

**SECOND SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2022**  
**(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. With suitable example discuss identity and membership operators of Python.
2. Correct the error in the program and find out the output:

```
def f(x):
    x=2*x
    return x
x= f(x+1) +f(x+2)
x=3
printx
```

3. Given  $x=[0,1,2,3,4,5,6,7,8,9]$ , write a python code to pick the even numbers from the list using slicing.
4. Write a program to draw a concentric circle for  $r=1$  to 10 using polar function.
5. Distinguish between List and Tuple.
6. Write any four dictionary functions.
7. What are the short comings of Euler method and how it has been rectified in Predictor method?
8. What are the advantages of Nemerov's method in python?

**(8 × 1 = 8 weightage)**

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

9. Explain Bessel and Gamma function. Write the python code for plotting it using Matplotlib.
10. Briefly explain cubic spline interpolation. The following values of x and y are given:

X	1	2	3	4
Y	1	2	5	11

Find the cubic splines and evaluate  $y(1.5)$  and  $y'(3)$ .

**(P.T.O.)**

11. Explain how shooting method is used to solve boundary value problem. Solve the boundary value problem

$$\frac{d^2y}{dx^2} - 64y + 10 = 0, y(0)=y(1)=0 \text{ by shooting method.}$$

12. Discuss Feynman-Newton method and write a program for motion of a damped oscillator using Feynman-Newton method.

**(2 × 5 = 10 weightage)**

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

13. Write a program to count the prime numbers in a given range where the range is given by the user.
14. Write a program for finding the inverse of a 3x3 matrix and read the given matrix from a file and write to a file.
15. Certain experimental data for x and y are given as (0, -1), (2,5), (5,12), and (7,20). If a straight line  $y = a_0 + a_1x$  is fitted to this data, find  $a_0$  and  $a_1$ .
16. Evaluate

$$I = \int_0^2 \frac{dx}{1+x+x^2} \text{ using Simpson's } 1/3 \text{ rule with } h = 0.25.$$

17. Explain how to calculate DFT of N sampled points and write a program.
18. Explain Monte-Carlo simulation. Write a python program to find the solution of radioactive decay problem using Monte-Carlo simulation.
19. Write a python program to find the second order differential equation using RK method taking as an example of planetary motion

**(4 × 3 = 12 weightage)**