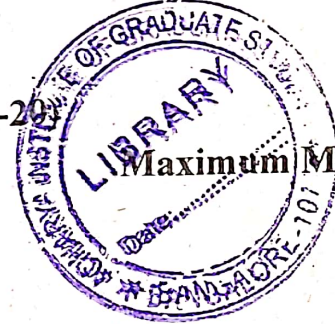62122

Reg. No. ☐☐☐☐☐☐☐☐☐

III Semester M.Sc. Degree Examination, April/May - 2022
PHYSICS
Computational Physics
Paper : 302
(CBCS New Scheme 2019-20)

Maximum Marks : 70

Time : 3 Hours

Instructions to Candidates:

Answer all questions.

(3×15=45)

1. a. Give an overall view of Computer hardware with a block diagram and explain the essential system softwares and application softwares qualitatively. **(8)**

    b. Discuss various types of number representation with examples. **(7)**

(OR)

2. a. Explain how Bisection method can be employed to find the roots of an equation numerically. **(7)**

    b. Evaluate $\int_0^1 \exp(x)dx$ using any of the numerical quadrature methods. **(8)**

3. a. For the Initial value problem $\frac{dy}{dx} + 2y = 2 - e^{-4t}$; $y(0) = 1$, find approximate values of the solution at $t = 0.1, 0.2, 0.3, 0.4,$ and 0.5 using Eulers method with $h = 0.1$. **(6)**

    b. Discuss types of partial differential equations with examples. **(6)**

    c. Elucidate types of boundary conditions used in differential equations. **(3)**

(OR)

4. a. Arrive at the solution to 1 Dimensional heat equation numerically with Neumann and Dirichlet boundary conditions. **(10)**

    b. Discuss how Runge - Kutta method can be used to find the solution to first order differential equation $\frac{dy}{dx} - 2xy = 1$; $y(0) = 3$ with step size, $h = 0.1$. **(5)**

[P.T.O.

5. a. Obtain an instaneous velocity for a body falling freely in a viscous medium using Eulers method and write the corresponding algorithm for it. **(10)**

   b. Using Ruge - Kutta 2nd order method, obtain the instantaneous velocity for a particle executing simple harmonic motion numerically. **(5)**

<div align="center">(OR)</div>

6. a. Write the solution to the one dimensional time independent Schrodinger equation for a particle in one dimensional box of infinite height and then obtain eigen values using Bisection method. **(8)**

   b. Discuss the digital Fourier transform method to find the Fourier series of a saw tooth function. **(7)**

7. Answer any **five** of the following : **(5×5=25)**

   a. How Newton - Raphson method can be employed to search for the eigen values of a particle in a finite potential well problem.

   b. Write a note on adaptive quadrature method in numerical integration.

   c. Find the general solution for coupled differential equations given by $\dfrac{dx}{dt} = -x + 6y$

   and $\dfrac{dy}{dt} = x + 2y$.

   d. Give the three difference formula to get first derivative approximation in finite difference method.

   e. Write an algorithm to find the eigen values of a simple harmonic oscillator by iteration method.

   f. Obtain differential equation for LCR circuit and explain the method to solve it numerically to determine instantaneous current.