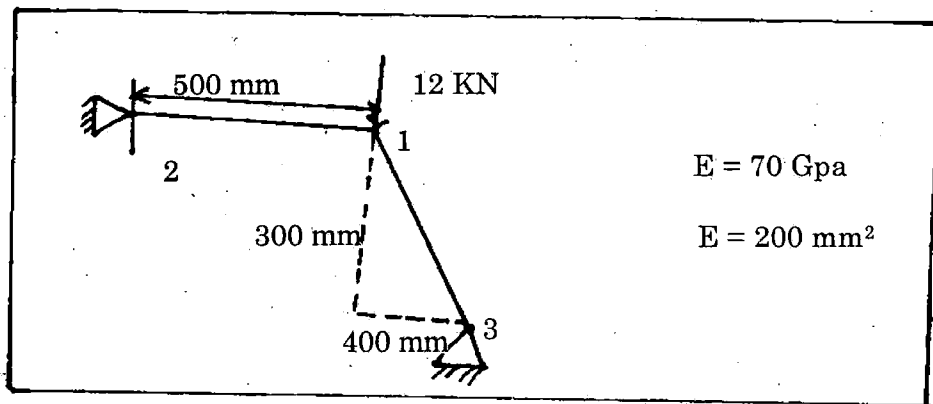
The boundary conditions are: $y(0) = 0$
 $y(1) = 1$. Obtain one term approximate solution by using Galerkin's method of weighted residuals. (16)

12. (a) A two noded truss element is shown in figure. The nodal displacements are $u_1 = 5 \text{ mm}$ and $u_2 = 8 \text{ mm}$. Calculate the displacement at $x = \frac{l}{4}, \frac{l}{3}$ and $\frac{l}{2}$. (16)

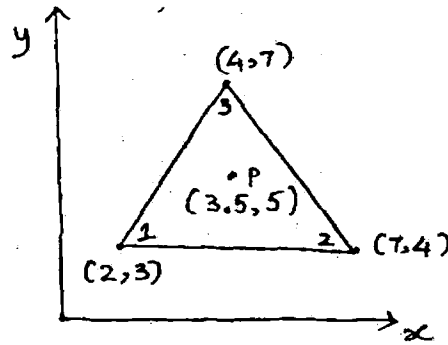


Or

- (b) For the two bar truss shown in the figure, determine the displacements of node 1 and the stress in element 1-3.



13. (a) Determine the shape functions N_1 , N_2 and N_3 at the interior point p for the triangular element shown in the figure. (16)



Or

- (b) Determine the shape functions for a constant strain triangular (CST) element in terms of natural co-ordinate system. (16)
14. (a) Derive the equation of motion based on weak form for transverse vibration of a beam. (16)

Or

- (b) Determine the eigen values and natural frequencies of a system whose stiffness and mass matrices are given below. (16)

$$[K] = \frac{2AE}{L} \begin{bmatrix} 3 & -1 \\ -1 & 1 \end{bmatrix}, \quad M = \frac{\rho AL}{12} \begin{bmatrix} 6 & 1 \\ 1 & 2 \end{bmatrix}$$

15. (a) Derive a finite element equation for one dimensional heat conduction with free end convection. (16)

Or

- (b) Derive the stiffness matrix and load vectors for fluid mechanics in two dimensional finite element. (16)