

Roll No.

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CMDQ/D-23

5123

COMPUTATIONAL PHYSICS-I

Paper-PHY-304-A

Time Allowed : 3 Hours]

[Maximum Marks : 60

Note : Attempt **five** questions in all, selecting **one** question from each Unit. Question No. **1** is compulsory. All questions carry equal marks. Use of scientific (non-programmable) calculator is allowed.

Compulsory Question

1. Answer the following : $4 \times 3 = 12$

- (a) Convert $\tan^{-1}\left(\sqrt{\sin^2 |a|}\right)$ into a valid FORTRAN code.
- (b) Define the term inherent error.
- (c) What are the advantages of using Lagrange's formula of interpolation as compared to Newton's forward/backward differences formula?
- (d) What do you understand by the term ill-conditioned matrix?

UNIT-I

2. (a) What are the different formats that are permissible for "SELECT CASE" structure of integers? 6

- (b) Write a program to read in the radius of a circle centered at the origin. Read in coordinate pair (x, y) of a point and determine if that point lies within the circle. Also, incorporate a counter variable to count the points inside the circle. 6

3. (a) What are the different rules for setting up the loop and the loop control variable? 6

- (b) Write a program that reads in a list of numbers from the terminal, calculates the average, and finally prints a list of individual deviations of each number from the average. 6

UNIT-II

4. (a) Give sequence of steps in regula-falsi method for determining a real root of the equation $f(x) = 0$. 6

- (b) Using Newton-Raphson method find $N^{1/3}$ when $N = 18$, correct to two decimal places ? 6

5. Derive the formulation to find the rate of convergence of Muller's method. 12

UNIT-III

6. (a) Using Lagrange interpolation formula, find $f(3)$ from the following table : 6

$x :$	0	1	2	4	5	6
$y :$	1	14	15	5	6	19

- (b) Obtain the cubic spline approximation for the function in the first interval defined by the following data with $M(0) = M(3) = 0$? 6

$x :$	0	1	2	3
$f(x) :$	1	2	33	244

7. (a) Find the values of a, b, c so that $y = a + bx + cx^2$ is the best fit to the data : 6

$x :$	0	1	2	3	4
$y :$	1	0	3	10	21

- (b) Describe the interpolation formulation of Bessel's formula. 6

UNIT-IV

8. Explain the formalism of decomposition of a matrix as product of lower triangular matrix and upper triangular matrix using Doolittle method. 12
9. (a) Solve the following set of equations by Gauss-Seidel method : 6

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

$$x_1 + x_2 + x_3 = 0$$

$$3x_1 + 2x_2 + 5x_3 = 1.$$

- (b) Find the inverse of the given coefficient matrix using Gauss-Jordan method : 6

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