Name **26P204**

Reg. No .....

M. Sc. DEGREE END SEMESTER EXAMINATION - APRIL 2026

SEMESTER 2 : PHYSICS

COURSE : **24P2PHYT05 : MATHEMATICAL METHODS IN PHYSICS - II**

(For Regular 2025 Admission and Improvement/Supplementary 2024 Admission)

Time : Three Hours Max. Weights: 30

PART A

Answer any 8 questions **Weight: 1**

1. Write a note on the parity relation of associated Legendre polynomial. (U)
2. What are harmonic functions? (U)
3. Express the function $f(z) = (z^*)^2/z$ in the form $u(x,y) + iv(x,y)$. (A)
4. Differentiate between Fourier series and Fourier transform. (An)
5. Write Laplace's and Poisson's equation. Express them in cartesian coordinates. (A)
6. Explain the physical meaning of Helmholtz' equation. (U)
7. Evaluate $\mathcal{L}(e^{at} sinwt)$. (A)
8. Write the other forms of beta function. (A)
9. What is meant by convolution theorem of Fourier transforms. (A)
10. What is an essential singularity? Give an example. (U)

(1 x 8 = 8)

PART B

Answer any 6 questions **Weights: 2**

11. Show that Green's function is symmetric with respect to its two variables. (A)
12. Find the fourier cosine transform of f(t) = e^{-at} (A)
13. Evaluate $\int_0^{2\pi} \frac{1}{5+4cos\theta} d\theta$. (A)
14. Find the Green's function for the differential equation $\frac{d^2y}{dx^2} = f(x)$, subject to the boundary conditions $y(0) = 0 = y(1)$. (A)
15. Obtain the generating function of Hermite polynomials. (A)
16. Develop the Fourier transform of a square pulse. (An)
17. Using $J_{1/2}\left(x\right) = \sqrt{\frac{2}{\pi x}} \sin\ x, \quad J_{-1/2}\left(x\right) = \sqrt{\frac{2}{\pi x}} \cos\ x \quad \& \quad \frac{2n}{x} J_n\left(x\right) = J_{n-1}\left(x\right) + J_{n+1}\left(x\right)$ Prove that $J_{5/2}\left(x\right) = \sqrt{\frac{2}{\pi x}} \left(\frac{3-x^2}{x^2} \sin\ x - \frac{3}{x} \cos\ x\right)$ (An)
18. Expand sin(z) as a Taylor series about $z = \pi/4$ (A)

(2 x 6 = 12)

PART C

Answer any 2 questions **Weights: 5**

19. Find the solution of Laplace's equation in general cylindrical coordinates. (A)
20. Find the Fourier transform of (i) $e^{-|t|}$ and (ii) $e^{-a^2x^2}$; a > 0 (A)
21. Show that $\int_0^{2\pi} \frac{cos2\theta d\theta}{5+4cos\theta} = \frac{\pi}{6}$. (A)
22. Obtain any five recurrence relation for $J_n(x)$. (A)

(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;