Finite Element Analysis [CVPB11184B]

T_1 – 20 marks. [Marking Scheme]

Q1) Sketch of element showing positive & negative stresses. – 02 marks

$\Sigma F_x = 0$ – 2 marks

$\Sigma F_y = 0$ – 2 marks

$\Sigma F_z = 0$ – 2 marks

ΣM @ X axis $= 0$
ΣM @ Y axis $= 0$
ΣM @ Z axis $= 0$
} – 2 marks.

Q2a) Plane stress condition ⇒ 03 marks

Plane Strain condition ⇒ 03 marks

Q2b) Draw of three dimensional element – 04 marks

Q3a) Beam element

$$[K] = \frac{EI}{L^3}\begin{bmatrix} 12 & 6L & -12 & 6L \\ 6L & 4L^2 & -6L & 2L^2 \\ -12 & -6L & 12 & -6L \\ 6L & 2L^2 & -6L & 4L^2 \end{bmatrix}$$ — 6 marks.

Q3b)

$$L_1 = \frac{a_1 + b_1 x + c_1 y}{2A}$$

$$L_2 = \frac{a_2 + b_2 x + c_2 y}{2A}$$

$$L_3 = \frac{a_3 + b_3 x + c_3 y}{2A}$$

$a_1 = x_2 y_3 - x_3 y_2$
$b_1 = y_2 - y_1$
$c_1 = x_3 - x_1$
$a_2 = x_3 y_1 - x_1 y_3$
$b_2 = y_3 - y_1$
$c_2 = x_1 - x_3$
$a_3 = x_1 y_2 - x_2 y_1$
$b_3 = y_1 - y_2$
$c_3 = x_2 - x_1$

$$A = \begin{vmatrix} 1 & 1 & 1 \\ x_1 & x_2 & x_3 \\ y_1 & y_2 & y_3 \end{vmatrix}$$

– 4 marks

Q4a) $N_1 = L_1$ $N_2 = L_2$ $N_3 = L_3$ — 2 marks each

4b) Theory – 4 marks

Sd/- S.G.Joshi