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Reg. No................................

Name...................................

M.Sc. DEGREE (C.S.S.) EXAMINATION, NOVEMBER 2020

Second Semester

Faculty of Science

Branch II—Physics—A—Pure Physics

PH2C05—MATHEMATICAL METHODS IN PHYSICS—II

(2012—2018 Admissions)

Time : Three Hours | Maximum Weight : 30

Part A (Short Answer Type Questions)

Answer any **six** *questions.*
Each question carries weight 1.

1. State and explain Cauchy's theorem.
2. What is meant by residue of a function?
3. Explain Fourier transform.
4. Illustrate inverse Laplace transform.
5. What is Fourier series ?
6. Explain a cyclic group.
7. Explain the characteristics of a Lie group.
8. State the features of partial differential equations.
9. Explain the symmetry of Green's function.
10. Give the applications of Green's function.

$(6 \times 1 = 6)$

Part B

Answer any **four** *questions.*
Each question carries weight 2.

11. Classify the singularities of a complex function.
12. Find the Laplace transforms of : (i) cos at ; and (ii) sinh at.

Turn over

13. Find the Fourier cosine and sine integrals of $f(x) = e^{-kx}$ $(x > 0, k > 0)$.

14. Show that SU(2) and SO(3) groups are homomorphic.

15. Give the Green's function for a linear harmonic oscillator.

16. Solve $\left(p^2 + q^2\right) y = qz$.

(4 × 2 = 8)

Part C

Answer **all** *questions.*
Each question carries weight 4.

17. (a) State and Cauchy's residue theorem. Prove that $\int_0^{\infty} \frac{\sin mx}{x} dx = \frac{\pi}{2}, m > 0$.

Or

(b) Evaluate the integral $\int_{-\infty}^{+\infty} \frac{\cos x}{a^2 + x^2} dx, a > 0$.

18. (a) State the advantages of Fourier series. Develop Fourier series in the interval (– 2, 2) if $f(x) = 0$ for $-2 < x < 0$ and $f(x) = 1$ for $0 < x < 2$.

Or

(b) State and prove Laplace transform theorem for derivatives and integrals.

19. (a) State and prove great orthogonality theorem.

Or

(b) (i) Show that in a rotation group all rotations with the same rotation angle belong to the same class.

(ii) Obtain the irreducible representation of SU(2) group.

20. (a) Discuss the applications of Green's function in scattering problems and arrive at the solutions.

Or

(b) Obtain the solution of the general cylindrical Laplace's equation.

(4 × 4 = 16)