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Total Number of Pages: 02

Course: M.Sc.I
Sub_Code: FMCC704

7th Semester Regular Examination: 2024-25

Advanced Numerical Method

BRANCH(S): M.Sc.I(MC)

Time: 3 Hours

Max Marks: 70

Q.Code: R190

Answer Question No.1 (Part-I) which is compulsory, any five from rest (Part-II)

The figures in the right hand margin indicate marks.

Part-I

Q1 Answer the following questions:

(2 x 10)

- Write the pade approximation of e^x .
- What is the meaning of convergence analysis of eigenvalues and eigenvectors?
- Write Poisson's equation for 2nd order LPDE.
- Write conditions for 2nd order LPDE of 2nd order in two variables.
- What do you mean by Rate of convergence?
- What is the meaning of Quadrature?
- What do you mean by similarity of matrices?
- What is the truncation error of Euler's method?
- What is the meaning of round-off error and its effect?
- What is the difference between interpolation and extrapolation?

Part-II

Long Answer Type Questions (Answer Any five)

Q2 a) Evaluate $\int_0^6 \frac{dx}{1+x^2}$ using Simpson's $\frac{1}{3}rd$ rule taking $n = 6$. Then find exact value and error. (5+5)

b) Solve by Lagrange interpolation and find $f(0.35)$ using the following table

x	0.3	0.5	0.6
$f(x)$	0.6179	0.6915	0.7257

Q3 a) Solve the equation $x^3 - 4x - 9$ by bisection method correct upto three decimal places. (5+5)

b) Prove that eigenvalues of a Hermitian Matrix are always real.

Q4 a) Using Runge-Kutta method find an approximate value of y when $\frac{dy}{dx} = x+y$ and $y = 1$ when $x = 0$. Take $h = 0.2$ **(5+5)**

b) Prove that determinant of orthogonal matrix is ± 1 .

Q5 a) Transform to principal axes $17x_1^2 - 30x_1x_2 + 17x_2^2 = 128$ **(5+5)**

b) Diagonalize the matrix $A = \begin{pmatrix} 5 & 4 \\ 1 & 2 \end{pmatrix}$.

Q6 Write short notes on: **(5+5)**

a) Romberg integration

b) Predictor and corrector method

Q7 a) Solve the initial value problem $\frac{dy}{dx} = \frac{y-x}{y+x}$, $y(0) = 1$ by Euler's method and the approximate value of y at $x = 0.1$ upto 5 decimal places. **(5+5)**

b) Find the cubic splines & evaluate $y(1.5)$ and $y'(3)$ for the following data:

x	1	2	3	4
y	1	2	5	11

Q8 a) For the system of linear equations $x + y + 2z = 4$, $3x + 2y + 5z = 10$, $4x + 5y + z = 10$. Find the inverse of A such that $Ax = B$, by inverse factorization method. **(5+5)**

b) Find the missing values in the following table.

x	45	50	55	60	65
y	3.0		2.0		-2.4