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III Semester M.Sc. Degree Examination, March/April - 2025

PHYSICS

Computational Physics  
(CBCS New Scheme 2019-21)

Paper : PHY302

Time : 3 Hours

Maximum Marks : 70

*Instructions to Candidates: Answer All questions.*

(3×15=45)

1. a) Distinguish between system software and application software  
b) Use least square fit method to fit a curve  $y=ab^2$  to the following data. (5+10)
- |   |   |    |    |     |
|---|---|----|----|-----|
| x | 1 | 2  | 3  | 4   |
| Y | 4 | 11 | 35 | 100 |
- (OR)
2. a) Find the real root of the equation  $x^3 - 5x + 1 = 0$  which lies between 0 and 1, for four iterations by secant method. (8)  
b) Evaluate  $\int_1^2 \frac{dx}{x}$  using Euler-Maclauren method taking  $h = 0.2$  (7)
3. a) Find the value of  $y(0.1)$  and  $y(0.2)$  for the differential equation,  $\frac{dy}{dx} = 1 + xy$  using range-Kutta method of fourth order. (9)  
b) Explain Neumann and Dirichlet boundary conditions of wave equations with suitable example. (6)
- (OR)
4. a) Construct a finite difference table for the function  $f(x) = x^3 + x + 1$ , where  $x$  takes the values 0,1,2,3,4,5,6. Also identify the leading forward and backward differences. (9)  
b) Find  $\Delta^n \sin x$  taking  $h=1$  (6)
5. a) Describe numerical solution of a freely falling body by considering air resistance  
b) Obtain the solution of one dimensional heat equation  $\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$  with the boundary conditions  $u(0,t)=0=u(1,t)$  and  $u(x,0)=100(x-x^2)$  by Crank-Nicolson's method (5+10)

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(OR)

6. a) Explain the numerical method to find energy Eigen values of a particle executing simple harmonic motion.  
b) Describe the solution of Time-Independent Schrodinger equation in terms of Eigen values and Eigen functions. (10+5)

7. Answer any Five of the following questions. (5×5=25)

- a) Write a note on interpolation method and its applications.  
b) Distinguish between Newton-Raphson method and Bisection method  
c) Find the general solution for the given coupled differential equation  
$$\frac{dx}{dt} = 5x - 3y \text{ and } \frac{dy}{dt} = -6x + 2y$$
  
d) Discuss the types of partial differential equations with examples  
e) Obtain differential equation for LCR circuit and explain the method to solve it numerically to determine instantaneous current.

- f) Obtain the eigen value of the given matrix  $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$

