UC-**5706**

M. A. / M. Sc. (Sem. II)
Examination, June - 2023

MATHEMATICS

PAPER - MATH 2C1

NUMERICAL ANALYSIS

Time Allowed : **Three Hours**

Maximum Marks : **100**

Note : *This question paper contains three sections as under :*

Section-A ***Max. Marks - 10***

This section contains one compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part. All questions carry equal marks.

Section-B ***Max. Marks-50***

This section contains 10 questions having 2 questions from each unit. Answer 5 questions (250 words each) selecting one question from each unit. All questions carry equal marks.

Section-C ***Max. Marks-40***

This section contains 04 descriptive type questions (questions may have sub divisions) covering all units but not more than one question from each unit. Answer any two questions. (500 words each). All questions carry equal marks.

SECTION - A

1 Answer the following questions :

(i) Write Secant method for non-linear equation.

(ii) Write Graeffe's root square method to find the roots of polynomial equations.

(iii) Define Gauss method for the solution system of linear equations.

(iv) Write relaxation methods.

(v) Write least square principle for curve fitting.

(vi) Define eigen values of a matrix.

(vii) Write improved Euler method for the solution of ordinary differential equations.

(viii) What is the order of error in the fourth-ordered Runge-Kutta formula.

(ix) Define boundary value problem.

(x) Write finite step method.

SECTION - B

UNIT - I

2 Using the Newton - Raphson method to find a root of the equation $x^3 - 2x - 5 = 0$.

3 Find a root of the equation $4e^{-x}\sin x - 1 = 0$ by Regula-Falsi method given that the root lies between 0 and 0.5.

UNIT - II

4 Using Gauss elimination method. solve the following system of equation :

$$2x_1 + 4x_2 + x_3 = 3$$
$$3x_1 + 2x_2 - 2x_3 = -2$$
$$x_1 - x_2 + x_3 = 6$$

5 Solve the following system by Gauss-Seidal iteration method :

$$27x - 6y - z = 85$$
$$6x + 15y - 2z = 72$$
$$x + y + 54z = 110$$

UNIT - III

6 Using the method of least-squares, find an equation of the form $y = a_1x + a_2x^2$ that fits the following data.

x:	1	2	3	4	5	6
y:	2.6	5.4	8.7	12.1	16	20.2

7 Use Chebyshev polynomials to find the best uniform approximation of degree 4 or less to x^5 on [-1, 1]

UNIT - IV

8 Use Euler's modified method to solve

$\frac{dy}{dx} = x^2 + y$ with $y(0) = 0.94$.

Find $y(0.1)$ to five significant figures.

9 Using Runge-Kutta method, find the approximate value of $y(0.1)$ if

$\frac{dy}{dx} = x + y^2$ if $y(0) = 1$

UNIT - V

10 Write a short note on stability analysis.

11 Solve the boundary value problem.

$\frac{d^2y}{dx^2} - 64y + 10 = 0$

$y(0) = y(1) = 0$

by the finite difference method, compute $y(0.5)$.

SECTION - C

12 Use Milne's P-C method to obtain $y(0.4)$ by solving

$\frac{dy}{dx} = 2e^x - y$ given that $y(0) = 2$; $y(0.1) = 2.01$;

$y(0.2) = 2.04$; $y(0.3) = 2.09$

13 Find the roots of the equation

$x^3 - 2x - 5 = 0$

by Birge-Vieta method correct upto four places of decimal.

14 Solve the system of equations :

$$2x_1 - 13x_2 - 3x_3 = 49$$
$$5x_1 - 6x_2 + 17x_3 = 25$$
$$11x_1 + 2x_2 - 4x_3 = -31$$

using Relaxation method.

15 Find the best lower order approximation to the polynomial:

$$y(x) = 1 - x + \frac{x^2}{2} - \frac{x^3}{6} + \frac{x^4}{24} + \frac{x^5}{120}, \quad x \in \left(-\frac{1}{2}, \frac{1}{2}\right).$$
