

B.E. Eighth Semester (Mechanical Engineering) (CGS)
10892 : Elective-III : Finite Element Methods : 8 ME 02

P. Pages : 2

Time : Three Hours



AU - 2985

Max. Marks : 80

- Notes :
1. All question carry equal marks.
 2. Answer **three** question from Section A and **three** question from Section B.
 3. Due credit will be given to neatness and adequate dimensions.
 4. Assume suitable data wherever necessary.
 5. Diagrams and equations should be given wherever necessary.
 6. Illustrate your answer necessary with the help of neat sketches.
 7. Use of pen Blue/Black ink/refill only for writing the answer book.

SECTION - A

1. a) What are the basic steps involved in FEA, and explain them briefly ? 7
b) Explain boundary condition in FEM. 7

OR

2. a) Explain the Galerkins' method in FEA with the help of suitable example. 10
b) What are the application of FEM. 4
3. a) Find the inverse at following matrix : 6
$$[A] = \begin{bmatrix} 4 & 2 & 14 \\ 2 & 17 & -5 \\ 14 & -5 & 83 \end{bmatrix}$$

b) Solve the following system of equation using Gaussian elimination method. 7
$$\begin{aligned} x_1 - x_2 + 3x_3 &= 10 \\ 2x_1 + 3x_2 + x_3 &= 15 \\ 4x_1 + 2x_2 - x_3 &= 6 \end{aligned}$$

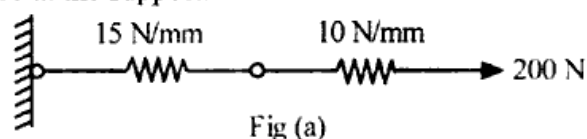
OR

4. a) Find the Eigen values and Eigen vector for the matrix A 8
$$A = \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$$

b) What is concept of matrix algebra and in what ways it is used in FEA. 5
5. a) What is Global stiffness matrix. Also write properties of Global stiffness matrix. 6
b) Explain meaning of shape function. Derive expression and how the shape function varies over the two and three noded rod element. 7

OR

6. Fig. (a) shows two spring are connected in series using FEM. Determine - 13
- The displacement at node 2 and 3
 - The deflection of individual spring and
 - The reaction force at the support.



SECTION - B

7. In a triangular element, the nodes 1, 2 and 3 have Cartesian co-ordinates (0, 0) , (10, 0) and (5, 8) respectively. The co-ordinate of point 'P' are (5, 6). The temperatures in °k at nodes 1, 2 and 3 are 100, 200 and 300 respectively. Determine : 14
- The natural co-ordinates
 - The shape functions and
 - The temperature of point 'P'.

OR

8. a) Derive Beam element equation using Galerkin approach. 8
- b) Explain 'Isoparametric element' with the help of suitable example. 6
9. Derive the methodology to develop A stiffness matrix and load vector for two noded beam element with two degree of freedom. 13

OR

10. a) Derive the expression for shape function for CST element. 7
- b) Explain the basic concept of plane stress and plain strain. 6
11. a) Explain : 7
- Preprocessor
 - Postprocessor
- b) What do you mean by mesh generation ? Explain with suitable example of free and mapped meshing. 6

OR

12. a) With an example, explain the procedure involved in solving an engineering problem in computational FEA using computer software. 7
- b) Derive the one dimensional heat transfer finite element using a variational method. 6
