MSc Degree Examination, ………YEAR

I SEMESTER

Faculty of Sciences

Physics – Material Science

PAPER I - PH1MC1: APPLIED MATHEMATICS FOR PHYSICS- I

Time : 3 Hours. **Maximum Weight : 30**

Part A (Short answer questions-weight 1 each)

Answer any six questions

1. If $f(z) = \sin z$, show that $f^{*}(z) = f(z^{*})$ for complex z.

2. Check whether $f(z) = i^{Z}$ is analytic.

3. Explain cyclic group with example?

4. Prove that inverse of any element of group is unique.

5. Write down two partial differential equations and their relevance in physics.

6. Write short note on the different boundary conditions employed to solve differential equations.

7. Obtain the Laplace transform of $f(x) = x^{n}$

8. Define the Fourier transform of a function $f(x)$. What is the Fourier transform of its first derivative.

9. What is meant by Earth's Nutation?

10. Explain SU (3) flavor symmetry and SU(3) colour symmetry.

(6 x 1 =6 wt)

Part B (Short Essay/Problems-Weight 2 each)

Answer any 4 questions

11. Evaluate $\int_{C} \frac{2z-1}{z(z+1)(z+3)}$ dz , where C is $|Z| = 2$ using Residue Theorem

12. Obtain the Laurent expansion of the function $f(z)$ about $z = z_0$

13. Show that the Fourier transform of a Gaussian function is another Gaussian.

14. Prove that the set of all matrices $\begin{pmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{pmatrix}$ for $0 \leq \theta \leq 2\pi$ form a Lie group.

15. State and prove convolution theorem of Laplace transforms.

16. Separate the partial differential equation $\nabla^2\psi(\rho, \phi, z) + k^2 \psi(\rho, \phi, z) = 0$ in to three ordinary differential equations.

(4 x 2 =8 wt)

Part C (Essay type questions- weight 4 each)

Answer all questions

17. a. State and prove Cauchy's integral theorem. Deduce Cauchy's integral formula from it.

Or

b. Evaluate $\oint_c \frac{dz}{\sinh 2z}$

18. a. Construct the multiplication table for the symmetry group of an equilateral triangle.

Or

b. State Schur's lemmas and prove the great Orthogonality theorem.

19. a. Solve the differential equation for the electric charge in a series LCR circuit using Laplace transform.

Or

b. Obtain the momentum representation of a wave function $\psi(x) = \sqrt{a}\ exp(-x^2/2a^2)$

20. a. Solve Poisson's Equation using Green's function.

Or

b. Obtain a general solution of Laplace equation in circular cylindrical co-ordinates.

(4 x 4 =16 wt)