25P207 (Pages: 2) Name: .....

Reg.No: .....

SECOND SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2026

(CBCSS - PG)

(Regular/Supplementary/Improvement)

CC19PPHY2C06 - MATHEMATICAL PHYSICS – II

(Physics)

(2019 Admission onwards)

Time : 3 Hours Maximum : 30 Weightage

Section A

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

1. State Cauchy's theorem.
2. Define classes of a group. Prove that all elements of a class have the same order.
3. Define a factor group. What is its order?
4. What idea does the Euler equation convey if x does not appear explicitly in the integrand i.e., $f = f(y, y_x)$.
5. Describe the advantages of integral equations over differential equations.
6. Briefly explain the use of generating function in the context of integral equation using the example of Legendre polynomials.
7. What is the restriction in using Seperable Kernel method? Name any two other methods employed in finding the solution of an integral equation.
8. Discuss the properties of one dimentional Greens's function.

(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. Discuss the properties of generators of continuous groups and derive the generators of SU(2) and SO(3).
11. Derive Euler’s equation by applying variational principle. How can it be generalized for the case of several dependent and several independent variables?
12. Explain Rayleigh-Ritz variational technique. How is it used to compute eigenfunctions and eigenvalues

(2 × 5 = 10 Weightage)

Section C

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

13. Find the Taylor expansion of $ln\,(1+z)$.

14. Show that e^{z^2} has an essential singularity at infinity. {Hint: use Taylor expansion}

15. Evaluate the integral $I = \int_{-\infty}^{\infty} \frac{dx}{1+x^2}$.

16. Check whether the set of the following four matrices forms a group under matrix multiplication.
$\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}, \begin{bmatrix}0 & 1\\ -1 & 0\end{bmatrix}, \begin{bmatrix}1 & -1\\ 1 & 0\end{bmatrix}, \begin{bmatrix}-1 & 0\\ 1 & -1\end{bmatrix}$

17. Prove that 2 right cosets of a subgroup in a given group are either equal or else have no elements in common.

18. Explain the eigenfunction expansion for a Green's function.

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)

****