D2APH2304 **(2 Pages)** **Name.....**
Reg.No.....

SECOND SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2024
(Regular/Improvement/Supplementary)

PHYSICS
FPHY2C08: COMPUTATIONAL PHYSICS

Time: 3 Hours **Maximum Weightage: 30**

Part A: Short answer questions. Answer *all* questions. Each carries 1 weightage.

1. Explain input function with suitable example. How will you read a number from keyboard using the input function?
2. List down the arithmetic operators and conditional operators in Python.
3. What are modules? Which are the different ways to import a module?
4. Explain the syntax of '*for loop* 'with '*else'*.
5. With suitable examples, explain different ways of creating arrays.
6. Write a python program to find the inverse of a given matrix using Numpy.
7. Write a brief note on pie charts in matplotlib.
8. Briefly explain the shooting method for solving boundary value problems.

(8 × 1 = 8 weightage)

Part B: Essay questions. Answer any *two* questions. Each carries 5 weightage.

9. With suitable examples, explain different data types supported by core python. What are the different operations and manipulations possible with each data types.
10. Derive general formula for numerical integration using Newtons forward difference interpolation and hence obtain Trapezoidal and Simpson's rule.
11. Write down the differential equations of motion of a projectile. Write a python code to simulate the motion of a projectile using Euler's Method. Generate plot of the trajectory of the projectile.
12. Write down the differential equation motion of a damped oscillator. Write a python program to simulate the motion of a damped oscillator using Feynmann-Newton method.

(2 × 5 = 10 weightage)

(P.T.O.)

Part C: Problems. Answer any *four* questions. Each carries 3 weightage.

13. With suitable example, explain arithmetic operations on Numpy arrays.
14. Write a Python program to plot cosine function. The figure must have a suitable title and label for the axes.
15. Using the method of least squares, find the equation of a straight line that best fit the following data.

    (1, 0.6), (2, 2.4), (3, 3.5), (4, 4.8), (5, 5.7)

16. Find the cubic polynomial which takes the following values:

    y (1) =24, y (3) =120, y (5) =336, and y (7) =720. Hence obtain the value of y (8).

17. Write a python program to solve the first order ordinary differential equation,

    $\frac{dy}{dx} = y - x$

    with initial condition y (0) =2, using fourth order Runge- Kutta method.

18. Briefly explain the Numerov's method.
19. Using matrices, find the DFT of the sequence $f_k = \{1,2,3,4\}$

(4 × 3 = 12 weightage)