Question Paper

Exam Date & Time: 30-Nov-2018 (09:30 AM - 12:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTRE FOR APPLIED SCIENCES
IV SEMESTER B.S. ENGG. END SEMESTER EXAMINATION-NOV/DEC 2018
Numerical Methods In Civil Engg. [CE 245]

Marks: 100 **Duration: 180 mins.**

Answer 5 out of 8 questions.

Missing data, if any, may be suitably assumed.

1) (10)

A) Explain the procedure of Jacobi's method of determination of Eigen values and Eigen vectors of a given vector.

B) (10)

Solve the following system of linear equations by 'Gauss Elimination Method'

$$2x_1 - 3x_2 + x_3 = -1,$$
$$x_1 + 4x_2 + 5x_3 = 25$$
$$3x_1 - 4x_2 + x_3 = 2$$

2) (10)

A) Evaluate $\int_{-2}^{+2} \frac{tdt}{5+2t}$ using Trapezoidal rule, take n=8.

B) (10)

Find the inverse of the given matrix by "Gauss-Jordan" method.

$$[C] = \begin{bmatrix} 2 & 1 & 1 \\ 3 & 2 & 3 \\ 1 & 4 & 9 \end{bmatrix}$$

show that $C.C^{-1}$ = Identity matrix

3) (10)

A) Solve the following system of linear equations by 'Jacobi Iteration Method'

$$20x_1 + x_2 - 2x_3 = 17$$
$$3x_1 + 20x_2 - x_3 = -18$$
$$2x_1 - 3x_2 + 20x_3 = 25$$

B) (10)

Using 'Adam's Bashforth' formula find y(0.4) for the differential function,

$$\left[\frac{dy}{dx}\right] = \frac{(1+x)^2 y^2}{2}$$ with y (0) = 1, y (0.1) =1.06, y(0.2)=1.12 and y(0.3)=1.21.

4) (10)

A) Using Newton-Rapson method, find the roots of the polynomial, $x^3 - 5x + 3 = 0$, correct to 3 decimal places.

B) (10)

A simply supported beam of span 6m supports a uniformly distributed load of 5 kN/m over the whole span. Estimate the area of bending moment diagram considering 1m intervals, using (a) Trapezoidal rule (b) Simpson's 1/3rd rule. Which method is more appropriate and why?

5) (10)

A) Using 'Runge-Kutta Fourth Order' method estimate the y (0.2) and y(0.4) given $\left[\frac{dy}{dx}\right] = \frac{y^2 - x^2}{y^2 + x^2}$ with y (0) = 1.0.

B) Evaluate numerically the following integral by "Gaussian Quadrature" method. (10)

$$I = \frac{3}{\sqrt{\pi}} \int_0^4 e^{-x^2} dx$$

6) Using fourth order central difference formula, estimate the critical load for the pin ended column with variable EI Refer **Fig. Q. No. 6.** (20)

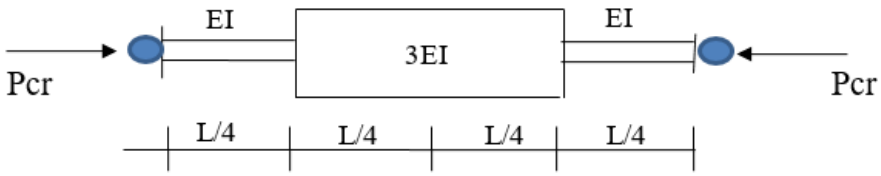

Fig. Q. No. 6

7) Find the largest Eigen values and corresponding eigen vector of the given matrix. (10)

A)

$$A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix} \qquad \text{Given } X_o = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$$

B) Solve the given system of equations using LU decomposition Method (10)

$$10x + y + z = 12$$
$$2x + 10y + z = 13$$
$$2x + 2y + 10z = 14$$

8) (12)

A) A simply supported beam supports a uniformly varying load of w kN/m. estimate the bending moment and deflection in each nodal points of beam by considering four equal intervals.

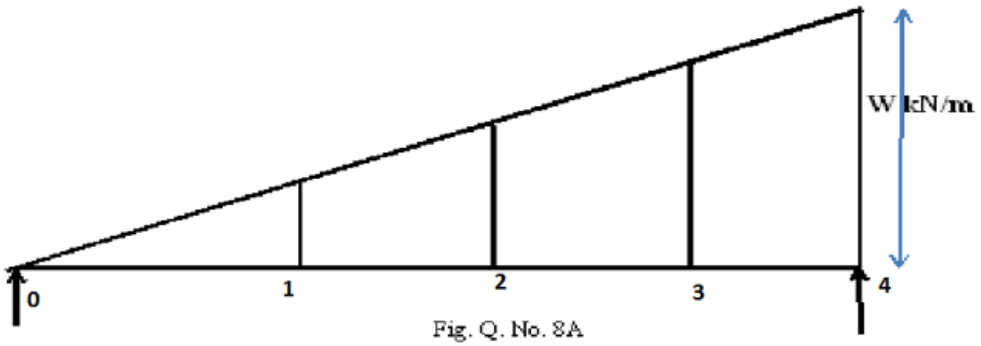

Fig. Q. No. 8A

B) Find the root of the polynomial, $x^3 - 4x - 9 = 0$ by 'Bisection Method'. (8)

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