2023

B.Sc. (Honours)

B.Sc. Third Semester End Examination - 2023

PHYSICS

PAPER - CC5P

[Practical]

Full Marks : 20 *Time : 2 hours*

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

Distribution of marks :

(Program : 15 + LNB :02 + Viva voce : 03)

Print input and output.

Attempt one set of questions from the following :

1. Solve the following set of equations

$x_1+2x_2-x_3=1$

$2x_1+x_2+4x_3=2$

$3x_1+3x_2+4x_3=1$ 15

2. Solve the differential equation.

$$\frac{d^2x}{dt^2}+2\frac{dx}{dt}+w_o^2x=0$$

Plot the displacement as a function of time for w_o=2, and b=0, 0.25, 2.0 and 2.5.
given x(0)=10 and x'(0)=0 15

3. Consider a series LR circuit with a de voltage of 20V. Plot the current as a function of time during growth and decay. given R=4Ω and L=5H. 15

4. Given a numpy array [[1,2,3,4,5], [0,1,2,3,4]], treat the first element as x-data and the second element as y-data, plot y^3 vs x using matplotlib. Label the axes as x-data and y-data and set title as 'Experimental Plot' 15

5. For an electrical resister network, we have the following set of equations.
$R_1I_1+R_2(I_1-I_3) + R_3(I_1-I_2)=0$
$R_4I_2 +R_3(I_2-I_1) + R_5(I_2-I_3)=5$
$R_6I_3 + R_5(I_3-I_2) + R_2(I_3-I_1) =5$
The resistances in the circuit are $R_1=R_2=R_3=2\Omega$ and $R_4=R_5=R_6=3\Omega$.
Find the currents I_1, I_2, I_3 15

6. Find the solution.

$\frac{d^2y}{dx^2}+3\frac{dy}{dx}+2y=e^{-x}$ that satisfies the initial conditions : y(0)=0 and y'(0)=0 15

7. The temperature θ of a well stirred liquid by the isothermal heating coil is given by $\frac{d\theta}{dt}$=k×1000. Where k=2.5, constant of the system. find the value of θ at t=1 second.

8. Write a program to solve the differential equation for damped motion

$\frac{d^2y}{dt^2}+2\frac{dy}{dt}+y=0$ with initial consitions y(0)=0, y'(0)=10. 15

9. Solve the differential equation.

$\frac{d^2x}{dt^2}=-w_0{}^2x$

with x(0)=10 and x'(0)=0.
Take w_0 as input.
Plot both displacement and velocity as functions of time.15

10. Generate a numpy array X within [0,5]. Plot the following curves using matplotlib for

(i) $y=(3x^3-2x^4)/(1+x^2)$

(ii) $y=\sin^2x$

(iii) $y = a_1 \exp(-\lambda_1 x) + a_2 \exp(-\lambda_2 x)$

for a_1, a_2, λ_1,λ_2=[1,–1,1,2], [1, –1,2,1], [1,10,1,1] and superpose them with putting legands. 5+5+5

11. Consider the set of measured values :

x	1	2	3	4	5
y	0.5	3.8	7.9	16.5	27.3

Fit the data with a user defined function (try quadractic). Plot the scattered data along with the fitted line graph over it.15

12. Use malplotlib package to plot the following functions :
    (i) $f(x) = e^{-x/10} \sin(\pi x)$ and
    (ii) $g(x) = xe^{-x/3}$ over the interval (0,10)
    include labels for the axes, give legend and a title, 'plotting Functions'.

13. Numerically show the following identify using Scipy

$(n+1)\, P_{n+1}(x)=(2n+1)x\, P_n(x)-\eta P_{n-1}(x)$

14. The equation for radioactive decay $\frac{dN}{dt} = -2N.$ where N(0)=10000 solve the equation and plot upto t=5s. Give title and properly label the axes. 15