

SECOND SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2023
(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. What is variable in python. List the rule for naming a variable.
2. List the arithmetic and conditional operators in python.
3. Explain formatted printing with suitable example.
4. Write a python program to create an array of integers from 1 to N and print an array of their squares. The program must allow the user to input the value of N.
5. Write a python program to find the inverse of a matrix using Numpy module. You may assign the elements of the matrix.
6. Write notes on creating polar plots using matplotlib module.
7. Explain shooting method for the solution of ordinary differential equation.
8. Compare numerical method with analytical method.

(8 × 1 = 8 weightage)

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

9. With suitable examples, explain the data types supported by python.
10. What do you mean by curve fitting? Explain the method of least squares for linear and exponential curve fitting.
11. Write down the differential equation of a falling body through viscous medium. Write a python program to simulate the motion of a falling body through viscous medium using Euler's method. Generate the position-time graph and velocity - time graph for the same.
12. Write down the differential equation of 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. Write a python program to solve the following set of equations.

$$3x + 2y + z = 8$$

$$x + y - z = 5$$

$$x - y - 5z = 3$$

14. Write a python program to plot sine curve. Give suitable title and label the axes.
15. Evaluate $\int_3^7 x^2 \log x \, dx$ using Simpson's 1/3 rd rule. Take $h=1$.
16. Write a python program to solve the equation $\sin x = 0.9$, using bisection method.
17. Given $\frac{dy}{dx} = y - x$ and $y(0)=2$. Find $y(0.1)$ and $y(0.2)$ using Euler's method.
18. Explain the solution of ordinary first order differential equation with initial value using fourth order Runge-Kutta method.
19. Using matrices, find the DFT of the sequence $f_k = \{1,2,3,4\}$.

(4 × 3 = 12 weightage)