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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)