C 1158 (Pages : 3) Name.....

Reg. No.....

SIXTH SEMESTER B.TECH. (ENGINEERING) [09 SCHEME] DEGREE EXAMINATION, APRIL 2016

ME / PTME 09 602—FINITE ELEMENT METHOD

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *the questions.*
Each question carries 2 *marks.*

1. List any *three* properties of stiffness matrix.
2. Give some example for boundary conditions.
3. What is interpolation function ?
4. List some sources of error in FEM.
5. What is a natural co-ordinate system ?

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*
Each question carries 5 *marks.*

1. Derive element stiffness matrix for a beam element.
2. Explain co-ordinate transformation in FEM with example.
3. Derive the strain displacement matrix for a beam element.
4. Briefly describe Rayleigh Ritz method.
5. Mention the difference between finite element method and variational method and also the points of equivalence between them.
6. Explain the advantages of isoparametric elements with examples.

(4 × 5 = 20 marks)

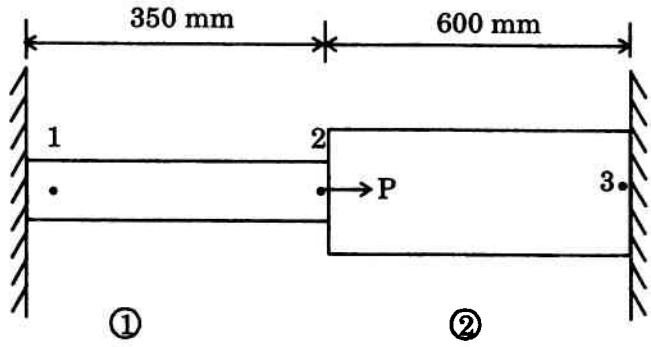
Part C

MODULE I

1. Explain in detail the steps involved in the structural problem of FEM with a suitable example.

Or

2. Determine the nodal displacement and element stresses for the structure loaded as shown in fig below.



Aluminium

$E_1 = 95 \times 10^9$ N/m^2

$A_1 = 1200$ mm^2

Steel

$E_2 = 225 \times 10^9$ N/m^2

$A_2 = 1500$ mm^2

Module II

3. With an example explain how matrix sparsity can be exploited using appropriate node numbering for the conservation of computer memory.

Or

4. The co-ordinates of the node 1, 2 and 3 of a constant strain triangular element are (1, 1) ; (8, 4) and (2, 7) in mm. respectively. The nodal displacements are $U_1 = 1$ mm. $U_2 = 3$ mm $U_3 = -2$ mm. $V_1 = -4$ mm $V_2 = 2$ mm and $V_3 = 5$ mm. Obtain the strain displacement matrix B and the strains, $\varepsilon_x, \varepsilon_y$ and γ_{xy}.

Module III

5. Describe the formulation of Finite Element equations using Rayleigh Ritz method.

Or

6. Derive an expression for stiffness matrix using Principle of Virtual Work.

MODULE IV

7. Derive the conductance matrix for two dimensional heat transfer and explain its boundary conditions.

Or

8. Write short notes on any *three* of the following :—

   (a) Isoparametric Elements.

   (b) Gaussian Quadrature.

   (c) Jacobian Matrix.

   (d) Weighted Residual Methods.

(4 × 10 = 40 marks)