

**M. Sc. DEGREE END SEMESTER EXAMINATION : NOVEMBER 2023****SEMESTER 3 : PHYSICS****COURSE : 21P3PHYT10 : COMPUTATIONAL PHYSICS***(For Regular - 2022 Admission and Supplementary - 2021 Admission)*

Duration : Three Hours

Max. Weights: 30

**PART A****Answer any 8 questions****Weight: 1**

1. Differentiate between interpolation and extrapolation. (U, CO 1)
  2. Differentiate between direct and iterative methods of solving numerical problems. Give examples of each. (U, CO 3)
  3. How does power method works in determination of the dominant Eigen value? (U, CO 3)
  4. Write down the general expression of 2<sup>nd</sup> order linear PDE and arrive at the cases when the equation leads to elliptical, hyperbolic and parabolic type. (U, CO 4)
  5. What are the advantages of Monte Carlo integration over the other usual Numerical integration schemes. (U, CO 4)
  6. Talk on the intervals spacing required to carry out Trapezoidal, Simpsons 1/3 and Simpsons 3/8 formula. (U, CO 2)
  7. Briefly discuss how higher order differential equations can be solved. (U, CO 3)
  8. Write a short note cubic spline method. (E)
  9. Prove that  $\Delta \cdot \nabla = \Delta - \nabla$ . (A, CO 1)
  10. Discuss least square method for fitting a parabola. (U, CO 1)
- (1 x 8 = 8)**

**PART B****Answer any 6 questions****Weights: 2**

11. From the following table find the value of  $dy/dx$  at the point  $x=1.0$ 

X	::1	1.1	1.2	1.3	1.4	1.5
Y	::5.4680	5.6665	5.9264	6.2551	6.6601	7.1488

(A, CO 2)
12. Find the missing term in the following table:

x	0	1	2	3	4
y	1	3	9	?	81

(A, CO 1)
13. Using  $n=4$  and using Simpsons rule obtain the value for the function  $\exp(x^2)$  evaluated between the limits  $x=0$  to  $2$ . (A, CO 2)
14. Solve by Gauss Jordan Method:  $2x + 4y - 6z = -8$ ;  $x + 3y + z = 10$ ;  $2x - 4y - 2z = -12$  (A, CO 3)
15. Solve the IVP in the interval  $(0.0, 2.0)$  using Modified Euler method with step size  $h=0.2$ ,  $dy/dx = y - 2x^2 + 1$ ;  $y(0)=0.5$  (A, CO 3)
16. Estimate the value of  $\sin(45^\circ)$  using newtons backward method by generating  $\sin(x)$  values from  $x=10$  to  $50$  in steps of  $10$  (A, CO 1)

17. Compute **f(0.3)** for the data

x	0	1	3	4	7
f	1	3	49	129	813

(A, CO 1)

18. Solve the following system of linear equation by Gauss Elimination with Pivoting:  $2x + 2y + z = 6$ ;  $4x + 2y + 3z = 4$ ;  $x - y + z = 0$

(A, CO 3)

**(2 x 6 = 12)**

**PART C**

**Answer any 2 questions**

**Weights: 5**

19. Discuss the classic Implicit method of solving 1 dimensional diffusion equation.

(U, CO 4)

20. Discuss Numerical differentiation and obtain an general expression for the same and discuss the errors associated with the same.

(U, CO 2)

21. Discuss Modified-Euler and estimate its leading error term.

(U, CO 3)

22. Discuss conditions Cubic Spline Interpolation and also state the conditions it has to satisfy.

(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	1, 9, 10, 12, 16, 17, 22	14
CO 2	Understand the concepts of Numerical Differentiation and Integrations and should be able to develop algorithms for the same	E	6, 11, 13, 20	10
CO 3	Solve Ordinary Differential Equations and linear set of equations using numerical methods.	A	2, 3, 7, 14, 15, 18, 21	14
CO 4	Solve Partial Differential Equations using numerical methods and understand the concepts of random numbers.	A	4, 5, 19	7

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