

APRIL/MAY 2018

MPH21 — MATHEMATICAL PHYSICS — II

Time : Three hours

Maximum : 75 marks

SECTION A — (5 × 6 = 30 marks)

Answer ALL questions.

1. (a) Evaluate $\int_C \frac{e^z dz}{z(z-1)^2}$ where C is circle $|z|=2$.

Or

- (b) Prove that the function

(i) Z^{-1} and

(ii) $\sin z$ are analytic functions of complex variable $z = x + iy$.

2. (a) Obtain the D'Alemberts solution of wave equation $\frac{\partial^2 y}{\partial x^2} = \frac{1}{c^2} \frac{\partial^2 y}{\partial t^2}$.

Or

- (b) By applying the method of separation of variable, solve Laplace equation in Cartesian Coordinates.

3. (a) Find the Laplace transform of $F(t) = \sin at$ and $F(t) = \cos at$.

Or

- (b) Find the Finite Fourier Cosine transform of $f(x) = e^{-ax}$ in the interval $(0, l)$.

4. (a) Explain the concept of group representations.

Or

- (b) Write short notes on Special Unitary group $SU(2)$.

5. (a) How is Doppler's effect in light defined? Obtain the relativistic expression for Doppler effect.

Or

- (b) Discuss Lagrangian formulation of relativistic mechanics.

SECTION B — (3 × 15 = 45 marks)

Answer any THREE questions.

6. (a) State and prove Cauchy's residue theorem.
(b) Find the residues of the function $\frac{1}{(z^2 + 1)^3}$ at $z = i$.

7. Obtain the solution of two-dimensional heat flow equation.

8. Solve the differential equation $\frac{d^2y}{dt^2} - 2\frac{dy}{dt} + 5y = 0$; $y = 0, \frac{dy}{dt} = 1$ at $t = 0$ and $y = 1$ at $t = \frac{\pi}{8}$ by Laplace transform method.

9. (a) What are reducible and irreducible representations of a group? Explain

- (b) Obtain the irreducible representations of C_{3v} point group and construct its character table.

10. Show that the Maxwell's electromagnetic equations are invariant under the Lorentz transformations.