

Total No. of Questions : 8]

SEAT No. :

P4182

[Total No. of Pages : 3

[4960]-34
M.E. (Civil-Structures)
STRUCTURAL MATHEMATICS
(2008 Pattern)

Time : 4 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) *Attempt three questions from section I and three questions from section II.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of non programmable electronic calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

SECTION - I

Q1) a) What is the relation between flexibility and stiffness matrix? Explain with proper illustration. **[4]**

b) Using Flexibility method, analyze the beam shown. **[13]**

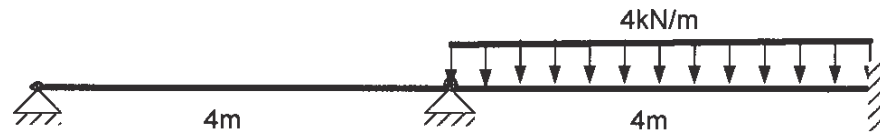


Fig.1. ■

Q2) a) Explain how the bandwidth and half bandwidth of stiffness matrix of a three storey double bay portal frame can be minimized. **[5]**

b) Using Flexibility or Stiffness method, analyze the truss shown in the Fig. 2.b. Find the joint displacements, support reactions, bar forces and bar elongations. Take $AE = 5000$ kN for all the bars. **[12]**

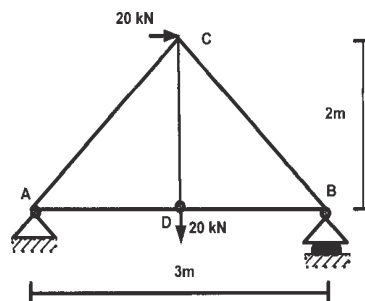


Fig. 2. ■

P.T.O.

- Q3) a)** Derive the transformation matrix for the grid member. [8]
- b)** Given $dy/dx = x-y+2$. At $x = 0, y = 1$. Calculate the value of y at $x = 0.1$ and 0.2 using an interval of 0.1 . Use Runge Kutta method. [8]
- Q4) a)** Find an approximate value of y when $x = 0.3$, given that $dy/dx = 3xy$ and $y = 0.6$ when $x = 0$. Take $h = 0.1$ Adopt Euler method. [8]
- b)** Derive the stiffness matrix of a typical space truss element. [8]

SECTION - II

- Q5) a)** For the fixed beam shown in Fig. 5.a, apply central difference formula dividing the beam in four equal parts and find the deflection at nodal points, and moment at fixed ends. [8]

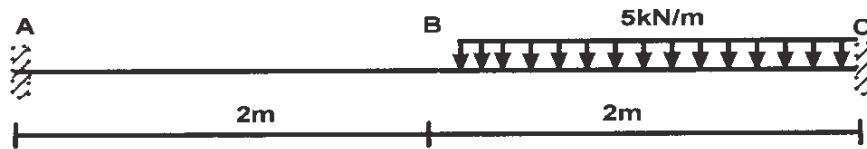


Fig. 5.a

- b)** A simply supported uniform plate of side length ' $2a \times a$ ' supports a uniformly distributed load over entire plate. Estimate the deflection at the various nodal points, using a grid interval of $h = a/2$ using finite difference method. Comment in the changes to be employed if the plate is fixed at all edges instead of simply supported. [8]
- Q6) a)** What are different interpolation techniques? Explain cubic spline interpolation? What are cubic splines? State the conditions for a spline to be cubic. [7]
- b)** Find the cubic splines for the following table of values. [9]

x :	1	2	3	4
Y :	1	5	11	8

Hence evaluate $y(1.5)$ and $y'(3)$.

Q7) a) Values of y are given at values of x as shown below. **[9]**

X	1.0	1.4	3.8	5.0
Y	15.0	20.5	38.0	34.0

Calculate the value of y at $x = 4.6$ using Lagrange interpolation technique.

b) Find a quadratic polynomial that fits the following data. **[8]**

x	-4	-2	0	2	4
y = f(x)	2	1	1	1	2

Q8) a) What are the numerical methods to evaluate area under the curve? Explain the advantage of Gauss Quadrature over other methods. **[7]**

b) A beam simply supported at its ends supports uniformly distributed load of 5 kN/m over the entire length of 6 m. Find a Fourier expression for the load. Calculate the deflection and bending moment at its centre. **[10]**

