C 26792 (Pages : 3) Name.....

Reg. No.....

SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION MAY 2012

PTME/ME 09 602—FINITE ELEMENT METHOD

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *questions.*

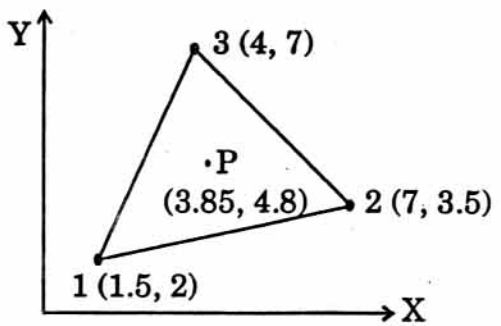
1. What are the advantages of FEM over classical method ?
2. Define the term 'node'.
3. Differentiate local and global coordinate system.
4. Discuss the convergence criteria for isoparametric elements.
5. State principle of minimum potential energy.

(5 × 2 = 10 marks)

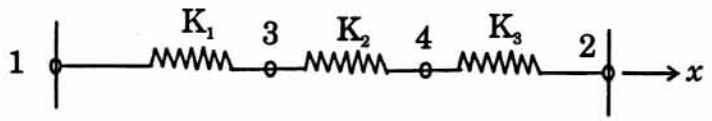
Part B

Answer any **four** *questions.*

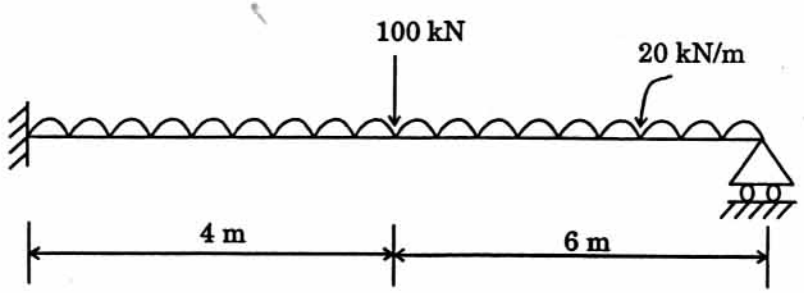
6. Evaluate shape functions N_1, N_2 and N_3 at the interior point '*p*' for the triangular element shown below :



7. Obtain the global stiffness matrix for the assemblage shown below :



8. Determine the consistent nodal vector due to loads acting on the beam shown below :



Turn over

9. Derive the element stiffness matrix for a 1–D bar element.

10. Write a short note on 'patch test'.

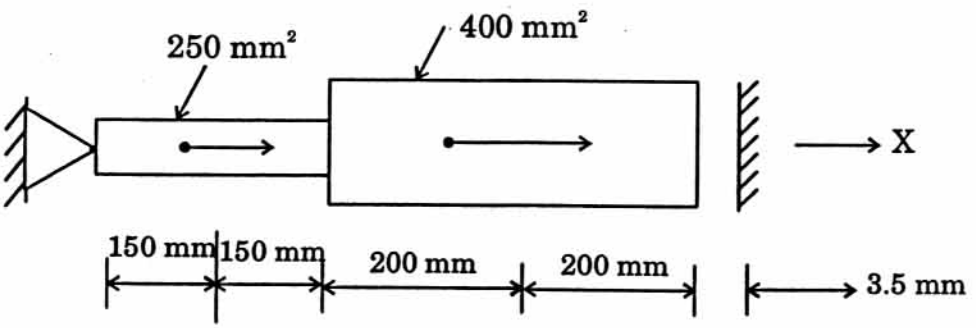
11. Evaluate $I = \int_{-1}^{1} \left[3e^x + x^2 + \frac{1}{x+2} \right] dx$ using one point and two-point quadrature.

(4 × 5 = 20 marks)

Part C

Answer **all** *questions.*

12. (a) Determine the nodal displacements, element stresses and support reactions for the bar shown below :



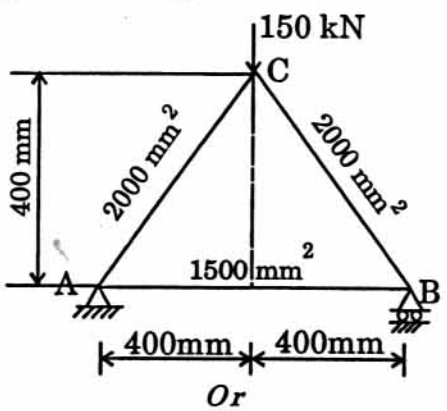
$E = 200 \times 10^9$ N/m²

Or

(b) Derive the stiffness matrix for the 1-D beam element and show how nodal displacements can be determined.

(10 marks)

13. (a) Determine the nodal displacements and stresses in each member of a truss shown below: Take of modulus elasticity as 200 GPa.



Or

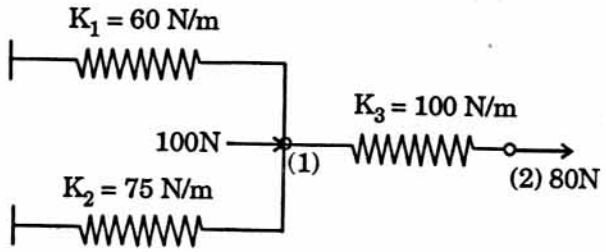
(b) Derive the stiffness matrix for a CST element by direct approach.

(10 marks)

14. (a) Determine the expression for deflection and bending moment in a simply supported beam subjected to a UDL over entire span using Rayleigh-Ritz method.

Or

(b) Determine the displacements of nodes 1 and 2 in the spring system shown below using minimum of potential energy principle.



(10 marks)

15. (a) Write short notes on :

(i) Uniqueness of mapping of isoparametric elements.

(ii) Jacobian matrix.

(iii) Gaussian quadrature integration technique.

Or

(b) Discuss and formulate the Galerkin's method applied to a one dimensional bar.(10 marks)

(4 × 10 = 40 marks)