ALCCS

Code: CS41 **Subject: NUMERICAL & SCIENTIFIC COMPUTING**

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

MARCH 2010

NOTE:

- **Question 1 is compulsory and carries 28 marks. Answer any FOUR questions from the rest. Marks are indicated against each question.**
- **Parts of a question should be answered at the same place.**
- **All calculations should be up to three places of decimals.**

Q.1 a. Find the number of terms of the exponential series such that their sum gives the value of e^x correct to six decimal places at x = 1.

b. Find a root of the equation $xe^x = \cos x$, by the secant method upto two iterations.

c. Factorize the matrix $\begin{pmatrix} 3 & 2 & 7 \\ 2 & 3 & 1 \\ 3 & 4 & 1 \end{pmatrix}$ using LU decomposition.

d. Given the matrix A = I + L + U, where $A = \begin{bmatrix} 1 & 2 & -2 \\ 1 & 1 & 1 \\ 2 & 2 & 1 \end{bmatrix}$, L and U are the lower and upper triangular matrices respectively, decide whether Jacobi method converges to the solution of Ax = b.

e. Evaluate $\int_{-1}^{1} \frac{dx}{1+x^2}$ using Gauss formula for n = 2.

f. Solve

$\frac{dy}{dx} = y - \frac{2x}{y}; y(0) = 1$ at x = 0.1 using Euler method.

g. Show that $\Delta^3 y_2 = \nabla^3 y_5$. **(7 × 4)**

Q.2 a. Find a real root of $2x - \log_{10} x = 7$ correct to four decimal places using Newton's Method.

b. One entry in the following table is incorrect and y is a cubic polynomial in x. Use the difference table to locate and correct the error: **(9+9)**

x	0	1	2	3	4	5	6	7
y	25	21	18	18	27	45	76	123

Q.3 a. Solve by Gauss-Seidel method, the following system of equations:

$$x + y + z = 9$$
$$2x - 3y + 4z = 13$$
$$3x + 4y + 5z = 40$$

b. Solve by Relaxation method, the system of equations:

$$10x_1 - 2x_2 - 2x_3 = 6;$$
$$-x_1 + 10x_2 - 2x_3 = 7;$$
$$-x_1 - x_2 + 10x_3 = 8.$$

(9+9)

Q.4 a. Using Jacobi's method, find all the eigenvalues and the eigenvectors of the matrix

$$A = \begin{pmatrix} 1 & \sqrt{2} & 2 \\ \sqrt{2} & 3 & \sqrt{2} \\ 2 & \sqrt{2} & 1 \end{pmatrix}$$

b. Using inverse interpolation, find the real root of the equation $x^3 + x - 3 = 0$ which is close to 1.2. **(9+9)**

Q.**5** a. The following table gives the distance in nautical miles of the visible horizon for the given heights in feet above the earth's surface :

x = height	100	150	200	250	300	350	400
y = distance	10.63	13.03	15.04	16.81	18.42	19.90	21.27

Find the value of y when x = 218 ft and x = 410 ft.

b. From the given data, find the maximum value of y: **(9+9)**

x	-1	1	2	3
y	-21	15	12	3

Q.6 a. Use Romberg's method to compute $\int_0^1 \frac{dx}{1+x^2}$ correct to four decimal places.

b. Determine f(x) as a polynomial in x for the following data: **(9+9)**

x	-4	-1	0	2	5
y	1245	33	5	9	1335

Q.7 a. Using Runge-Kutta method of fourth order, solve for y(0.1), y(0.2) given that $\frac{dy}{dx} = xy + y^2, y(0) = 1$.

b. Using Taylor's series method, solve $\frac{dy}{dx} = x^2 - y, y(0) = 1$ at x = 0.1, 0.2. **(12+6)**