24P207 (Pages: 2) Name: ....

Reg.No: ....

SECOND SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2025

(CBCSS - PG)

(Regular/Supplementary/Improvement)

CC19P PHY2 C06 - MATHEMATICAL PHYSICS – II

(Physics)

(2019 Admission onwards)

Time : 3 Hours Maximum : 30 Weightage

Section A

Answer ***all*** questions. Each question carries 1 weightage.

1. Locate and name all the singularities of $f(z) = \dfrac{z^8 + z^4 + 2}{(z-1)^3(3z+2)^2}$
2. Write a note on Lie groups.
3. Discuss any two forms of Euler equation and its applications.
4. Describe the significance of Lagrangian Multiplier's in calculus of variation.
5. Give the general form of Fredholm and Volterra Equations. Describe the need for integral equations
6. Briefly explain the use of generating function in the context of integral equation using the example of Legendre polynomials.
7. Describe how the symmetry property of Green's function is connected with the eigen function expansion form of Green's function.
8. Discuss the continuous behavior of Green's function and its derivative.

(8 × 1 = 8 Weightage)

Section B

Answer any ***two*** questions. Each question carries 5 weightage.

9. State and Prove Cauchy Riemann conditions. Distinguish between analytic and harmonic functions with proper examples.
10. Explain the various symmetry transformations of a square. Show that these symmetry transformations form a group and obtain its multiplication table.
11. Compare Homomorphism and Isomorphism. Explain how SU(2) and SO(3) groups are homomorphic to each other.
12. Explain the theory of Neumann series solution for solving an Fredholm integral equation.

(2 × 5 = 10 Weightage)

Section C

Answer any ***four*** questions. Each question carries 3 weightage.

13. Evaluate $\int \frac{e^z}{(z^2+\pi^2)^2}\,dz$ on a circle, $|z|=4$.

14. Expand $f(z) = \frac{z+1}{z+3}$ in a Laurent series valid for the region $1<|z|<3$.

15. Find out the class structure of the element C_3 of the C_{3v} group (symmetry group of equilateral triangle).

16. Prove that a group of prime order is always cyclic.

17. Prove that (i) group of order two is always cyclic (ii) group of order three is always cyclic (iii) group of order 4 may or may not be cyclic.

18. Find the eigen function and eigen value corresponding to a vibrating string clamped at x=0 and 1.

19. Solve the eigenvalue equation for the harmonic oscillator equation and find the corresponding eigenfunction. Use them to obtain the expression for Green's function using eigenfunction expansion.

(4 × 3 = 12 Weightage)

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