53 (CE 813) FELM

2018

FINITE ELEMENT METHODS IN ENGINEERING

Paper : CE 813

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions out of **seven**.*

1. *(a)* Define Stiffness Matrix. Determine the stiffness matrix of bar element. 4+6=10

   (b) Explain in detail the steps involved in the solution of non-linear finite element problem. 10

2. *(a)* What do you understand by shape function? Determine the shape function of a 4-noded rectangular element. 4+6=10

(b) Draw the Pascals triangle and write the displacement equations of 4-noded and 8-noded element. 4+3+3=10

3. (a) Define with suitable figures, Plane stress and Plane strain problems. 5+5=10

(b) Explain Isoparametric element concept. Also state the basic theorem related to isoparametric concept. 4+6=10

4. (a) Using Lagrange's interpolation function, determine shape function for 8-noded two-dimensional rectangular element. 10

(b) Determine the shape function of a 3-dimensional brick element. 10

5. (a) Integrate the following oner 'l'.

(i) $\int_0^l L_1^2 L_2 \, dx$

(ii) $\int_0^l L_1 L_2 \, dx$

5+5=10

(b) Explain Rayleigh-Ritz Method and principle of minimum potential energy. 5+5=10

6. (a) Derive the equilibrium conditions for 2-dimensional stress distribution. 10

(b) Derive the expression for natural coordinates for a two-noded element in terms of $L1$ and $L2$, when range is 0 to 1. 10

7. Explain the following : 4×5=20

(a) Axis-symmetric Problem

(b) State of stress at a point

(c) State of strain at a point

(d) Natural coordinate system.
