

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 — ( $3 \times 15 = 45$ 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  $\frac{d^2 y}{dt^2} - 2\frac{d^2 y}{dt^2} + 5\frac{dy}{dt} = 0$ ;  $y = 0, \frac{dy}{dt} = 1$  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.