

211130

M. Sc./M. A. (Fourth Semester) Examination, June 2021

MATHEMATICS

Paper : Group-III-O

(Advanced Numerical Analysis-II)

Maximum Marks : 42

*Note: This paper is divided into **three** sections. Attempt questions in each section as per instruction in that section.*

Section-‘A’

(Objective Type Questions)

7×1=7

Note : Attempt all questions. Each question carries 1 mark.

1. Choose the correct answer :

(i) Milne-Simpson method is a :

- (a) Single step method
- (b) Multi step method
- (c) Both
- (d) None

(ii) By Euler’s method n^{th} approximate value of y at $x = x_n = x_0 + nh$ is :

- (a) $y_n = y_0 + hf(x_{n-1}, y_{n-1})$
- (b) $y_n = y_0 - hf(x_{n-1}, y_{n-1})$
- (c) $y_n = y_{n-1} + hf(x_{n-1}, y_{n-1})$
- (d) $y_n = y_{n-1} - hf(x_{n-1}, y_{n-1})$

(iii) A solution to a boundary value problem which satisfies boundary condition is a solution to the

- (a) Differential equations
- (b) Integral equations
- (c) Logical equations
- (d) Quadratic equations

- (iv) Numerical method for solving differential the equations by approximating them with difference equations is called :
- Finite volume
 - Finite difference
 - Finite element
 - None
- (v) The higher order elements are also called as :
- Complex elements
 - Compound elements
 - Linear elements
 - None
- (vi) Method of constructing new data points within range of discrete set of known data points is termed as :
- Extrapolation
 - Interpolation
 - Antipolation
 - Dentipolation
- (vii) An ordinary differential equation is differential equation which involves?
- Only one independent variable
 - Two independent variable
 - n independent variable
 - None

Section-‘B’
(Short Answer Type Questions)

5×2=10

Note : Attempt all questions. Each question carries 2 marks.

2. What is extrapolation? Explain.

Or

Explain the explicit multistep method.

3. Write the diference between absolute and relative stabilities.

Or

Solve the equation :

$$\frac{dy}{dx} = -yx^2 \text{ with } y(0) = 2$$

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4. Write a note on second order non linear differential equation.

Or

Explain secant method.

5. Explain Local Truncation Error.

Or

Write a note on stability of finite difference schemes.

6. Explain Linear Lagrange Polynomial.

Or

What is Adaptivity? Explain.

Section-‘C’

(Long Answer Type Questions)

5×5=25

Note : Attempt all questions. Each question carries 5 marks.

7. Solve $y' = x + y$ with $y(0) = 1$ from $x = 0$ to $x = 0.4$ with $h = 0.1$ by Milne's method.

Or

Given $\frac{dy}{dx} = x - y^2$ and $y(0) = 0$, $y(0.2) = 0.0200$, $y(0.4) = 0.795$, $y(0.6) = 0.1762$ evaluate $y(0.8)$ by Adams-Bashforth method.

8. Prove that the order p of an Astable linear multistep method cannot exceed 2 and the method must be implicit.

Or

Use Runge-Kuta method to find $y(0.2)$ for the equation

$$\frac{d^2y}{dx^2} = x \frac{dy}{dx} - y$$

initial conditions are $x = 0, y = 1, \frac{dy}{dx} = 0$.

9. Explain shooting method in detail.

Or

Solve the boundary value problem

$$\frac{d^2y}{dx^2} + \sin y = \cos x$$

with boundary conditions $y(-1) = 0, y(1) = 0$.

10. Explain finite difference approximation method in detail.

Or

Solve the following differential equation by finite difference method.

$$y'' = \frac{1}{2}y' - \frac{1}{2}y + \frac{x^2 + 3}{2}$$

given $y(0) = 1, y(4) = 24$.

11. Explain finite element method. What is the advantage of finite element method over finite difference method?

Or

Solve the boundary value problem

$$u'' + u = x, \quad 0 < x < 1$$

$$u(0) = 4, u(1) = 1$$

Using the Ritz finite element method with linear piecewise polynomials for two elements of equal length.