[This question paper contains 6 printed pages.]

Your Roll No.....

Sr. No. of Question Paper: 7568 **J**

Unique Paper Code	:	32223902
Name of the Paper	:	Computational Physics Skills
Name of the Course	:	**B.Sc. (Hons.) Physics** **B.Sc. (Prog.): SEC**
Semester	:	III

Duration : 3 Hours Maximum Marks : 50

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question No. 1 is compulsory.
3. Attempt 3 questions from each section.

1. Attempt any five questions : (5x1=5)

   (a) Describe the fortran statement parameter (pi= 3.14159).

   (b) Give example (without explanation) of the fortran statements required to open a file for data writing, writing data in the opened file, closing the opened data file.

(c) What is meant by a structured programming language?

(d) Briefly describe the use of any two LaTeX packages.

(e) What is a documentclass in LaTeX? Name some documentclasses.

(f) write the gnuplot statements to put title on the graph and labels on the axes.

(g) Write the gnuplot statements to define a function (2X+1) and plot it.

SECTION - A

2. Write a fortran program to multiply (m x k) matrix with (k x n) matrix to give an m x n matrix. (5)

3. Write a fortran FUNCTION to calculate factorial of a number. Use this FUNCTION in a fortran. program to evaluate the value of $\cos(x) = 1 - \frac{x^2}{2!} + \frac{x^4}{4!}$ at x = 0.5 (5)

4. Write the syntax of logical if, arithmetic if and block if statements in fortran. (5)

5. Write a fortran program to evaluate roots of a quadratic equation considering all three cases where discriminant (D) : D = 0, D > 0, D < 0. (5)

SECTION - B

6. Write a LaTeX code to display the following Maxwell equations. (5)

$$\nabla \cdot \mathbf{D} = \rho$$
$$\nabla \cdot \mathbf{B} = 0$$
$$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$$
$$\nabla \times \mathbf{H} = \mathbf{J} + \frac{\partial \mathbf{D}}{\partial t}$$

7. Write the output of the following Latex code

```
\[\scalebox{3} {$ I=I_{0} \left(e^{\frac {e V} {\eta K T}}-1\right)$} \]
```
(5)

8. Write the Latex code to generate following equation

$$I = I_0 \left(\frac{\sin\left(\frac{\pi a \sin\theta}{\lambda}\right)}{\frac{\pi a \sin\theta}{\lambda}} \right)^2 \left(\frac{\sin\left(\frac{N\pi d \sin\theta}{\lambda}\right)}{\sin\left(\frac{\pi d \sin\theta}{\lambda}\right)} \right)^2$$

This equation describes the Intensity distribution resulting from interferense of diffraction patterns of N-slits. Here a = slit width, d= distance between centers of two consecutive slits(grating element), θ is the angle of diffraction and A is the wavelength of light used. (5)

9. Describe any method of including bibliography and citations in a LaTeX document. Also describe any method to include index in the LaTeX document. (5)

SECTION - C

10. Describe briefly any five Terminals and corresponding output file extenstions .xxx in gnuplot that can be set using set terminal terminal-type command and set out "filename.xxx" command. (5)

11. Describe the use of any three of the following gnuplot statements

    (a) "save" and "load"

    (b) set parametric

    (c) set pm3d

(d) set samples 3000

(e) set title

(f) unset key (5)

12. Using parametric curve plotting in gnuplot, draw the trajectory of a projectile fired with initial velocity 100 m/s at an angle of 45° with the horizontal. (5)

13. Describe the outcome of the following gnuplot script

```
reset
set multiplot layout 2,2 columns first scale 1,1
plot sin(x)
plot cos(x)
plot x**3
plot sin(x)**2
unset multiplot
```

(5)

14. Given the functions

f1(x) = $\sin(\pi x)$

f2(x) = $\dfrac{\sin(3\pi x)}{3}$

$$\text{f3(x)} = \frac{\sin(5\pi x)}{5}$$

$$\text{f4(x)} = \frac{\sin(7\pi x)}{7}$$

write a gnuplot script to plot (f1(x) - f2(x) + f3(x) - f4(x)) as a function of x. (5)