Reg. No ....   Name **22P341**

M. Sc. DEGREE END SEMESTER EXAMINATION : OCTOBER 2022
SEMESTER 3 : PHYSICS
COURSE : **21P3PHYT10 : COMPUTATIONAL PHYSICS**
(For Regular - 2021 Admission)

Duration : Three Hours   Max. Weights: 30

PART A
Answer any 8 questions   Weight: 1

1.	How can one numerically obtain the lowest Eigen value of a matrix and its corresponding Eigen vector.	(U, CO 3)
2.	What is the difference between explicit and implicit scheme of solving a PDE?	(U, CO 4)
3.	Write down the diffusion equation and represent the same in a finite difference representation.	(U, CO 4)
4.	Discuss least square method for fitting a parabola.	(U, CO 1)
5.	Discuss truncation and rounding off errors in Numerical differentiation.	(U, CO 2)
6.	Write a short note trapezoidal rule of integration.	(U, CO 2)
7.	Graphically explain what happens in Euler method way of solving ODE.	(U, CO 3)
8.	Differentiate between interpolation and extrapolation.	(U, CO 1)
9.	Differentiate Euler and modified Euler method	(U, CO 3)
10.	Express $\Delta^2 y_3$ in terms of y values.	(A, CO 1)

(1 x 8 = 8)

PART B
Answer any 6 questions   Weights: 2

11. The population of a town in decennial census was as given below. Estimate the population for the year 1985.   (A, CO 1)

Year	1891	1901	1911	1921	1931
Population in thousands	46	66	81	93	101

12. Integrate sin(x) from 0 to pi using Trapezoidal rule and obtain the error.   (A, CO 2)

13. Following are the population of a district. Find the population for the year 1911
(Year,Population): (x,y):: (1881, 363), (1891,391),(1901,421), (1911,___), (1921, 467),(1931, 501)   (A, CO 1)

14. Solve the following 3X3 system using Gauss Elimination Method. (A, CO 3)
    $3x + 2y + z = 10$
    $2x + 3y + 2z = 11$
    $x + 2y + 3z = 14$

15. Given the equation: $y' = 2y/x$ with $y(0)=2$. Estimate $y(2)$ using Heun's Method / 2nd order RK method at $h = 0.25$ (A, CO 3)

16. The velocities of a car (running on a straight road) at intervals 2 minutes are given below: (A, CO 2)

Time in min::	0	2	4	6	8	10	12
Vel km/Hr::	0	22	30	27	18	7	0

    Apply Simpson's rule to find the distance covered by the car

17. Evaluate $\Delta^2((5x+2)/(x^2+5x+6))$ taking 1 as the interval of differencing. (A, CO 1)

18. Using Taylor's series expansion, find the solution of the differential equation $y' = (0.1)(x^3 + y^2)$ with $y(0) = 1$ correct to 4 decimal places. (A, CO 3)

(2 x 6 = 12)

PART C
Answer any 2 questions **Weights: 5**

19. Discuss Numerical differentiation and obtain an general expression for the same and also discuss the errors associated with the same. (U, CO 2)

20. Discuss Gauss - Jordan Elimination method and Gauss - Seidel iteration method. (An)

21. Discuss Schmidt Method of solving 1 dimensional diffusion equation. (U, CO 4)

22. Discuss Least-Squares curve fitting procedures for fitting a parabola, power and exponential curves (U, CO 1)

(5 x 2 = 10)

OBE: Questions to Course Outcome Mapping

CO	Course Outcome Description	CL	Questions	Total Wt.
CO 1	Apply the concept of curve fitting and interpolation	A	4, 8, 10, 11, 13, 17, 22	14
CO 2	Understand the concepts of Numerical Differentiation and Integrations and should be able to develop algorithms for the same	E	5, 6, 12, 16, 19	11
CO 3	Solve Ordinary Differential Equations and linear set of equations using numerical methods.	A	1, 7, 9, 14, 15, 18	9
CO 4	Solve Partial Differential Equations using numerical methods and understand the concepts of random numbers.	A	2, 3, 21	7

Cognitive Level (CL): Cr - CREATE; E - EVALUATE; An - ANALYZE; A - APPLY; U - UNDERSTAND; R - REMEMBER;