D 140704 **(Pages : 2)** **Name.....**

Reg. No.....

SECOND SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, APRIL 2026

(CBCSS)

Physics

PHY2C08—COMPUTATIONAL PHYSICS

(2019 Admission onwards)

Time : Three Hours Maximum : 30 Weightage

Section A

Answer **all** *questions, each carry weightage* 1.

1. Briefly explain the role of a compiler in software development.
2. Provide an example of a variable declaration in Python.
3. Name one method for creating arrays using NumPy.
4. Differentiate between linear and polynomial interpolation.
5. What is the Euler method used for in numerical analysis ?
6. What is the purpose of Monte Carlo simulations ?
7. What is the purpose of the pickle module in Python ?
8. Name one special function provided by the math module.

(8 × 1 = 8 weightage)

Section B

Answer any **two** *questions, each carry weightage* 5.

9. Discuss the significance of Python as a high-level programming language in modern software development. Highlight its key features and advantages over low-level languages. Provide examples to illustrate its versatility and widespread use in various domains.

Turn over

10. Explain the role of numerical methods in computational physics. Discuss how numerical techniques such as interpolation, curve fitting, and differential equation solvers contribute to the simulation and analysis of physical systems in Python.

11. Describe the NumPy module's importance in scientific computing with Python. Discuss its array manipulation capabilities and mathematical functions. Provide examples of NumPy arrays and operations, highlighting their use in data analysis and numerical simulations.

12. Analyse the role of data visualization in scientific computing using Python's matplotlib module. Discuss the importance of visualizing data for understanding complex phenomena and communicating results effectively with examples.

(2 × 5 = 10 weightage)

Section C

Answer any **four** *questions, each carry weightage* 3.

13. Declare a tuple named 'colours' containing three strings : "red", "green", and "blue".

14. Write a programme in Python to perform element-wise multiplication of two NumPy arrays : [1,2, 3] and [4, 5, 6].

15. Programme to generate a scatter plot of 100 random points with x-values ranging from 0 to 10 and y-values ranging from 0 to 20.

16. Given the data points (1, 3), (2, 5), and (3, 7), write a programme to perform polynomial interpolation to estimate the value at $x = 2.5$.

17. Approximate the derivative of the function $f(x) = \sin(x)$ at $x = \pi/4$ using the central difference method with a step size of 0.01 in Python.

18. Write a programme to solve the initial value problem $dy/dx = y - x2 + 1$ with $y(0) = 0$ using the Euler method with a step size of 0.1 from $x = 0$ to $x = 1$.

19. Write a Python programme that takes user input for a radius and calculates the area and circumference of a circle using the math module. Output the results as a dictionary with keys 'area' and 'circumference'.

(4 × 3 = 12 weightage)