

Total No. of Questions : 8]

SEAT No. :

P5289

[5562]-141

[Total No. of Pages : 2

M.E.(Civil - Structures)

FINITE ELEMENT METHOD

(2017 Course) (Semester - II) (501007)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.
- 2) Figures to the right indicate full marks.
- 3) If necessary, assume suitable data and indicate clearly.
- 4) Use of electronic pocket calculator is allowed.

Q1) a) Solve the differential equation for a physical problem using Galerkin's method expressed as $\frac{d^2 y}{dx^2} + 50 = 0$ for $0 \leq x \leq 10$, Boundary conditions are $y(0) = 0$; $y(10) = 0$

Assume trial function: $y = ax(10 - x)$. **[5]**

b) Discuss the convergence requirement for a displacement function with suitable examples. **[4]**

OR

Q2) a) Using Variational principle, formulate the stiffness matrix for truss element. **[4]**

b) Using area coordinate, derive the shape functions for a CST element having coordinates (10,10), (30,10) and (30,40). Hence derive the strain displacement matrix for CST element using area coordinates. **[5]**

Q3) a) What is Lagrangian Polynomial? Using this, determine and plot the shape functions of three noded bar element in Cartesian as well as natural coordinate system. **[4]**

b) Explain isoparametric concept. What does term 'mapping' signify in isoparametric formulation. Derive the shape functions for linear isoparametric triangular element. **[5]**

OR

Q4) a) Determine the Jacobian matrix for 2D plane stress problem. For the four noded element having coordinates (1,1), (3,0), (3.5, 2.5), (2,3), find the value of Jacobian at (1.5, 2.5). **[5]**

b) Derive the strain displacement matrix for the rectangular 2D serendipity element for plane strain condition. **[4]**

P.T.O.

- Q5)** a) State the salient features shear deformation theory with reference to finite element analysis. [4]
- b) Explain shear locking phenomenon. [4]
- c) Explain the Mindlin's plate element and briefly explain the formulation of stiffness matrix. [8]

OR

- Q6)** a) Explain the convergence requirements of displacement functions. Write a note on conforming and non-conforming elements with reference to plate elements. [8]
- b) Compare BFS element with ACM plate bending element. [8]
- Q7)** a) For axisymmetric element, write constitutive relations and hence obtain the element stiffness matrix for a typical triangular element for its application in solving a problem of cylinder subjected to internal pressure. [6]
- b) i) Explain shape function for geometry for typical curved shell elements.
ii) Write the strain displacement matrix for the curved shaped element. [10]

OR

- Q8)** a) Explain how axi-symmetric problems can be analyzed using axi-symmetric elements in Finite element method. [8]
- b) Explain the concept of degenerated solid elements. Write the displacement field for 4 noded degenerated shell element. [8]

