YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY
FARIDABAD

M.SC (PHYSICS) SEM-I EXAMINATION (under CBS)

MATHEMATICAL PHYSICS (PHY-101)

Time: 3 hr **M.Marks:60**

Note: Note: Part-A consists of Question No.1 which is compulsory. Attempt any four from Part-B.

Part-A

1 (a) Separate into real and imaginary parts $sin\,(x + iy)$

(b) What is the necessary and sufficient condition(s) for f (z) to be analytic?

(c) Differentiate between Simply connected and Multiply connected regions.

(d) State and prove the change of scale property of Fourier transform.

(e) Find the Laplace transform of $tcosat$.

(f) Find the inverse Laplace transform of $\frac{s^2-3s+4}{s^3}$

(g) For any matrix A, prove that AA' and A'A are both symmetric.

(h) What is a Triangular matrix?

(i) Differentiate between Abelian and non-Abelian group.

(j) What is the need of integral transforms? (2x10)

Part-B

2. (a) If u (x, y) = $x^2 - y^2$ is the real part of an analytic function f (z) = u + iv, find u. (3)

2 (b) State and prove Cauchy's Integral Theorem for the function of a complex valuable. (4)

2 (c) Evaluate $\int_0^{2\pi} \frac{d\theta}{2+\cos\theta}$ (3)

3. (a) Find the Fourier sine and cosine transform of xe^{-ax} (5)

3 (b) State and prove *Parseval's Identity* for Fourier Transforms. (5)

4. (a) Obtain Laplace transform of the function:

$$f(t) = sint, \quad 0 < t < \pi$$
$$= 0, \quad t \geq \pi$$

(5)

4 (b) Evaluate inverse Laplace transform of $\int_s^\infty \tan^{-1}(\frac{2}{s^2})ds$ (5)

5 (a) Derive the Laurent's series expansion for the function of a complex variable. (5)

5 (b) Describe any three properties of LaplaceTransforms. (5)

6 (a) Prove that if G be an infinite cyclic group, then G has exactly two generators. (4)

6 (b) If a group has four elements, show that it must be abelian. (3)

6 (c) Show that any two characteristic vectors (Eigen vectors) corresponding to two distinct Eigen values of a Hermitian matrix are orthogonal. (3)

7 (a) Let G be finite non-abelian group of order with the property that G has a subgroup of order k for each positive integer k dividing n. Prove that G is not a simple group. (5)

7 (b) Prove that

$$\frac{2}{\pi}\int_0^\infty F_s(s)G_s(s)ds = \int_0^\infty f(x)g(x)dx$$

where the symbols have their usual meanings. (5)