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Reg. No.....

SECOND SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, APRIL 2023

(CBCSS)

Physics

PHY 2C 08—COMPUTATIONAL PHYSICS

(2019 Admission onwards)

Time : Three Hours Maximum : 30 Weightage

Section A

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

1. What are the collection data types in python programming ?
2. Explain formatted printing in python.
3. Give the python method to convert a string in to a lower case.
4. Write a python program to draw a line from position $(1, 1)$ to position $(5, 8)$.
5. Explain spline interpolation.
6. What is meant by the order of Runge-Kutta method ?
7. Write a NumPy program to generate the matrix $\begin{bmatrix} 2 & 1 \\ 1 & 0 \end{bmatrix}$.
8. What is forward Euler method ?

$(8 \times 1 = 8$ weightage)

Section B

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

9. Derive a general formula for numerical integration and hence establish Trapezoidal rule.
10. Give the principle of least squares. Explain the method of fitting a straight line to a given set of data (x_i, y_i).

Turn over

11. Explain the Discrete Fourier Transform method for aperiodic functions.

12. Write a python program to obtain the trajectory of a projectile motion using Euler metho

(2 × 5 = 10 we

Section C

7 problems answerable within 15 minutes.

Answer any **four** *questions, each question carries 3 weightage.*

13. Write a Python program to solve a quadratic equation of the form :

$ax^2 + bx + c = 0$; $a, b, c > 0$.

14. Write a Python program to produce a plot of the first six Bessel functions using N Matplotlib.

15. Using Newton's forward difference formula, find the sum

$S_n = 1^3 + 2^3 \ldots\ldots\ldots + n^3$

16. Using Simpson's rule, evaluate

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

correct to three decimal places. (Take $h = 0.5$ and 0.25).

17. A function $f(x)$ is given by the table of values. Approximate the area under $y = f(x)$, between $x = 0$ and $x = 8$ using the trapezoidal rule with $n = 4$ subintervals

X	$f(x)$
0	3
2	7
4	11
6	9
8	3

18. Using the Runge-Kutta method of fourth order, evaluate the value of $y(0.2)$ correct to four decimal places for the function :

$$\frac{\partial y}{\partial x} = \frac{x - y}{2} \; ; x_0 = 0 \; ; y_0 = 1 \; ; h = 0.1.$$

19. Explain the Monte Carlo simulation method to estimate the value of π.

(4 × 3 = 12 weightage)