Total No. of Questions : 8]

SEAT No. :

P4460

[Total No. of Pages : 4

[4860]-34

M.E. (Civil/Structures)

STRUCTURAL MATHEMATICS

(2008 Course) (Semester-I) (501401)

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) Using Flexibility method, analyze the beam shown. **[12]**

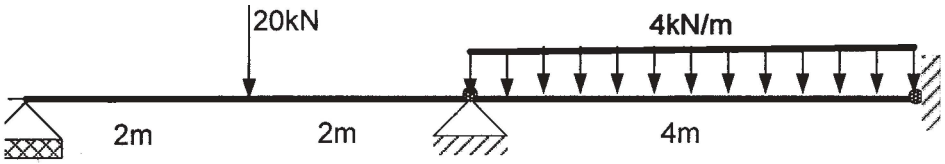

Fig.1.a

b) Discuss the concept of banded matrix. Explain the band width and half band width of stiffness matrix with a suitable example. **[5]**

Q2) a) A 2.4 m long boom is held by ball and socket joint at A and by two cables BD and CD as shown in the Fig. 2a, find the displacement of joint D if weight of 380 N is attached at D. Use stiffness method. **[12]**

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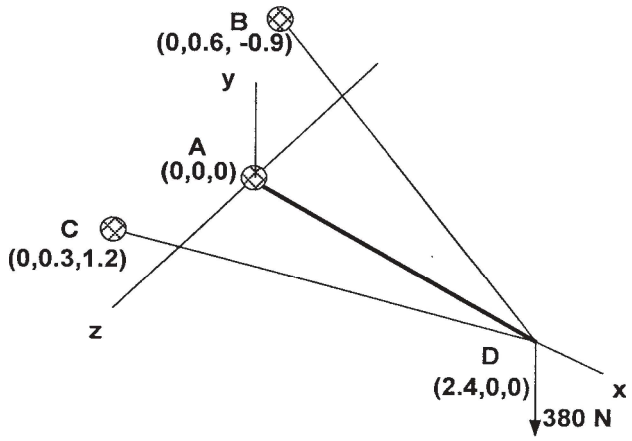

Fig. 2.a

b) Estimate the lowest buckling load of a uniform pin ended column of length L and flexural rigidity EI using Eigen value technique. Divide the column in three equal parts. **[5]**

Q3) a) For a space frame member, develop the member stiffness matrix with proper sketches. **[8]**

b) Derive the transformation matrix for the grid member. **[8]**

Q4) a) Using Euler's method, find an approximate value of y when $x = 0.3$, given that $dy/dx = 2xy$ and $y = 0.5$ when $x = 0$. Take $h = 0.1$. **[7]**

b) Solve the pair of simultaneous equations **[9]**

$$dy_1/dx = y_2, y_1(0) = 1$$

$$dy_2/dx = y_1 * y_2 + x^2 + 1, y_2(0) = 0$$

Estimate the values of $y_1(0.2)$ and $y_2(0.2)$.

SECTION-II

Q5) a) A fixed beam of variable flexural rigidity supports a concentrated load W as shown in Fig. 5a. Estimate the deflection under the load considering three sub intervals of the beam. Use finite difference method. **[8]**

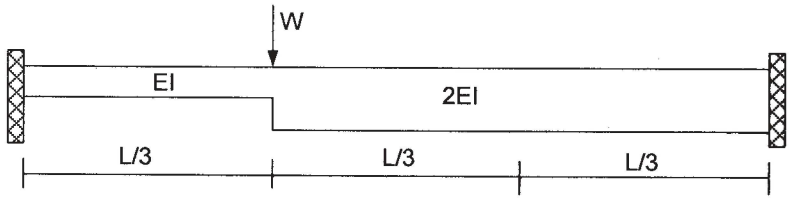

Fig. 5.a

b) A simply supported uniform rectangular plate of size 3m by 6m supports a uniformly distributed load of intensity 500 kN/m^2 over one half of the plate as shown in Fig. 5b. Estimate the deflections at the interior nodes, assuming the thickness of the plate t = 50 mm, Poisson's ratio = 0.25 and Modulus of elasticity E = 2×10^5 N/mm^2. Divide the plate into 2×4 mesh. Use finite difference method. **[9]**

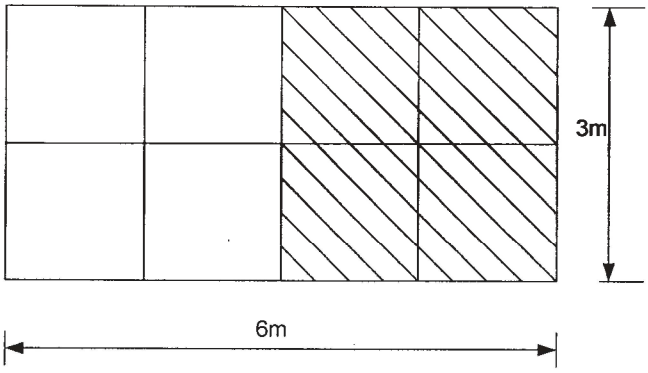

Fig 5.b

Q6) a) Values of y are given at values of x as shown below. **[10]**

x	1.0	1.5	4.0	6.0
y	16.0	22.5	40.0	36.0

Calculate the value of y at $x = 4.5$ using Lagrange interpolation Technique.

b) What do you understand by Spline interpolation? What are cubic splines? State the conditions for a spline to be cubic. **[7]**

Q7) a) With a schematic diagram show the coefficients of different operators for the second order, third order and fourth order central differences. **[5]**

b) The data given in table, fit a formula of the type $y = a\,x^n$. Find the values of a and n and hence the required formula. **[11]**

x	10	20	30	40	50	60	70	80
y	1.06	1.33	1.52	1.68	1.81	1.91	2.01	2.11

Q8) a) Compute the Integral $\int_2^5 (1+x^4)dx$ using Gaussian three point formula. Compare it with Simpson's 3/8th rule by taking h = 1. **[8]**

b) A beam 9 m long simply supported at its ends supports uniformly distributed load of 4 kN/m over the entire length. Find a Fourier expression for the load. Calculate the deflection and bending moment at its centre. **[8]**

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