

Exam. Code : 209001

Subject Code : 4765

M.Sc. Physics 1<sup>st</sup> Semester

## COMPUTATIONAL TECHNIQUES

Paper—PHY-404

Time Allowed—Three 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) Discuss in detail the Formatted Input-Output Functions in MATLAB. 10
- (b) Write a program to plot the curve given by equation  $y = \sin(x)$ , as  $x$  varies from 0 to  $2\pi$ . Also label the  $x$ - and  $y$ -axis and provide a suitable title to the plot. 10
2. (a) How can help be sought for various commands in MATLAB? Describe various commands used for seeking help. 10

- (b) Write a MATLAB program to find the length of the third side and area of the triangle, if two sides  $a = 3.2$  and  $b = 4.6$  of triangle and angle  $\theta = 60^\circ$  between these sides. 10

### SECTION—B

3. (a) Using Newton's divided difference formula, evaluate  $f(6)$  for given values :

x	5	7	11	13	21
f(x)	150	392	1452	2366	9702

10

- (b) Derive the Newton-Gregory formula for forward interpolation with equal intervals. 10
4. (a) Form the difference table of  $f(x) = x^3 - 3x^2 + 5x + 7$  for the values of  $x = 0, 2, 4, 6, 8$  and also compute  $f(10)$ . 10
- (b) Derive the Lagrange's interpolation formula. 10

### SECTION—C

5. (a) Solve by Euler's modified method of the following differential equation for  $x = 0.02$  by taking  $h = 0.01$ ,  $\frac{dy}{dx} = x^2 + y$ ,  $y = 1$  when  $x = 0$ . 10
- (b) Derive Weddle's rule of numerical integration. 10

6. (a) The acceleration  $a(\text{km/hr}^2)$  of a train which starts from rest, is given at fixed intervals of time  $t$  in hours as follows :

t(hours)	0	2	4	6	8	10	12	14	16	18	20
a(km/hr <sup>2</sup> )	0	10	18	25	29	32	20	11	5	2	0

Estimate approximately the velocity acquired by the train in 20 hours using Simpson's one-third rule. 10

- (b) Explain working of second order Runge-Kutta method. 10

#### SECTION—D

7. (a) Compute the real root of  $x^3 - 5x + 3 = 0$  in the interval  $[1, 2]$  by Regula Falsi Method by performing four iterations. 10
- (b) Discuss the convergence of Newton-Raphson method in detail. 10
8. (a) Explain the working of Gauss-Elimination method. 10
- (b) Find approximation to  $\sqrt{3}$  correct to two decimal places using bisection method. 10