[4760] - 47
M.E. Civil (Structures)
FINITE ELEMENT METHOD
(2008 Pattern) (Semester - II)

Time : 4 Hours]   *[Max. Marks : 100*

Instructions to the candidates:
  1) *Answer any two questions from each section.*
  2) *Answer to the two sections should be written in separate books.*
  3) *Figures to the right indicate full marks.*
  4) *Neat diagrams must be drawn wherever necessary.*
  5) *Use of non programmable calculator is allowed.*
  6) *Assume suitable data, if necessary.*

SECTION - I

Q1) a) Using potential energy approach derive stiffness matrix for a beam element.
                                                                            [9]

  b) Explain with examples different types of co-ordinates used in finite element method to define location of points in element. Hence obtain relation for natural co-ordinates for two noded element when range is -1 to $+1$.   **[8]**

  c) Using finite element approach, show that, stiffness matrix for one-dimensional axially loaded bar element is $[K] = \dfrac{AE}{L}\begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$.   **[8]**

Q2) a) Derive area co-ordinates of three noded constant strain triangular (CST) element.   **[9]**

 b) State the convergence criteria for the choice of the displacement function in FEM.   **[8]**

  c) Explain standard formulation procedure using variational principle. **[8]**

Q3) a) State and explain the three basic laws on which isoparametric concept is developed. **[7]**

b) Derive shape functions of following isoparametric elements in natural coordinate. **[18]**

system (ξ, η).

   i) Two noded bar element

   ii) Four noded rectangular element

   iii) Eight noded rectangular element

   iv) Nine noded rectangular element

(i) Two noded bar element   (ii) Four noded rectangular element   (iii) Eight noded rectangular element   (iv) Nine noded rectangular element
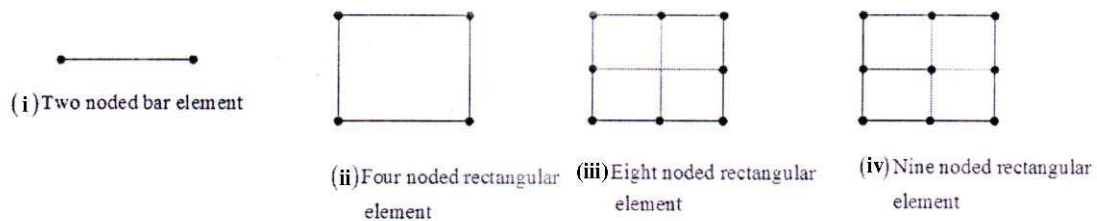
SECTION - II

Q4) a) Explain strain-displacement and stress-strain relationships for triangular problem. Hence, derive necessary matrices for formulation of stiffness matrix of triangular axisymmetric element. **[18]**

b) Explain in brief plane stress, plane strain and axisymmetric problems. **[7]**

Q5) a) Write displacement functions for both ACM and BFS elements. **[12]**

b) Write short note on conforming and non-conforming plate bending elements. **[6]**

c) What do you understand by C^0, C^1 and C^2 continuity? Explain with suitable examples. **[7]**

Q6) a) Explain the concept of degenerated solid elements by suitable examples. Write displacement fields in 4 noded degenerated shell element. **[13]**

b) Explain membrane and bending actions in shell elements. How these two states of stresses are considered in formulating [K] for shell element. **[12]**

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