



- Notes :
1. All question carry equal marks.
 2. Assume suitable data wherever necessary.
 3. Illustrate your answer necessary with the help of neat sketches.
 4. Solve **any five**.

1. a) Define elements, node, shape function. Classify and draw different types of elements. 8
b) Principle of virtual work is another statement of the principle of minimum potential energy. Justify. 8
2. a) Explain 'Galerkin's method in detail. 8
b) What are the characteristics of shape function? 8
3. a) Discuss the validity of isoperimetric element by showing that these elements satisfy condition of constant strain. 8
b) Explain how will you calculate the shape function for a tetrahedron element. 8
4. a) Determine the invariants of stress and the principle stresses from the given stress matrix in kN/m^2 . 8
$$S = \begin{bmatrix} 100 & 200 & -400 \\ 200 & 200 & -200 \\ -400 & -200 & 100 \end{bmatrix}$$

b) Differentiate between. 8
a) Constant strain triangle & linear strain triangle.
b) Lagrange & Serendipity family.
5. a) How will you use axisymmetric element for solving the Boussinesq's problem for determining the stress distribution due to concentrated point load? 8
b) Differentiate between. 8
a) Local Coordinate and Natural coordinate.
b) Brick element and tetrahedron element.
6. a) Draw broad flow diagram for FEM analysis. 8
b) Draw flow chart for subroutine for shape function and mesh generation. 8
7. Define the seepage problem, when a dam of impervious material risk on a permeable layer underlain by rock, suggest suitable finite element technique to solve this problem with special reference to the following. 16
i) Boundary condition.
ii) Layered permeable strata.
