C 4760 **(Pages : 3)** **Name.....**

Reg. No.....

SECOND SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, APRIL 2021

(CBCSS)

Physics

PHY 2C 08—COMPUTATIONAL PHYSICS

(2019 Admissions)

Time : Three Hours Maximum : 30 Weightage

General Instructions

1. *In cases where choices are provided, students can attend* **all** *questions in each section.*
2. *The minimum number of questions to be attended from the Section / Part shall remain the same.*
3. *There will be an overall ceiling for each Section / Part that is equivalent to the maximum weightage of the Section / Part.*

Section A

8 Short questions answerable within 7.5 *minutes.*
Answer **all** *questions.*
Each question carries 1 *weightage.*

1. Distinguish lists and tuples in Python.
2. What is pickling and unpickling in Python ?
3. List out the built-in data types in python programming.
4. Write a python program to plot a cosine wave from 0 to 2π.
5. Give the differences between interpolation and curve fitting.
6. Explain the two-point boundary value problem.
7. Write a program to create a NumPy array of five zeros of dimension 1.
8. What is Logistic map equation ?

(8 × 1 = 8 weightage)

Turn over

Section B

4 essay questions answerable within 30 *minutes.*
Answer any **two** *questions.*
Each question carries 5 *weightage.*

9. Derive Newton's forward and backward difference interpolation formula.

10. Explain the least square curve fitting for an exponential function of the form, $y = Ae^{Bx}$.

11. Outline the Shooting method and Numerov's method in numerical analysis.

12. Explain the Euler method. Write a python program to obtain the trajectory of a simple harmonic motion using Euler method.

(2 × 5 = 10 weightage)

Section C

7 problems answerable within 15 minutes.
Answer any **four** *questions.*
Each question carries 3 *weightage.*

13. Write a Python program to display all the prime numbers within the interval {10, 50}.

14. Write a python code to calculate the Fourier coefficients of a square wave and to plot the wave.

15. Using Lagrange's interpolation formula, find the form of the function $y = f(x)$ from the following table :

X	y
0	–12
1	0
3	12
4	24

16. Using Trapezoidal rule, evaluate

$$I = \int_0^1 \frac{1}{1+x}\, dx$$

correct to three decimal places. (Assume h = 0.5, 0.25).

17. Approximate the area under the curve, $y = f(x)$, between $x = -4$ and $x = 8$ using Simpson's rule with $n = 6$ subintervals.

x	:	–4	–2	0	2	4	6	8
$f(x)$	:	1	3	4	4	6	9	14

18. Using the Runge-Kutta method of fourth order, evaluate the value of $y(0.1)$ correct to four decimal places for the function :

$$\frac{\partial y}{\partial x} = y - x \; ; \; x_0 = 0 \; ; \; y_0 = 2.$$

19. Write a python program to estimate the value of π using Monte Carlo simulation method.

(4 × 3 = 12 weightage)