Total No. of Questions :8] *[Total No. of Printed Pages :2*

Roll No .....

MVSE-202

M.E./M.Tech. II Semester

Examination, June 2016

FEM in Structural Engineering

Time : Three Hours

Maximum Marks: 70

Note : Attempt any five questions. All questions carry equal marks. Assume missing data suitably.

1. a) Discuss the merits and demerits of FEM.
   b) Discuss applications of FEM in structural Engineering.

2. a) Starting from the first principles, derive the expression for Element stiffness matrix in FEA:

$$[K]=\int_V [B]^T [O][B]dV$$

   with the terms having their usual meanings.

   b) Obtain the matrices [*B*] and [*D*] for a triangular element for plane stress problem with three nodes at vertices of the triangle and two degree of freedom *u* and *v* at each node.

3. Explain Jacobi or Power method for finding eigenvalues and eigenvectors. Find the eigenvalues and eigenvectors of following matrix.

$$A=\begin{bmatrix} 1 & 2 & 0 \\ 2 & 2 & 0 \\ 0 & 0 & -1 \end{bmatrix}$$

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4. Solve a fixed-fixed beam problem for free vibration using finite element method by discretizing the beam into three elements.

5. Obtain the element stiffness matrix for a plane frame element.

6. a) Explain Runge-Kutta method of numerical integration. Take an example and show how it helps in FEM solution?
   b) What are eigenvalue problems and discuss its use in FEM?

7. a) What are plain stress, plain strain axisymmetric problem? Write their stress strain relationship for elastic isotropic material for all the three types of problem.
   b) What is variation concept of FEM? How it is used in assembly process? Explain with example.

8. Write short notes on any four of the following:
   a) Primary, secondary nodes and internal nodes
   b) Iterative method of solution
   c) Aspect ratio
   d) Hermite interpolation function
   e) Discretization of domain

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