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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 × 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





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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 $(p^2 + q^2)y = qz$.

 $(4 \times 2 = 8)$ **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.

 $(4 \times 4 = 16)$ 