M.Sc. DEGREE EXAMINATION,NOVEMBER 2018
I Year I Semester
Core Major -I
MATHEMATICAL PHYSICS

Time : 3 Hours **Max.marks :75**

Section A $(10 \times 2 = 20)$ Marks

Answer any **TEN** questions

1. What is meant by Orthonormal basis.
2. State Schwartz inequality.
3. Define Dirac delta function.
4. What is order of a differential equation?
5. When is a function $f(z)$ is said to be analytic in a domain?
6. Find the poles of $\frac{1}{(z^2+1)^2}$.
7. Show that $L(e^{at}) = \frac{1}{s-a}$.
8. Find Fourier sine transforms of e^{-ax}.
9. Define subgroup.
10. Distinguish between homomorphism and isomorphism.
11. What is Hermitian matrix?
12. State Laurent's theorem.

Section B $(5 \times 5 = 25)$ Marks

Answer any **FIVE** questions

13. Find the eigen values of the matrix $\begin{pmatrix} 1 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \end{pmatrix}$
14. Explain the reciprocity theorem of Green's function.
15. Evaluate $\int \frac{e^z dz}{z(z-1)^2}$ where c is the circle $|z| = 2$.
16. Find the Fourier cosine transform of $5e^{-2x} + 2e^{-5x}$.

17. Construct the character table for C_{3V} point group.

18. Show that $A = \begin{pmatrix} \frac{1}{\sqrt{2}} & \frac{i}{\sqrt{2}} \\ \frac{-i}{\sqrt{2}} & \frac{-1}{\sqrt{2}} \end{pmatrix}$ is unitary matrix.

19. Find the first three terms of the Taylor's series expansion of $f(z) = \dfrac{1}{z^2+4}$ about $z = -i$. Also find the region of convergence.

Section C $(3 \times 10 = 30)$ Marks

Answer any **THREE** questions

20. From the set of vectors (1,0,1), (0,0,1) and (1,1,0) construct a set of orthonormal vectors.

21. What do you mean by orthogonality of functions. Prove that Laguerre polynomials are orthogonal functions.

22. State and prove Cauchy's integral formula $f(z_0) = \dfrac{1}{2\pi i}\displaystyle\int \frac{f(z)dz}{(z-z_0)}$. State also the condition of its applicability.

23. Using Laplace transform solve $y'' - 3y' + 2y = e^{2t}$ Given that $y(0) = -3$, $y'(0) = 5$.

24. State and prove great orthogonality theorem.

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