

SECOND SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2025
(Regular/Improvement/Supplementary)

PHYSICS
FPHY2C06: MATHEMATICAL PHYSICS II

Time: 3 Hours**Maximum Weightage: 30****Part A: Short answer questions. Answer *all* questions. Each carries 1 weightage.**

1. State and explain Cauchy's Integral Formula.
2. Explain the terms: i) Pole; ii) Essential Isolated singularity.
3. Distinguish between homomorphism and Isomorphism.
4. Explain the classes of a group.
5. What do you mean by reducible and irreducible representation?
6. Obtain the eigen function expansion of Greens function.
7. Explain the role of Langrangian multipliers.
8. Give the properties of Greens function.

(8 × 1 = 8 weightage)

Part B: Essay questions. Answer any *two* questions. Each carries 5 weightage.

9. Find the Lorentz series expansion of a function $f(z)$ that is analytic in an annular region about a point Z_0 .
10. Obtain the group multiplication table of symmetry transformations of an equilateral triangle.
11. Explain Neumann series for solving integral equations.
12. a) Explain the method of Greens function for solving non homogeneous differential equations.
b) Find the Greens function for $\frac{d^2y}{dx^2} + k^2y = f(x)$, satisfying the boundary condition $y(0) = y(L) = 0$.

(2 × 5 = 10 weightage)

Part C: Problems. Answer *any four* questions. Each carries 3 weightage.

13. Find the residue of $f(z) = \frac{ze^z}{(z-a)^3}$ at $z = a$.
14. Show that the set of $\{1, i, -1, -i\}$ form a group under multiplication.
15. Prove that the group of order 4 may or may not be a cyclic group.

(P.T.O.)

16. Explain the soap film problem using variation principles.
17. Find the extremals of the functional $\int_{x_0}^{x_1} \frac{y'^2}{x^3} dx$.
18. Starting with the ODE, integrate twice and derive the Volterra integral equation corresponding to $y''(x) - y(x) = 0$; $y(0) = 0$, $y'(0) = 1$.
19. Find the Euler equation, if $f = f(y_{xx}, y_x, y, x)$ assuming that y and y_x have fixed values at the end points of their interval of definition.

(4 × 3 = 12 weightage)