Total No. of Questions : 8]

SEAT No. :

P4744

[Total No. of Pages : 2

[5060] - 542
M.E. (Civil-Structural Engineering)
FINITE ELEMENT ANALYSIS
(2013 Pattern)

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

Instructions to the candidates:

1) ***Attempt any five 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) Write a note on weighted residual method. Explain collocation method and Galerkin method in detail. **[5]**

b) Derive elemental stiffness matrix for a beam element using variational approach. **[5]**

Q2) Explain the process of discretization in finite element analysis and explain the following terms: Aspect ratio, material and geometric discontinuities, numbering of nodes, refining mesh in context of discretization. **[10]**

Q3) The end A of beam is clamped and end C of the beam can translate vertically without rotation as shown in Figure 1. The beam carries distributed load of 60kN/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]**

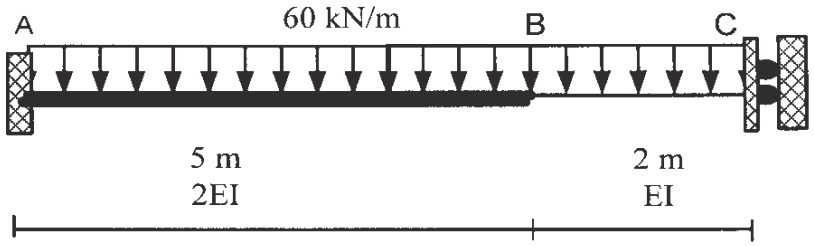

Figure 1

P.T.O.

Q4) a) Derive the shape functions using Lagrangian function for a one dimensional three noded bar element. Extend the same to obtain the shape function for nine noded rectangular element in Cartesian or natural coordinate system. Plot the variation of the same. **[5]**

b) Explain the following terms with reference to finite element analysis **[5]**

i) Global coordinates

ii) Local coordinates

iii) Natural coordinates.

Q5) a) Using polar coordinates for the displacement function, derive the stiffness matrix for a typical triangular axisymmetric element starting from assuming the displacement function. **[5]**

b) Explain the term 'Axi-symmetric problems' and give constitutive law for such problems. **[5]**

Q6) Explain the isoparametric mapping and derive the Jacobian matrix for 1 - D, 2 - D and 3 - D isoparametric formulation. **[10]**

Q7) Explain rectangular plate element with 12 degrees of freedom and 16 degrees of freedom. Comment on conformity of the displacement function. **[10]**

Q8) a) Explain the analysis of shells by finite element analysis. Explain commonly used elements for shell analysis. **[5]**

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

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