

Exam. Code : 209001

Subject Code : 3753

M.Sc. Physics 1st Semester
COMPUTATIONAL TECHNIQUES
Paper—PHY-404

Time Allowed—3 Hours] [Maximum Marks—100

Note :— Attempt **FIVE** questions in all, selecting **ONE** question from each Section. The **fifth** question may be attempted from any Section. Use of Scientific Calculator is allowed.

SECTION—A

1. (a) What is the difference between a script file and a data file ? What are the other types of files in MATLAB ? 10
- (b) Write a program to plot the curve for equation $y = \sin(x) + \cos(x)$ as x varies from 0 to 2π . Make use of labels along x - and y -axis. 10
2. (a) Discuss in detail the major components of the MATLAB environment. 10
- (b) Write a program to generate first five odd numbers and illustrate the use of *fopen*, *fprint* and *fclose* commands related to file input-output. 10

SECTION—B

3. (a) Estimate from the following table the number of students who obtained marks between 40 and 45 :

Marks	No. of Students
30–40	31
40–50	42
50–60	51
60–70	35
70–80	31

- (b) Derive the Newton's divided difference for interpolation. 10
4. (a) Show that the divided differences are symmetrical in their arguments i.e. independent of the order of the arguments. 10
- (b) Apply Lagrange's formula to find $f(5)$ given that :
 $f(1) = 2$, $f(2) = 4$, $f(3) = 8$, $f(4) = 16$, $f(7) = 128$
 and explain why the results differs from 2^5 . 10

SECTION—C

5. Derive General Quadrature formula for equidistant ordinates. Also, find out the Simpson's one-third and three-eighths rules from the General Quadrature formula. 20
6. (a) Derive Euler's formula for solving ordinary differential equations. State its limitations. 10

- (b) Given $\frac{dy}{dx} = y - x$ where $y(0) = 2$.

Find $y(0.1)$ correct to four decimal places by

- (i) Runge-Kutta second order formula and
(ii) Runge-Kutta fourth order formula. 10

SECTION—D

7. (a) Find a positive root of the equation $xe^x = 1$, which lies between 0 and 1, using the bisection method. 10
(b) Discuss the working of Regula-Falsi method in detail. 10
8. (a) Derive Newton-Raphson method and discuss its geometrical interpretation in detail. 10
(b) Solve the following equations by Gauss-Elimination method :

$$2x + 2y + 4z = 18$$

$$x + 3y + 2z = 13$$

$$3x + y + 3z = 14 \quad 10$$