KANYASHREE UNIVERSITY

M.Sc. 1st Semester Examination-2024

Subject: Mathematics

Course- CC 6

Numerical Analysis

Full Marks-40 **Time-2.00 Hours**

GROUP - A

(Answer **any four** of the following) **(5×4=20)**

1. What do you mean by n-digit Floating Point Form? Calculate both the absolute and relative error when the real number 0.000005823417658 is stored in 5-digit base ten floating point form. (2+3)
2. Define Interpolation. Determine the Hermite polynomial of degree 4, which fits the following data: (1+4)

x	0	1	2
y(x)	0	1	0
y′(x)	0	0	0

3. Using Picard's method to compute $y(0.2)$ correct up to three decimal places from the differential equation $\frac{dy}{dx}=1+xy$ with $y=1$ at $x=0$.
4. Let (2, 2), (-1.5, -2), (4, 4.5) and (-2.5, -3) be a sample, use least squares method to fit the line $y = ax + b$ based on this sample and estimates the total error (sum of the square of the residuals).
5. Solve the following system of equations $x^2 + y^2 = 4x$, $x^2 + y^2 = 8x - 15$ starting with (3.5, 1.0) by iteration method.
6. Using Adams-Bashforth method obtain the solution of the differential equation $\frac{dy}{dx}=x-y^2$ at $x=0.8$, given that $y(0)=0,\ y(0.2)=0.02,\ y(0.4)=0.0795$ and $y(0.6)=0.1762$.

GROUP – B

(Answer **any two** of the following) **(10× 2=20)**

7. (i) Consider the following table of values and calculate the value of y(1.5) using Aitken interpolation method.

x	0	1	2	3
y(x)	21.4	27.5	32.6	40.3

(ii) Use least squares method to approximate the function $y = xe^x$ to a quadratic polynomial on [0, 1]. (6+4)

8. Write down the fourth order Runge-Kutta method. Find $y(0.4)$ from the differential equation $\frac{dy}{dx} = x - y$, $y(0) = 1$ by taking $h = 0.1$ by fourth order Runge-Kutta method correct up to four decimal places. (2+8)

9. (i) Express $x^4 - x^3 + 3x + 2$ in terms of Chebyshev polynomials.

(ii) Compute the approximate solution of the partial difference equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$; $0 \le x \le 1,\ t > 0,\ u(x,0) = \frac{1}{2}\sin \pi x,\ u(0,t) = u(1,t) = 0$ using the forward difference method. Use $h = \frac{1}{3},\ \alpha = \frac{1}{2}$. (4+6)

****