

**R09**

Code: 9A01701

B.Tech IV Year I Semester (R09) Regular & Supplementary Examinations December 2015

**FINITE ELEMENT METHODS IN CIVIL ENGINEERING**

(Civil Engineering)

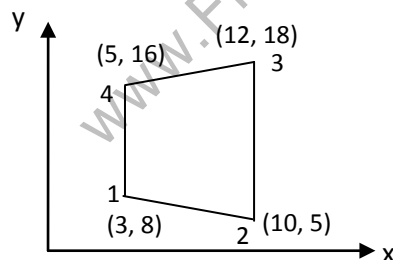
Time: 3 hours

Max. Marks: 70

Answer any FIVE questions  
All questions carry equal marks

\*\*\*\*\*

- 1 (a) Explain the basic principle used in FEM.  
(b) What is potential energy? State and explain the principle of minimum potential energy.
- 2 In a plane strain situation  $\sigma_x = 150 \text{ MPa}$ ,  $\sigma_y = 100 \text{ MPa}$ ,  $E = 2 \times 10^5 \text{ MPa}$  and Poisson's ratio  $\mu = 0.25$ . Find the values of  $\sigma_z$ ,  $\epsilon_x$ ,  $\epsilon_y$ .
- 3 Derive the stiffness matrix and nodal load vectors for one dimensional 3-noded quadratic element.
- 4 A triangular element has nodal co-ordinates A (1, 3), B (6, 4) and C (4, 6). The x-coordinate at an interior point is 5.5 and  $N_1 = 0.4$ . Determine the y-coordinate of the point and other shape functions.
- 5 Derive the shape function matrix strain displacement matrix, stiffness matrix and nodal load vectors for a 4-noded rectangular element.
- 6 (a) Explain the isoparametric elements and their advantages.  
(b) For the isoparametric, quadrilateral element shown in figure below. Determine the Jacobian matrix at  $\xi = 1/4$ , and  $\eta = 1/4$ .



- 7 (a) Write the basic principles in Axi-symmetric analysis.  
(b) Write short notes on Lagrangian and Serendipity elements.
- 8 Write short notes on:
  - (a) Static condensation.
  - (b) Convergence and compatibility requirements.

\*\*\*\*\*