P-518

Seat No.	

B.E. (Mechanical) (Semester-VII) (Revised)
Examination, May - 2016
FINITE ELEMENT ANALYSIS
## Sub. Code: 47981

Day and Date : Monday, 02- 05 - 2016   **Total Marks : 100**

Time : 3.00 p.m. to 6.00 p.m.

Instructions :
1) Answer any three questions from each section.
2) Figures to right indicate full marks.
3) Assume if necessary suitable data and state them clearly.
4) Draw neat labelled sketch wherever necessary.
5) Use of non-programmable calculators is permissible.

SECTION-I

Q1) Analyse the axially loaded stepped bar shown in figure below. Use the finite element method (element and global matrix) to predict the nodal displacements u_2, u_3 and u_4 at the nodes 2, 3 and 4, and the support reaction R at the fixed node 1 ($u_1 = 0$). The cross sectional areas are 50 mm², 20 mm² and 10 mm², the lengths of steps are 10mm each and the modulus of elasticity is 200 GPa. **[16]**

Nodes: 1,2,3,4
Elements: 1-2, 2-3, 3-4

F= 50N
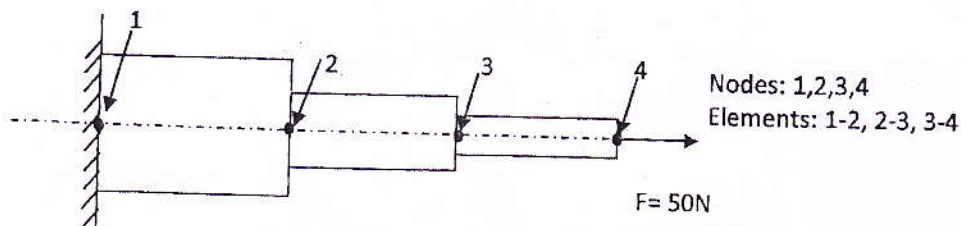
Q2) a) For a one-dimensional bar element prove that the displacement through the element (with a linear variation) is given by $U_{(x)} = N_i U_i + N_j U_j$, where the shape functions $N_i = (x_j - x)/l$ and $N_j = (x - x_i)/l$. Also plot N_i and N_j over the length of the element. Evaluate $(N_i + N_j)$, and $(dN_i/dx + dN_j/dx)$. **[8]**

b) State different weighted residual methods used in FEA formulation. **[8]**

Q3) a) Explain the steps required to carry out the analysis of simple 1-D steady state heat conduction using ANSYS software. **[8]**

b) Explain 1-D, 2-D, 3-D elements in FEA. **[8]**

Q4) Write short notes on (Any Three): **[18]**

a) Functional extremization in FEA.
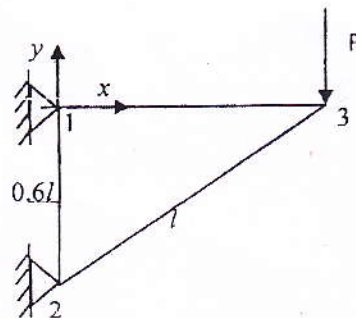
b) Discretization/meshing of a model.

c) Choice of the element.

d) Weighted residual method.

e) Steps involved in Time History Postprocessor in ANSYS.

SECTION-II

Q5) For the truss shown in figure, determine the element and global stiffness matrices. The cross section of all members is 'A' and modulus of elasticity, 'E'. **[16]**

Q6) a) Prepare an algorithm/flowchart to write a computer code for the finite element analysis of a simple plane truss having *n* nodes and *m* elements. **[8]**

b) Explain simplex, complex and multiplex elements in FEA. **[8]**

Q7) a) Explain in detail the activities involved in postprocessor of an FEA software. **[8]**

b) Explain with suitable examples simplification of a model using symmetry. **[8]**

Q8) Write short notes on (Any Three): **[18]**

a) Preprocessing in ANSYS.

b) Body forces and surface tractions.

c) 1-D, 2-D, 3-D elements in FEA.

d) Interpolation function.

e) Bandwidth of the stiffness matrix.

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