D 140702 **(Pages : 2)** **Name.....**

Reg. No.....

SECOND SEMESTER M.Sc. (CBCSS) REGULAR/SUPPLEMENTARY DEGREE EXAMINATION, APRIL 2026

Physics

PHY2C06—MATHEMATICAL PHYSICS—II

(2019 Admission onwards)

Time : Three Hours Maximum Weightage : 30

Section A

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

1. Show that the complex function sin z is analytic.
2. Explain the following : simply connected and multi-connected domains, singularities and poles for a complex function.
3. Draw the group multiplication table for 3 element permutation group.
4. Prove that : (a) In a representation by matrices the identity matrix is a unit matrix ; (b) a matrix representing the inverse of an element is equal to the inverse of the matrix representing the element.
5. Apply Euler equation to find the shortest distance between two points in space.
6. Explain Rayleigh-Ritz variational technique for the computation of Eigen function and Eigen values.
7. Define Dirac delta function. Write down an equation showing the relationship between Green's function and Dirac delta function.
8. Define Kernel with reference to an integral equation. What are its properties ?

(8 × 1 = 8 weightage)

Section B

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

9. Explain Cauchy's integral formula. Using it derive the Laurent's series for a complex function.
10. Discuss the symmetry elements of a square and show that they form a group. Prepare the group multiplication table.

Turn over

11. Derive Euler equation for one dependent and independent variable. Extend it to Euler equation for several dependent and independent variables.

12. (a) Explain the properties of Green's functions.

    (b) Find the Green's function for linear oscillator.

(2 × 5 = 10 weightage)

Section C

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

13. Prove that for any analytic function $f(z)$, nth derivative, $f^n(z_0) = \frac{n!}{2\pi i}\oint \frac{f(x)}{(z-z_0)^{n+1}}dz$ when the contour integration is carried out over a unit circle surrounding z_0.

14. (a) Find a group isomorphic to the sub group of C_{4v}, $H = \{E, C_4, C_4^2, C_4^3\}$.

    (b) Show the homomorphism between C_{4v} group and any of its subgroups.

15. Apply the method of Lagrange multipliers to find the radius to height ratio of a right circular cylinder of constant volume and minimum surface area.

16. Show that the symmetry elements of an equilateral triangle forms a group. Prepare the group multiplication table.

17. Derive a Fredholm integral equation corresponding to $y''(x) - y(x) = 0$, given $y(1) = 1$ and $y(-1) = 1$.

18. Outline the method of finding eigen values and eigen functions to a homogeneous Fredholm integral equation with separable Kernal

$$\phi(x) = f(x) + \lambda\int_a^b K(x,t)\phi(t)\,dt, \text{ where } K(x,t) = \sum_{j=1}^{n} M_j(x)N_j(t).$$

19. Find the Green's function solution for the differential equation $\frac{d^2y}{dx^2} + y = f(x)$ with the initial conditions $y(0) = 0$ and $y'(0) = 0$.

(4 × 3 = 12 weightage)