(13)

Total No. of Questions : 8]

MAY 2016

SEAT No. :

P4371

[Total No. of Pages :3

[4960] - 1032
M.E. (Civil) (Structural Engineering)
FINITE ELEMENT ANALYSIS
(2013 Pattern)

Time : 3 Hours] *[Max. Marks :50*

Instructions to the candidates:

1) ***Attempt any 5 questions.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of non programmable electronic calculator is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) For the following boundary value problem solve using Galerkin method

$$\frac{d^2u}{dx^2}+u=1 \quad 0\leq x\leq 1.$$

The conditions given are $u(0)=0$ and $\frac{du}{dx}=0$ at $x=1$. Consider the quadratic approximation $u=a+bx+cx^2$. **[4]**

b) i) Distinguish between Error in solution and Residual. **[2]**

ii) Derive elemental stiffness matrix for a plane truss element or 1 - D bar element using variational approach. **[4]**

Q2) a) Using shape functions of CST element in area coordinates, obtain strain-displacement matrix for the element having coordinates at nodes as node 1(0, 0), node 2(20, 10), node 3(0, 10) from fundamentals. **[5]**

b) i) Explain with suitable examples, compatible and completeness requirements of displacement functions. **[3]**

ii) Explain with suitable example the 'aspect ratio' in modelling a problem using Finite element method. **[2]**

P.T.O.

Q3) Analyse the propped cantilever ABC with clamped support at A and roller support at C shown in Figure3. The beam carries distributed load of 60 kN/m over entire length. The flexural rigidities for portion AB and BC are 2EI and EI respectively. Analyse the beam using direct approach of FEM using standard stiffness and load vector formulation considering two elements. **[10]**

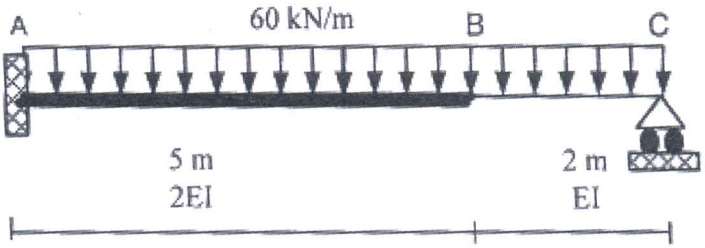

Figure 3.

Q4) a) i) Derive the lagrangian polynomials the shape functions for a one dimensional three noded bar element. Plot the variation of the same. **[2]**

ii) Derive the shape function for eight noded serendipity element in Cartesian or natural coordinate system. **[4]**

b) For a tetrahedral element derive the shape function in terms of the volume of tetrahedral and express the displacements in terms of shape function. **[4]**

Q5) a) Explain in detail step wise development of stiffness matrix for a typical triangular axisymmetric element starting from assuming the displacement function. **[5]**

b) Write the expressions for normal and shear strain for the axisymmetric element and give the isotropic stress/strain relationship for the axisymmetric element. **[3]**

c) How should one model the boundary conditions of nodes acting on the axis of symmetry? **[2]**

Q6) Explain in detail the formulation procedure for strain displacement matrix for a two dimensional isoparametric element in plane elasticity problem, using Jacobian matrix. **[10]**

Q7) What are ACM and BSF elements? Explain these with reference to conforming and nonconforming elements. **[10]**

Q8) a) Write short note on Flat and Curved shell element. **[5]**

b) Write a note on Ahmad's degenerated solid element or Pawsey's eight noded shell element. **[5]**

XXXX