

U.G. 4th Semester Examination - 2021

PHYSICS

[HONOURS]

Course Code : PHY-H-CC-P-08

[PRACTICAL]

Full Marks : 20

Time : 2 Hours

Answer any **four** questions from the following: $5 \times 4 = 20$

- Write an algorithm to compute the two square roots of $-5 + 12i$.
- Write an algorithm to numerically evaluate the integral

$$\int_{-\infty}^{\infty} \frac{dx}{1+x^2}$$

using Simpson's rule.

- Write an algorithm to compute orthogonality of Legendre polynomial $P_1(x)$ which satisfies the orthonormality relation

$$\int_{-1}^1 P_m(x)P_n(x)dx = \frac{2}{2n+1} \delta_{mn}$$

using Simpson's rule.

- Write an algorithm to calculate the coefficients of linear least squares fit line for a set of data points.

- Write an algorithm to evaluate the integral

$$\frac{1}{\sqrt{2\pi\sigma^2}} \int e^{-\frac{(2-x)^2}{2\sigma^2}} (x+3)$$

using trapezoidal rule.

- Write an algorithm to solve the second order differential equation

$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = 0$$

for $y(0) = 0$ and $y'(0) = 2$ using Euler's method.

- Write an algorithm to numerically evaluate the integral

$$\int_{-\infty}^{\infty} \frac{dx}{1+x^2}$$

using trapezoidal rule.

- Write an algorithm to solve the first order differential equation

$$\frac{dy}{dx} + e^{-x} = x^2$$

for $y(0) = 0$ using Runge-Kutta 4th order method.

- Write an algorithm to find Fourier coefficients of a square wave represented by the function

$$f(x) = \begin{cases} -1 & -\pi < x < 0 \\ 1 & 0 < x < \pi \end{cases}$$

[Turn Over]

10. Sine series is computed from the recurrence relation

$$\frac{(N+1)^{\text{th}} \text{ Term}}{(N)^{\text{th}} \text{ Term}} = \frac{x^2}{2n(2n+1)}$$

Write an algorithm to evaluate $\sin(6)$

11. Write an algorithm to compute FFT of the function

$$\exp\left(-\frac{x^2}{4}\right).$$

12. Write an algorithm to calculate n^{th} roots of unity for $n = 2; 3$ and 4 .
