(DCE 416 C)

B.Tech. DEGREE EXAMINATION, MAY - 2015

(Examination at the end of Final Year)

CIVIL ENGINEERING

Paper - VI : Finite Element Analysis

Time : 3 Hours **Maximum Marks : 75**

Answer question No.1 compulsory ***(15)***

Answer ONE question from each unit ***(4 × 15 = 60)***

1) Write briefly on :

a) What is variational method.

b) What is the basic concept involved in the finite element method.

c) Discuss the advantages and disadvantages of FEM over classical methods.

d) Define Discretisation.

e) Define natural coordinates.

f) Define stiffness matrix.

g) What is geometric variance.

h) Write the importance of isoparametric formulation.

i) What is the principle of minimum potential energy.

j) List the advantages of finite element method.

k) Define bar element and truss element.

l) Differentiate between CST and QST elements.

m) Differentiate between global coordinates and local coordinates.

n) Why patch test is used in finite element analysis.

o) Write any two applications of FEM in CIVIL ENGINEERING.

UNIT - I

2) a) Explain the concept of FEM briefly and outline the procedures. **(7)**

b) Give strain displacement relations in case of a three dimensional elasticity problem upto : **(8)**

i) Accuracy of linear terms only

ii) Accuracy of quadratic terms.

OR

3) a) Explain the convergence and compatibility requirements of a displaced functions. **(6)**

b) The element shown in Figure 1 is subjected to a temperature change of 10ºC. It has coefficient of thermal expansion, $\alpha = 7 \times 10^{-6}$ cm/cm^{o}C. The thickness of the element is 2 cm, Poisson's ratio is 0.3 and E = 200 Gpa. Find the load due to temperature change. Assume plane stress condition. **(9)**

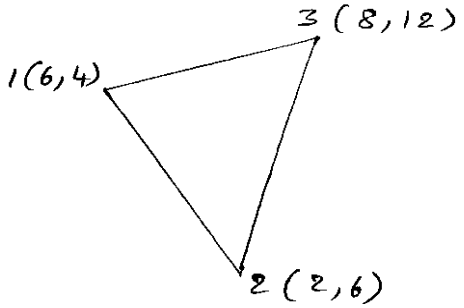

Figure 1.

UNIT - II

4) Determine the stiffness matrix, stresses and reactions in the truss structure as shown in figure 2. **(15)**

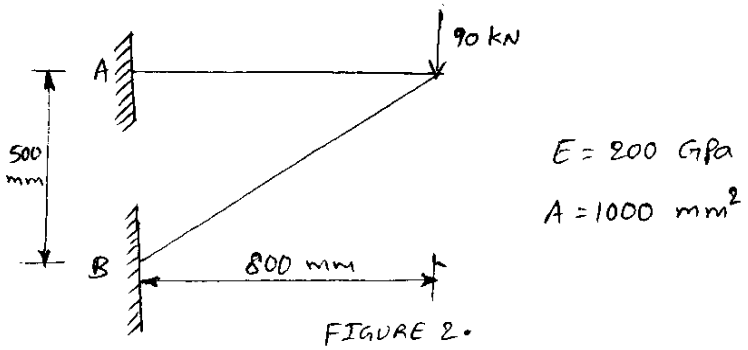

FIGURE 2.

OR

5) For the isoparametric quadrilateral elements as shown in Figure 3 determine local co-ordinates of the point Q which has Cartesian coordinates ***(15)***

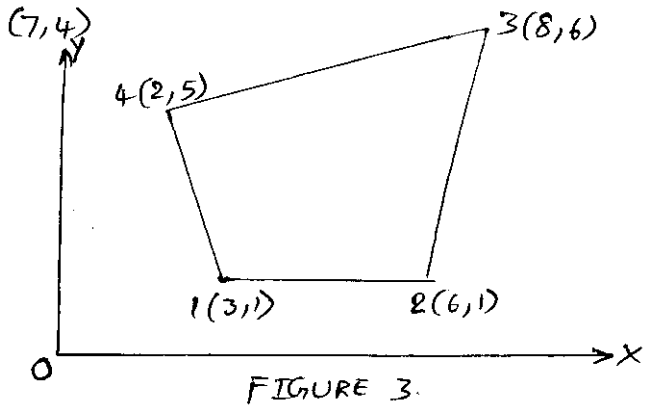

FIGURE 3.

UNIT - III

6) a) Compare between lumped loads and consistent loads. **(5)**

b) Write briefly on Gauss elimination and matrix decomposition. **(10)**

OR

7) A two dimensional plate as shown in the following figure (4) is subjected to a linearly varying load. Analyse the problem using CST elements. **(15)**

$E = 2.1 \times 10^{12}$ N/m^2, Poissons Ratio (μ) = 0.35

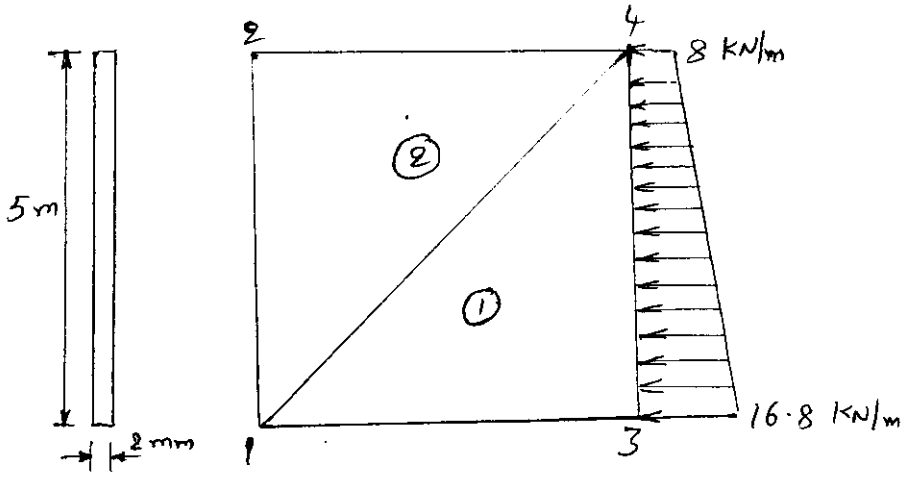

Figure (4)

UNIT – IV

8) Determine the stiffness matrix and the deflection at the centre of the simply supported beam of length 2.5 m. A 150 kN of load is acting at the centre of the beam and an uniformly distributed load of 10 kN/m throughout the length. Take Flexural Rigidity 'EI' as $900 \times 10^3 N.m^2$. **(15)**

OR

9) Explain briefly the following : **(3 × 5 = 15)**

a) Discretisation of structure.

b) Mesh refinement Vs High order element.

c) Coordinate system in FEM.

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