D 122527 **(Pages : 2)** **Name.....**

Reg. No.....

SECOND SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, APRIL 2025

(CBCSS)

Physics

PHY 2C 06—MATHEMATICAL PHYSICS—II

(2019 Admission onwards)

Time : Three Hours Maximum : 30 Weightage

Section A

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

1. Prove that $\sin(x+iy) = \sin x \cosh y + i \cos x \sinh y$.
2. Explain the concept of residues.
3. For a group $\left(A, A^2, A^3 = E\right)$, find the elements conjugate to A and A^2.
4. Draw the group multiplication table for 3 element permutation group.
5. Give with proof any *two* properties of representations of groups.
6. Apply Euler equation to find the shortest distance between two points in space.
7. Define Fredholm and Volterra types of integral equations with one example for each.
8. Define one dimensional Green's function.

(8 × 1 = 8 weightage)

Section B

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

9. a) Explain Cauchy's integral theorem.
   b) Derive Cauchy's integral formula.

Turn over

10. Distinguish between discrete and continuous groups. Give characteristics of special orthogonal groups $SO(2)$ and $SO(3)$.

11. Explain the method of Lagrange's undetermined multipliers in problems of minimization under constraints. Illustrate your answer with an example.

12. Explain the procedure of converting a 2nd order first degree non-homogeneous Differential Equation into an integral equation. Illustrate with the example of linear oscillator.

(2 × 5 = 10 weightage)

Section C

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

13. Evaluate the following integral by Cauchy's residue theorem : $\int_0^{2\pi} \frac{d\theta}{1-2p\cos\theta+p^2}$ where p is a real number fixed between 0 and 1, $(0<p<1)$.

14. List with proper proof, the sub groups of the symmetry elements of an equilateral triangle .Find the normal sub group for this group.

15. Explain "Eight fold way" for the classification of particles.

16. Derive a Volterra integral equation corresponding to $y''(x)-y(x)=0$. Given $y(0)=0$ and $y'(0)=1$.

17. Find the Neumann series solution for the integral equation

$$\phi(x)=1-2\int_0^x t\,\phi(t)\,dt.$$

18. Find the Green's function solution for the equation $\nabla^2\psi(\mathbf{r})=f(\mathbf{r})$.

19. Apply calculus of variations to find the path of a point mass falling under gravity.

(4 × 3 = 12 weightage)