K23P 0504

Reg. No. : .....

Name : .....

II Semester M.Sc. Degree (C.B.S.S. – Reg./Supple./Imp.) Examination, April 2023
(2019 Admission Onwards)
PHYSICS
PHY2C07 : Mathematical Physics – II

Time : 3 Hours Max. Marks : 60

SECTION – A

Answer **both** the questions (Either **a** or **b**).

1. a) i) Write the three-dimensional Laplace's equation in Cartesian, cylindrical and spherical polar coordinates. Solve it in Cartesian coordinates.

   ii) Solve the following equation $\frac{\partial^2 z}{\partial x^2} - 2\frac{\partial z}{\partial x} + \frac{\partial z}{\partial y} = 0$ by the method of separation of variables.

   OR

   b) i) What is Geometric series ? Under what condition a geometric series is convergent, divergent or oscillatory.

   ii) State and explain any three methods for testing the convergence or divergence of a series.

2. a) State and prove the following properties of the Fourier Transforms :
   i) Linearity property
   ii) Change of scale property
   iii) Shifting property
   iv) Convolution property
   v) Conjugate property.

   OR

   b) i) What are reducible and irreducible representations ? Give examples.

   ii) State and prove orthogonality theorem. What is its importance ? **(2×12=24)**

P.T.O.

SECTION – B

Answer **any four** questions (**One** mark for Part **a**, **3** marks for Part **b**, **5** marks for Part **c**).

3. a) Show that the following series is convergent.

$$\frac{1}{1.2}+\frac{1}{2.3}+\frac{1}{3.4}+.....+\frac{1}{n(n+1)}+.....\infty$$

   b) "The nature of an infinite series remains unaltered by addition or removal of finite number of terms". Justify.

   c) Discuss the Cauchy's ratio test for the convergence or divergence of a series.

4. a) What is the importance of character table in Group theory ?

   b) Illustrate the method of splitting partial differential equation into ordinary differential equations by taking Helmholtz equation as example.

   c) Applying the method of separation of variable techniques, find the solution of the equation $3\frac{\partial u}{\partial x}+2\frac{\partial u}{\partial y}=0$.

5. a) What is the uniqueness of Green's function ?

   b) What is Green's function ? State and explain its symmetry property.

   c) Find the Green's function required for the boundary value problem

   $\frac{d^2y}{dx^2}+k^2y=f(x)$ where f(x) is a known function of x, and y(x) satisfy the boundary conditions y(0) = 0 and y(L) = 0.

6. a) How many irreducible representations are possible for the C_{3v} point group ?

   b) Show that the groups of order 2 and 3 are always cyclic.

   c) If an Abelian group is constructed with two distinct elements a and b such that, $a^2 = b^2 = I$, where I is the group identity. What is the order of the smallest Abelian group containing a, b and I ? Justify your answer.

7. a) What is meant by self-reciprocal with respect to Fourier Transform ?
   b) Find the Fourier transform of e^{-ax^2}, where $a > 0$.
   c) Define a group. Show that (1, i, –1, –i) form a cyclic group under multiplication.
8. a) State any property of Inverse Laplace transforms.
   b) State and prove Laplace convolution theorem.
   c) Find the Laplace transform of (1 + cos 2t). **(4×9=36)**

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