M. Sc. DEGREE END SEMESTER EXAMINATION - OCTOBER 2025
SEMESTER 3 : PHYSICS
COURSE : **24P3PHYT10: COMPUTATIONAL PHYSICS**
(For Regular - 2024 Admission)

Time : Three Hours   Max. Weights: 30

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

1. Differentiate between partial and full pivoting   (U)
2. Write a short note trapezoidal rule of integration.   (U)
3. What are the advantages of Monte Carlo integration over the other usual Numerical integration schemes.   (U)
4. Differentiate between Absolute and Relative errors.   (U)
5. How can one numerically obtain the largest Eigen value of a matrix and its corresponding Eigen vector.   (U)
6. Interpolate the missing entries: (x,y):: (0,0) ,(1,__), (2,8), (3,15), (4,__), (5,35)   (A)
7. How does Monte Carlo integration works   (U)
8. Differentiate Euler and modified Euler method   (U)
9. Discuss truncation and rounding off errors in Numerical differentiation.   (U)
10. Evaluate $\Delta^2((5x+2)/(x^2+5x+6))$ taking 1 as the interval of differencing.   (A)

(1 x 8 = 8)

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

11. Is the ODE (x'' + 11 x'+24 x = 33 t) – stable? Give proper justification. (A)
12. Solve the following initial boundary value problem using an explicit finite difference method:
    T_t = T_xx , 0<=x<=1,
    Given T= sin(πx) when t=0, 0<=x<=1 and
    T=0 at x=0 and x=1 for t>0   (A)
13. Using Power Method, find the dominant Eigen value and the corresponding Eigen vector of the following matrix:

    $A = \begin{bmatrix} 1 & -5 \\ -3 & -1 \end{bmatrix}$ (A)
14. Discuss Hit or miss method associated with Monte Carlo method to evaluate an Integral and write an algorithm to evaluate the value of Pi using the same method.   (U)
15. Write down an algorithm to carry out Simpson's 1/3 rule of integration.   (U)
16. Integrate the function f(x)=sqrt(1+x^2) within the limit 1 to 5 using Trapezoidal rule   (A)

17. 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)

18. The following values are taken from the table of cubes

6.1	6.2	6.3	6.4	6.5	6.6	6.7
226.981	238.328	250.047	262.144	274.625	287.496	300.763

Find $(6.15)^3$ (A)

(2 x 6 = 12)

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

19. Discuss Newton's divided difference formula. Write down the expression for the leading error term observed in this formula. (A)

20. Discuss the Crank-Nicholson method of solving 1 dimensional diffusion equation. (U)

21. Discuss Gauss Jordan method to find inverse of a matrix. (U)

22. Discuss Trapezoidal method and error associated with it. (U)

(5 x 2 = 10)

OBE: Questions to Course Outcome Mapping

CO	Course Outcome Description	CL	Questions	Total Wt.

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