Total No. of Questions :8]

SEAT No. :

P3842

[Total No. of Pages : 3

[5462]-540

M.E. (Civil - Structures)

NUMERICAL METHODS IN STRUCTURAL ENGINEERING

(2017 Credit Course) (Semester - I) (501004)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.***
2) ***Figures to the right indicate full marks.***
3) ***If necessary, assume suitable data and indicate clearly***
4) ***Use of electronic pocket calculator is allowed.***

Q1) a) A propped cantilever beam AB is loaded as shown in *fig.1*. Using matrix method of analysis, determine the reactions at supports. **[5]**

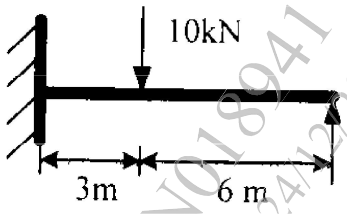

Fig. 1

b) Solve the linear system step by step by Gauss Jordan Method. **[4]**

$$x + y + z = 5.$$
$$2x + 3y + 5z = 8$$
$$4x + 5z = 2$$

OR

Q2) a) Find the displacements at 1, 2 and 3 for the following assembly shown in *Fig. 2* using stiffness method. **[5]**

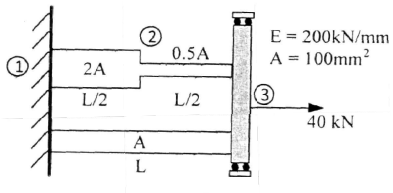

Fig. 2

b) Explain the difference in Gauss Seidel and Gauss Jordan method for the solution of linear equations. Explain the convergence criteria and diagonal dominance with reference to above methods. **[4]**

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Q3) a) Complete six iterations of power method to approximate a dominant **[4]**

Eigen vector of $A = \begin{bmatrix} 2 & -12 \\ 1 & -5 \end{bmatrix}$ beginning with an initial non zero approximation of $x_0 = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$

b) Derive the 1-point and 2-point Gauss Quadrature formula and hence evaluate the integral $\int_0^{0.8} \frac{\sin hx}{x} dx$ and compare with exact value. **[5]**

OR

Q4) a) Find the approximate solution of the initial value problem $\frac{dx}{dt} = 1 + \frac{x}{t}\ 0 \le t \le 3$ with the initial condition $x(1) = 1$ using the Runge Kutta fourth order with step size h=1. **[4]**

b) Write note on closed and open Newton's Cote method. **[5]**

Q5) a) A square plate with side length L fixed on one side and supporting a transverse load P at the center of the outboard side as shown in the *Fig.3*. Develop the equations of deflection using finite difference method. **[8]**

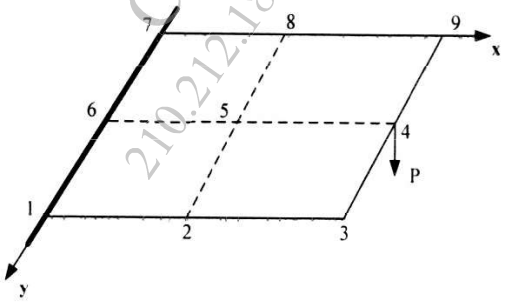

Fig. 3

b) Estimate the lowest buckling load of a uniform pin ended column of length L and flexural rigidity EI using three sub-intervals. Compare the approximate value obtained with the exact value given by Euler's critical load theory. **[8]**

OR

Q6) a) A propped cantilever beam of 6m span is subjected to an uniformly distributed load of 10kN/m. Applying central difference formula dividing the beam in four equal parts, find the deflection at the nodal points, rotation at the simply supported end and moment at its fixed end. **[8]**

b) A simply supported uniform square plate is subjected to a uniformly distributed load q. Dividing the plate into 4×4 mesh, find the deflection at the interior nodal points using finite difference methods.

If the plate is subjected to concentrated load P at the center instead of uniformly distributed load q, comment on the changes to be made in the formulation. **[8]**

Q7) a) What is spline interpolation function? How are they different from Lagrange's interpolation function? **[8]**

b) Find the quadratic polynomial that fits the given data: **[8]**

x	-3	-1	0	1	3
y = f(x)	2	1.5	1.4	1.5	2

OR

Q8) a) Find the cubic splines for the given data: **[8]**

x	1	2	3	4
y	1	4	12	6

b) Explain regression analysis with suitable example. **[8]**