Reg. No.											

INTERNATIONAL CENTRE FOR APPLIED SCIENCES

(Manipal University)

IV SEMESTER B.S. DEGREE EXAMINATION - OCT. / NOV. 2017

SUBJECT: NUMERICAL METHODS OF CIVIL ENGINEERING (CE 245)

(BRANCH: CIVIL)

Tuesday, 31 October 2017

Time: 3 Hours **Max. Marks: 100**

✓ **Answer ANY FIVE Questions.**

1A. Explain the procedure of Jacobi's method of determination of Eigen values and Eigen vectors of a given vector.

1B. Solve the following system of linear equations by 'Gauss Elimination Method'

$$2x_1 - 3x_2 + x_3 = -1,$$

$$x_1 + 4x_2 + 5x_3 = 25$$

$$3x_1 - 4x_2 + x_3 = 2$$ (10+10)

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

2B. 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 (10+10)

3A. Solve the following system of linear equations by 'Jacobi Iteration Method'

$$20x_1 + x_2 - 2x_3 = 17$$

$$3x_1 + 20x_2 - x_3 = -18$$

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

3B. 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.

(10+10)

4A. Using Newton-Rapson method, find the roots of the polynomial, $x^3 - 5x + 3 = 0$, correct to 3 decimal places.

4B. 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? (10+10)

5A. 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.

5B. Evaluate numerically the following integral by "Gaussian Quadrature" method.

$$I = \frac{3}{\sqrt{\pi}} \int_0^4 e^{-x^2} dx \qquad (10+10)$$

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)

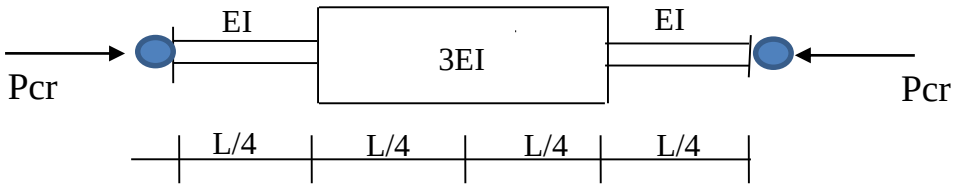

Fig. Q. No. 6

7A. Find the largest Eigen values and corresponding eigen vector of the given matrix.

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

7B. Solve the given system of equations using LU decomposition Method

$$10x + y + z = 12$$
$$2x + 10y + z = 13$$
$$2x + 2y + 10z = 14 \qquad (10+10)$$

8A. A simply supported beam supports a uniformly varying load of w kN/m. estimate the bending moment and deflection in each nodal points beam by considering four equal intervals.

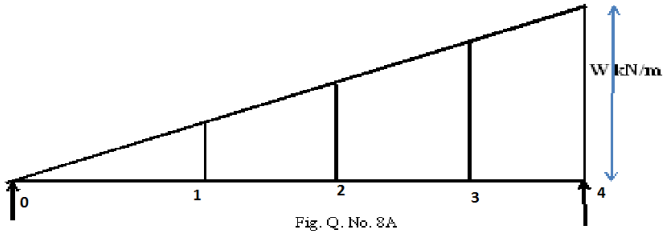

Fig. Q. No. 8A

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

(12+8)