* V – 0 0 3 2 *

Printed Pages : 4 **CE – 021**

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 0032 Roll No.

B. Tech.

(SEM. VIII) EXAMINATION, 2006-07

FINITE ELEMENT & FINITE DIFFERENCE METHOD

Time : 3 Hours] *[Total Marks : 100*

1 Attempt any **four** of the following : **5×4=20**

(a) Derive the expressions for **du/dx, d^2y/dx^2** and **d^3y/dx^3** using Backward difference method.

(b) Derive the expressions for **d^2y/dx^2, d^3y/dx^3** and **d^4y/dx^4** using central difference method.

(c) A beam of length 'L' supports a UDL of intensity 'w' kN/m. Calculate the maximum moment in the beam. Assume EI as constant. Use four sub-intervals.

(d) A beam of span 'L' is fixed at both ends supports a UDL of 'w' kN/m. Estimate the deflections at quarter span intervals. using second order central difference.

(e) Estimate the buckling load of a uniform pin ended column of length 'L' and flexural rigidity EI using three sub intervals.

(f) Derive the fourth order expression to solve beam vibration problems.

2 Attempt any **two** of the following : **10×2=20**

(a) A thin membrane is stretched with a constant tensile force 100 N/cm across a square frame, the length of the sides being 600 mm. The uniform lateral load on the membrane is $1N/cm^2$. Find the deflection at various grid points at 100 mm intervals. Also determine maximum slope in the membrane.

(b) What is membrane analogy ? Derive the expression required to solve torsion problems using membrane analogy.

(c) Determine the maximum deflections of a uniformly loaded square plate of side length 600 mm. Plate is clamped at all four sides. Adopt a grid spacing of '150 mm' The intensity of loading is 8 kN/m^2.

3 Attempt any **two** of the following : **10×2=20**

(a) Derive the expression for natural co-ordinates for a two noded element in terms of

(i) $\mathbf{L_1}$ and $\mathbf{L_2}$ when range is 0 to 1

(2) ξ when range is – 1 to 1.

(b) What is shape function? Using polynomial functions (generalized co-ordinate) determine shape for a two noded bar element.

(c) Explain how we descretize structures to apply finite element method.

4 Attempt any **two** of the following **10×2=20**

(a) Explain what you understand by plane stress and plane strain problems.

(b) Determine the expression of the bar shown in figure due to self weight and a concentrated load of 400 N applied at its end. Given

b_1 = 150 mm., b_2 = 75 mm, t = 20 mm,

E = 2×10^5 N/mm^2, ρ = 0.8×10^{-4} N mm^3.

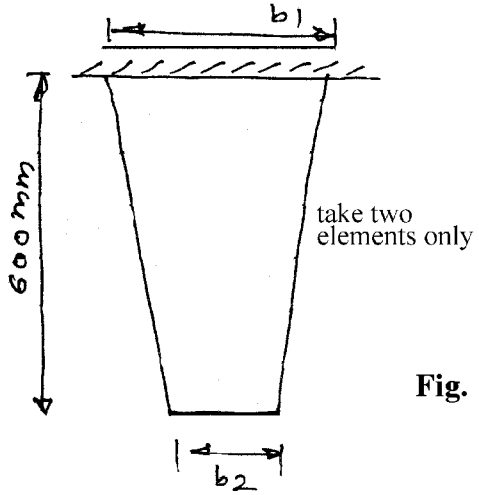

Fig.

(c) Generate the overall stiffness matrix and consistent load vector for the beam shown in figure

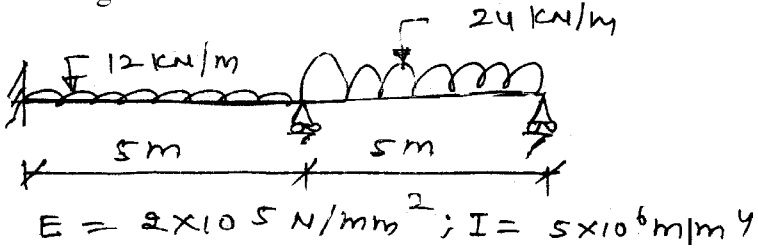

Fig.

5 Attempt any **two** of the following : **10×2=20**

(a) Explain the Gauss-Seidel iteration method to solve linear system of equations.

(b) Solve the following equations by Gaussian eleminations method :

$$3x_1 + x_2 + x_3 = 4$$

$$x_1 + 4x_2 - x_3 = -5$$

$$x_1 + x_2 - 6x_3 = -12$$

(c) Solve the following set of simultaneous equation by matrix inverse method :

$$\begin{bmatrix} 3 & 1 & 1 \\ 1 & 4 & 1 \\ 2 & 1 & 2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{Bmatrix} 2 \\ 12 \\ 10 \end{Bmatrix}$$