C 6149 (Pages : 2) Name.....

Reg. No.....

SIXTH SEMESTER B TECH. (ENGINEERING) DEGREE EXAMINATION JUNE 2010

ME 04 604—FINITE ELEMENT METHOD

(2004 Admissions)

Time : Three Hours Maximum : 100 Marks

Answer **all** *the questions.*

Any missing data may be suitably assumed.

I (a) What is a shape function ? State its characteristics.

(b) What is meant by displacement function ?

(c) Express the shape functions of a 1-D beam element.

(d) Explain the different coordinate transformation in FE modeling.

(e) Express the shape functions of a bilinear rectangular element.

(f) Explain global stiffness matrix.

(g) What are essential and non-essential boundary conditions ?

(h) Sketch the isoparametric quadrilateral element and show 2×2 and 3×3 Gaussian points.

($8 \times 5 = 40$ marks)

II (a) Explain with suitable example, the basic steps involved in finite element analysis of a structural problem.

Or

(b) (i) What are various applications of Finite Element Analysis ? Explain with simple examples.

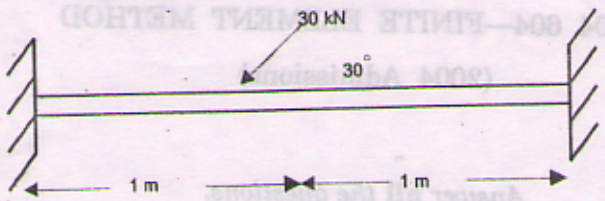
(ii) Derive the generalised stiffness matrix from minimum potential energy principle.

III (a) Derive stiffness equations for a bar element from the one dimensional second order equation by variated approach.

Or

Turn over

(b) Calculate the deflection at the center of the beam as shown in Figure. Take E = 220 Gpa ; A = 40 mm × 40 mm.



IV (a) (i) Derive strain displacement [B] matrix for a 3 noded Triangular element.

(ii) The nodal coordinates and the nodal displacements of a triangular element, under a specific load condition are given below :

$X_i = 0$, $Y_i = 0$, $X_j = 1$ mm, $Y_j = 3$ mm, $X_k = 4$ mm, $Y_k = 1$, $u_1 = 1$ mm, $u_2 = -0.05$ mm, $u_3 = 2$ mm, $v_1 = 0.5$ mm, $v_2 = 1.5$ mm and $v_3 = -1$ mm. If $E = 2 \times 10^5$ N/mm^2 and, $\mu = 0.3$, find the stresses in the element.

Or

(b) Consider a brick wall (0.7 W/m K) of thickness 30 cm. The inner surface is at 28°C and the outer surface is exposed to cold air with heat transfer coefficient of 36W/m^2 K at −15°C. Determine the steady state temperature distribution and heat flux through the wall.

V (a). (i) What are various applications of Finite Element Analysis ? Explain with simple examples.

(ii) Derive the generalised stiffness matrix from minimum potential energy principle.

Or

(b) Derive the shape functions of a constant strain triangular element. Also briefly explain area co-ordinates.

(4 × 15 = 60 marks)