Reg. No .... Name **18P204**

M Sc DEGREE END SEMESTER EXAMINATION - APRIL 2018
SEMESTER 2 : PHYSICS
COURSE : **16P2PHYT05** ; MATHEMATICAL METHODS IN PHYSICS- II
(For Regular - 2017 admission)

Time : Three Hours   Max. Marks: 75

Section A
Answer All (1 marks each)

1. The residue of $\cot(z)$ at $z = 0$ is
    (a) -1 (b) 1 (c) π (d) $(1/4)\sin h$

2. The order of C_{3v} group is
    (a) 2 (b) 4 (c) 6 (d) 8

3. The Fourier transform of which of the following functions does not exist?
    (a) $e^{-|x|}$ (b) xe^{-x^2} (c) e^{x^2} (d) e^{-x^2}

4. The solution of the equation $\frac{\partial u}{\partial x} - y\frac{\partial u}{\partial y} = 0$, is ....
    (a) $u = ky^c e^{cx}$ (b) $u = ky^{c+1} e^{cx}$ (c) $u = kxy$ (d) $u = kx + ky$

5. The solution of the equation $\frac{\partial u}{\partial x} - x\frac{\partial u}{\partial y} = 0$, is ....
    (a) $u = Ce^{\lambda x^2}$ (b) $u = Ce^{\lambda y^2}$ (c) $u = Ce^{\lambda(x^2+y^2)}$ (d) $u = Ce^{\lambda xy}$

                                                                                        (1 x 5 = 5)

Section B
Answer any 7 (2 marks each)

6. State and explain Cauchy's residue theorem.

7. What are generators of a group?

8. Describe how Earth's nutation can be explained on the basis of transforms.

9. Find the inverse Laplace transform of $2/s^4 + 3/(s^2 + 4)$

10. What is the Laplace transform of sin[ht]?

11. Differentiate between Fourier series and Fourier transform.

12. Write down four partial differential equations relevant to Physics.

13. Explain the different boundary conditions used to solve differential equations.

14. Write down two fundamental equations of Physics that are in the form of Helmholtz partial differential equation.

15. Separate the partial differential equation $\nabla^2 \psi(x, y, z) = 0$, into three ordinary differential equations.

                                                                                        (2 x 7 = 14)

Section C
Answer any 4 (5 marks each)

16. Given w(x,y) = u(x,y)+iv(x,y). If u and v are real functions and if w is analytic, show that $\nabla^2 u = \nabla^2 v = 0$.

17. Discuss isomorphism and homomorphism of groups with examples.

18. Show that the Fourier transform of a Gaussian function is another Gaussian.

19. Obtain the Fourier transform of Dirac delta function $\delta(t - x)$

20. Separate the partial differential equation $\nabla^2 \psi(r, \theta, z) + k^2 \psi(r, \theta, z) = 0$, into three ordinary differential equations.

21. Define Dirac delta function and show that $\int_{-\infty}^{\infty} f(x)\delta(x-a)dx = f(a)$, where symbols have their usual meaning.

(5 x 4 = 20)

Section D
Answer All (12 marks each)

22. What are analytic functions. Derive Cauchy Reimann equations in polar form.

   OR

   Check whether $\int_{-\infty}^{\infty} \frac{dx}{(x^4+a^4)} = \frac{\pi}{2\sqrt{2}a^3}$.

23. Write an essay about the application of group theory in particle physics.

   OR

   State and Prove Schur's lemma 1.

24. Explain what is meant by the momentum representation of a quantum particle. Obtain the equation of state in momentum representation corresponding to Schrödinger equation. Find the momentum wavefunction for the ground state of hydrogen atom.

   OR

   Separate Helmholtz' equation in spherical polar coordinates.

(12 x 3 = 36)

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