RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. SIXTH SEMESTER EXAMINATION, JUNE 2022

THIRD YEAR (BATCH 2019-22)

Date : 16/06/2022 **MATHEMATICS (Honours)**

Time : 11.00 am – 1.00 pm **Paper : XIII [CC13]** Full Marks : 50

***Answer <u>any five</u> questions*:** [5×10]

1. a) Deduce Newton's backward interpolation formula. When the formula is applicable? [4+1]

   b) Find the error in general form for polynomial interpolation. [5]

2. a) Find the numerical differentiation formula based on Lagrange's interpolation. [5]

   b) Establish Simpson's Three-Eighth Rule for numerical integration. [5]

3. a) Find the Inherent error in Simpson's one-third rule for numerical integration. [5]

   b) Discuss fixed point iteration method for finding a simple root of $f(x)=0$. [5]

4. a) Establish Newton-Raphson method for finding a simple root of $f(x)=0$. Why is this method called method of tangents? [6+1]

   b) Show that the order of convergence of Newton-Raphson method for finding a simple root of $f(x)=0$ is 2. [3]

5. a) Discuss with example :

   i) Round-off error ii) Truncation error [4]

   b) Using Gauss Jordan method solve

   $$x_1+3x_2+2x_3=1$$
   $$x_1+2x_2+3x_3=2$$
   $$2x_1-x_2+4x_3=3$$

   [6]

6. a) Solve $\frac{dy}{dx}=x-y$ with $y=1$ at $x=0$ for the interval $I=\left[0,\frac{3}{4}\right]$ using Runge-Kutta fourth order method with step length $h=0.25$, correct upto 3 significant figures. [7]

   b) Calculate $y(0.25)$ for the above problem using modified Euler method with same h. [3]

7. a) Find a bound on the truncation error committed while taking $e^x \approx 1+x+\frac{x^2}{2!}+\frac{x^3}{3!}$ in the interval $[-1,1]$. [3]

   b) Find the eigen value with largest magnitude for the matrix

   $$A=\begin{bmatrix}2 & 4 & 6\\ 3 & 9 & 15\\ 4 & 16 & 36\end{bmatrix}$$ using power method. [7]

8. a) Use Gauss-elimination method to solve

$$2x_1 + 3x_2 + x_3 = 9$$
$$x_1 + 2x_2 + 3x_3 = 6$$
$$3x_1 + x_2 + 2x_3 = 8$$

correct upto 2 significant figures. [7]

b) Compare Gauss-Seidel method with Gauss-Jacobi method. [3]

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