

Civil

**COLLEGE OF ENGINEERING, PUNE**  
B. Tech. Civil Engineering

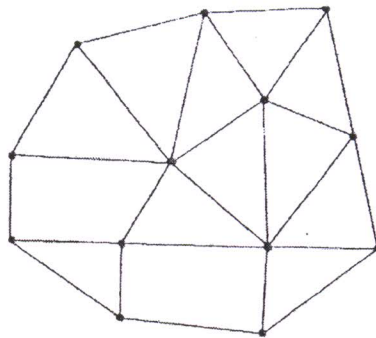
**(CE469) Introduction to Finite Element Analysis**  
End-semester Examination

Year : 2012-13  
Max. Marks: 50

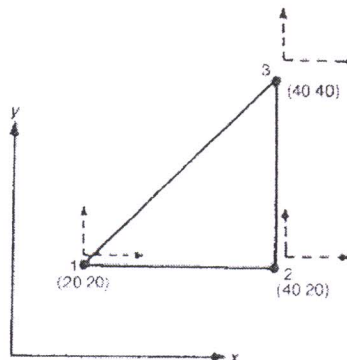
Semester : I  
Time: 3 Hour

**Instructions:** 1. ALL Questions are compulsory.

1. The plate shown below is modeled using 13 triangular and 2 quadrilateral [4] elements. Label the nodes such that the bandwidth of the system matrix is minimal. Compute the resulting bandwidth assuming 1 degree of freedom at each node.



2. Triangular elements are used for the stress analysis of a plate subjected to in-plane [6] loads. The components of displacement parallel to  $(x,y)$  coordinates of the nodes shown in figure are in centimeters, find the components of displacement of the point  $(x_p, y_p) = (30, 25)$  cm



3. A bar, subjected to an axial force, is divided into a number of quadratic elements. For [8]  
 a particular element, the nodes  $i, j$ , and  $k$  are located at 15mm, 18mm, and 21 mm,  
 respectively, from the origin. If the axial displacements of the three nodes are given  
 by  $u_i=0.0015$  mm,  $u_j=0.0024$  mm, and  $u_k=0.0033$  mm, determine the following:
- Shape functions.
  - Variation of the displacement,  $u(x)$ , in the element.
  - Axial strain,  $\epsilon_{xx}$ , in the element.

4. Find the solution of the differential equation [8]

$$\frac{d^2\phi}{dx^2} + \phi + x = 0; \quad 0 \leq x \leq 1$$

Subject to the boundary conditions  $\phi(0) = \phi(1) = 0$  using the Galerkin method.

5. What do you mean by *Convergence requirements* in the context of Finite Element [4]  
 method?
6. Comprehend on the technical article for *Finite Element Method* attached with [20]  
 following pages:

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