

2022

M.Sc.

2nd Semester Examination

**APPLIED MATHEMATICS WITH OCEANOLOGY
AND
COMPUTER PROGRAMMING**

PAPER—MTM-297

(Practical)

C PROGRAMMING WITH NUMERICAL METHODS LAB.

Full Marks : 25

Time : 2 Hours

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer one question from each group.
(Questions to be selected by lottery)

Group - A

1×8

1. Write a program in C to find the value of integration

$\int_0^1 (x^2 + 1) dx$ by Gauss-Legendre quadrature formula

for 4 & 6 points.

(Turn Over)

2. Write a program in C to search a number from a dynamic sorted list of numbers by binary search technique.
3. Write a program in C to sort a dynamic list of numbers by insertion sort technique.

4. Write a program in C to find the value of integration

$$\int_{-1}^1 \sqrt{x^2 + 1} dx \text{ by Gauss-Chebyshev quadrature}$$

formula for 4 & 6 points.

5. Write a program in C to sort a dynamic list of numbers by bubble sort technique.
6. Write a program in C to create two vectors using dynamic memory allocation and perform addition and subtraction operations among them.

7. Write a program in C to create two vectors for two polynomials using dynamic memory allocation and find the products of them.
8. Write a program in C to create two matrices using dynamic memory allocation and perform addition and subtraction operations among them.
9. Write a program in C to create two matrices using dynamic memory allocation and perform multiplication and transpose operations among them.
10. Write a program in C to create a vector and a matrix using dynamic memory allocation. Then solve a system of linear equations.

Group - B

1×12

1. Write a program in C to fitting a straight line through a set of points (x_i, y_i) using dynamic memory allocation.

2. Write a program in C to find a real root of an equation $x^3 - 8x - 4 = 0$ by Newton-Raphson's method.

3. Write a program in C to find the solutions of a system of linear equations

$$-3x_1 + x_2 - 5x_3 = -12$$

$$x_1 + 2x_2 + 4x_3 = 11$$

$$x_2 + 2x_3 = 5$$

by Gauss-Seidal method.

4. Write a program in C to find the solutions of a system of linear equations

$$-3x_1 + x_2 - 5x_3 = -12$$

$$x_1 + 2x_2 + 4x_3 = 11$$

$$x_2 + 2x_3 = 5$$

by LU decomposition method.

5. Write a program in C to find the solution of a Tri-diagonal system of equations

$$x_1 + x_2 = 3$$

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

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

6. Write a program in C to find $y(0.4)$ by solving the differential equation $\frac{dy}{dx} = x^2 - y^2$, $y(0) = 1$ by fourth order Runge-Kutta method using step length 0.1.
7. Write a program in C to find the value of integration $\int_1^2 (x^2 + 1) dx$ by Monte-Carlo technique.
8. Write a program in C to find $y(0.4)$ by solving the differential equation $\frac{dy}{dx} = x^2 - y^2$, $y(0) = 1$ by Milne's Predictor Corrector method using step length 0.05.
9. Write a program in C to find the largest eigen value and the corresponding Eigen vector of the following matrix using Power method :

$$\begin{bmatrix} 1 & 3 & 2 \\ -1 & 0 & 2 \\ 2 & 4 & 5 \end{bmatrix}$$

10. Write a program in C to find the natural cubic spline interpolation for the following information :

x	0.15	0.17	0.18	0.21	0.23
y	0.14944	0.16918	0.18886	0.20846	0.22798

[Note Book & Viva - 05]
