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63/2 (SEM-3) PHY 302

2022

(Held in 2023)

PHYSICS

(Theory Paper)

Paper Code : PHY 302

(Computational Physics)

Full Marks – 40

Pass Marks – 16

Time – Two hours

The figures in the margin indicate full marks for the questions.

1. Answer any *five* of the following questions : 2×5=10
- (a) Mention one advantage and one disadvantage of Newton-Raphson method.
 - (b) Discuss briefly the method of least squares.
 - (c) Discuss how one can estimate the value of π using Montecarlo method.
 - (d) What is meant by interpolation. Write one advantage of Lagrange interpolation method over Newton's interpolation procedure.

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- (e) Briefly explain the Regula-Falsi method for determining the root of a non-linear equation.
- (f) Discuss why Simpson's 1/3 Rule is better than that of the Trapezoidal rule for evaluating integration.

2. Answer any six of the following questions :

$$5 \times 6 = 30$$

- (a) Find the real root, which lies between 2 and 3, of the equation $x \log_{10} x - 1.2 = 0$ using Bisection method. Perform three iterations.
- (b) Values of x (in degrees) and $\sin x$ are given in the following table :

x (in degrees)	15	20	25	30	35	40
$\sin x$	0.258819	0.3420201	0.4226183	0.5	0.5735764	0.6427876

Find the value of $\sin 38^\circ$ using Newton's Backward interpolation method.

- (c) Fit a function of the form $y = ax^b$ for the following data using method of Least squares :

x	61	26	7	2.6
y	350	400	500	600

- (d) Given the initial value problem defined by,

$$\frac{dy}{dx} = y(1 + x^2), y(0) = 1$$

and find $y(0.2)$ and $y(0.4)$ by the Runge-Kutta Fourth order method.

- (e) Use Simpson's 1/3 rule to approximate the following integration with $n=6$ subintervals.

$$I = \int_0^\pi \sin x \, dx.$$

- (f) The values of x and $\log_{10} x$ are : (300, 2.4771), (304, 2.4829), (305, 2.4843) and (307, 2.4871). Find $\log_{10} 301$ using Lagrange Interpolation method.

- (g) Solve the system of equations using Gauss Elimination method.

$$4y + 2z = 1$$

$$2x + 3y + 5z = 0$$

$$3x + y + z = 11.$$

3. Practical : 40 marks.