

2019

UG 3rd Semester (Honours) Examination

PHYSICS

Paper - C5P

[Practical]

Full Marks : 20

Time : 3 Hours

*The figures in the margin indicate full marks.
Candidates are required to give their answers
in their own words as far as practicable.*

Answer any *one* of the following.

1. (a) Write a Python program to find the Inverse of the following matrix. 7

$$A = \begin{pmatrix} 3 & 5 & 8 \\ 4 & 6 & 9 \\ 8 & 6 & 4 \end{pmatrix}$$

[Turn Over]

- (b) Write a Python program to solve the differential equation for radioactive decay using Euler method and plot it using Matplotlib module.

8

2. (a) Write a program to compute the value of R from the five set of data of Ohm's law experiment.

7

A (Volt)	2.1	3.2	3.8	4.5	4.8
I (mA)	5.12	7.80	9.26	10.90	11.70

- (b) Write a computer program to solve the differential equation for finding the time variation of charge during charging of a capacitor with DC source using RK2 method and plot it using Matplotlib module.

8

3. (a) Write a computer program to generate an ellipse and plot it using Matplotlib module.

5

- (b) Write a computer program to solve the differential equation for finding the current LC circuit connected with DC source using RK4 method and plot it using Matplotlib module.

10

4. (a) An experiment of spring constant determination is performed and obtained the following information :

Mass (g)	50	100	150	200	250
Displacement(cm)	2	4	6	8	11

Fit a straight line $F = kx$ (Hooke's law formula) and plot your fitted graph on the curve with the data. 7

- (b) The temperature of a well stirred liquid by the isothermal heating coil is given by the equation $\frac{d\theta}{dt} = K(100 - \theta)$, where K is a constant of the system.

Write a computer program to solve the equation using scipy package to find θ at $t = 2.0$ s for $K = 2.5$. Initial condition $\theta = 90^\circ\text{C}$ at $t = 0$ s. 8

5. (a) Write a computer program to generate a parabola and plot it using Matplotlib module. 5

[Turn Over]

- (b) Write a computer program to solve the differential equation for finding the time variation of charge during discharging of a capacitor with DC source using scipy package and plot it using Matplotlib module. 10

6. (a) Write a program to find the solution of the linear system of three equations given below. 7

$$3x_1 + 2x_2 + 4x_3 = 7$$

$$2x_1 + x_2 + x_3 = 4$$

$$x_1 + 3x_2 + 5x_3 = 2$$

- (b) Write a computer program to find the solution of a damped harmonic oscillator using scipy package, given $b = 0.1$ and $\omega_0 = 1$. Plot it using Matplotlib module. 8

7. (a) Write program to find the solution of three mesh equations of electrical circuit. 7

$$50I_1 - 30I_2 = 80$$

$$40I_2 - 20I_3 = 80$$

$$100I_3 - 20I_2 - 30I_2 = 0$$

- (b) Write a computer program to find the solution of a simple harmonic oscillator (no friction) using scipy package, given $k=1$ and plot it using Matplotlib module. 8

8. (a) Solve the ODE problem :

$$\frac{dT}{dt} = \frac{1}{27}(T - 65); T(0) = 200^\circ F$$

Using scipy package in the range [0.0, 10.0] with step 1.0. Plot the numerical solution together

with the exact solution : $T(t) = 65 + 135e^{-t/27}$.

10

- (b) Write a computer program to find the Transpose of the following matrix. 5

$$A = \begin{pmatrix} 2 & 5 & 12 & 8 \\ 3 & 6 & 9 & 13 \\ 8 & 6 & 4 & 10 \end{pmatrix}$$

[Turn Over]

9. (a) An electrical circuit with a resistor a capacitor, an inductor and a voltage source can be described by the ODE.

$$L \frac{dI}{dt} + RI - \frac{Q}{C} = E(t), \frac{dQ}{dt} = I$$

Use the Euler method to solve these two ODE

for time step $\frac{2\pi}{60\omega}$.

8

Where $L = 1H$,

$$E(t) = 3 \sin(\omega t) V,$$

$$\omega^2 = 3.5 s^{-2},$$

$C = 0.25F$, $I(0) = 1A$ and

$$Q(0) = 1C.$$

- (b) Write a computer program to generate Legendre Polynomials of order up to 3 and plot them using Matplotlib module. 7
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