Name **25U677**

Reg. No .....

B. Sc. DEGREE END SEMESTER EXAMINATION - MARCH 2025

SEMESTER 6 : PHYSICS

COURSE : **19U6CRPHY13 : COMPUTATIONAL PHYSICS (EL)**

(For Regular 2022 Admission and Supplementary 2021/2020/2019 Admissions)

Time : Three Hours Max. Marks: 75

PART A

Answer any 10 (2 marks each)

1. What are analytic solutions? Are there any limitations, with such solutions?
2. Differentiate between average and differential operator.
3. Discuss the graphical analysis of solving 1st order Ordinary Differential equation using Modified Euler Method.
4. Give a graphical analysis of implementing Simpson's 1/3 rule and also mark the error involved in this calculation.
5. Obtain the Forward difference table for a set of 5 points.
6. What is the major difference between Runge-Kutta 1st and 2nd order methods to solve 1st order Ordinary Differential Equations.
7. What is meant, when a system of linear equations is said to have a a non unique solution?
8. How are initial value guesses made?
9. Differentiate between interpolation and extrapolation.
10. Define the forward difference operator and arrive at the expression for the second forward differences.
11. Discuss the Euler method for solving 1st order Ordinary Differential equation – explain with equations.
12. What is meant, when a system of linear equations is said to have a unique solution?

(2 x 10 = 20)

PART B

Answer any 7 (5 marks each)

13. Find the polynomial f (x) by using Lagrange's formula and hence find f(3) for (x,y): (0,2), (1,3), (2,12) and (5,147)
14. Solve the following equation using Newton-Raphson method, $x^4 + 3x^3 - 2x^2 - 12x - 8 = 0 (x_0 = 1)$.
15. Using false position method, solve, $sin(x) - x + 2 = 0$.
16. Using Heun's method evaluate the solution of the initial value problem at x=0.1 and 0.2 ; $dy/dx = -xy^2$, y(0)=2; choose h=0.05
17. Using Euler method evaluate the solution of the initial value problem at x=0.1 ; $dy/dx = -2xy^2$, y(0)=1.
18. From the following data sets obtain the second derivates for x=15

x	:	15	20	25	30	35	40
y	:	0.2588190	0.3420201	0.4226183	0.5	0.5735764	0.6427876

19. Using Newton's divided differences interpolation, find u(3), given that u(1) = – 26, u(2) = 12, u(4) = 256, u(6) = 844.

20. Value of x in degrees and sin(x) are given. Evaluate sin(16)

x	:	15	20	25	30	35	40
Sin(x)	:	0.2588190	0.3420201	0.4226183	0.5	0.5735764	0.6427876

21. Using Taylor series method, upto 3rd order, find solution for the differential equation $y' = x^2 - y$, $y(0)=1$

22. Find a root of the given equation using, secant method: $xsin(x) - 1 = 0$.

(5 x 7 = 35)

PART C

Answer any 2 (10 marks each)

23. Explain how the solution of linear equations can be found using elimination technique, using a general case of three linear equations.

24. Discuss the linearization fitting techniques to be used to solve the following non-linear laws: $y = ax + b/x$; $xy^a = b$ and $y = ab^x$

25. Derive general formula for Runge Kutta 2nd order method for solving 1st order ordinary differential equations and show that Heun's method too belongs to this category.

26. Discuss the method of fitting a straight line using the concept of Least Squares.

(10 x 2 = 20)