

M. Sc. DEGREE END SEMESTER EXAMINATION : MARCH 2023**SEMESTER 2 : PHYSICS****COURSE : 21P2PHYT05: MATHEMATICAL METHODS IN PHYSICS - II***(For Regular - 2022 Admission and Supplementary - 2021 Admission)*

Duration : Three Hours

Max. Weights: 30

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

1. Express the function $f(z) = (z^*)^2/z$ in the form $u(x, y) + iv(x, y)$. (A, CO 1)
2. Find the point (x, y) at which the function $f(z) = |z|^2$ is analytic. (A, CO 1)
3. Find whether $f(z) = c^2$ (c is a constant), is analytic. (A, CO 1)
4. Evaluate $\mathcal{L}(e^{at} \sin wt)$. (A)
5. Evaluate $\mathcal{L}(t^n e^{at})$. (A)
6. Describe how Earth's nutation can be explained on the basis of transforms. (An, CO 2)
7. Write any two recurrence formulae for Hermite polynomials. (U)
8. Write any two recurrence formulae for Laguerre polynomial. (A)
9. State two properties of one dimensional Green's function. (U)
10. Write down two fundamental equations of Physics that are in the form of partial differential equation. (A, CO 4)

(1 x 8 = 8)**PART B****Answer any 6 questions****Weights: 2**

11. State and prove Cauchy's integral theorem. (A, CO 1)
12. Explain the different types of singularities with examples. (U)
13. Show that the Fourier transform of a Gaussian function is another Gaussian. (An, CO 2)
14. Find the Laplace transform of $\cosh(3t)$. (A, CO 2)
15. Show that $xJ'_n(x) = -nJ_n(x) + xJ_{n-1}(x)$ (A)
16. Show that $P_n(x) = 1$. (A)
17. Separate the partial differential equation $\nabla^2\psi(r, \theta, z) + k^2\psi(r, \theta, z) = 0$, into three ordinary differential equations. (A, CO 4)
18. Explain the different boundary conditions used to solve differential equations. (U, CO 4)

(2 x 6 = 12)**PART C****Answer any 2 questions****Weights: 5**

19. What are analytic functions? Derive Cauchy Reimann equations. (An)
20. Using Laplace transform solve $X' + 4X = t$, with $X(0) = 0$. (A, CO 2)
21. Obtain the orthogonal property of Legendre's polynomial. (An)
22. Find the solution of Laplace equation in 2D cylindrical coordinates. (A, CO 4)

(5 x 2 = 10)

OBE: Questions to Course Outcome Mapping

CO	Course Outcome Description	CL	Questions	Total Wt.
CO 1	Apply methods of functions of complex variables for calculations of integrals	A	1, 2, 3, 11	5
CO 2	Understand the concepts of Laplace and Fourier transforms.	U	6, 13, 14, 20	10
CO 4	Apply partial differential equations to solve problems.	A	10, 17, 18, 22	10

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