M.Sc DEGREE EXAMINATION,APRIL 2019
I Year I Semester
Mathematical Physics

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

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

Answer any **TEN** questions

1. What is inner product?
2. Define invariant subgroup.
3. State reciprocity theorem.
4. Define wronskian determinant.
5. Define single and multi-valued functions.
6. Define analytic function.
7. Find the Fourier series for the function $f(x) = x^2$ in the interval $-\pi < x < \pi$ and hence evaluate $\sum_{n=1}^{\infty} \frac{1}{(2n-1)^2}$.
8. Find out the Laplace transformations of *t sin at*.
9. State Schur's Lemma theorem.
10. State orthogonality theorem.
11. What do you mean by Hermitian matrix?
12. Define unitary matrices.

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

Answer any **FIVE** questions

13. Find the characteristic equation of the following matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & -1 & 4 \\ 3 & 1 & 1 \end{bmatrix}$ and verify the Cayley-Hamilton theorem.
14. Explain eigen function and expansion of Green's function.
15. Write and prove Cauchy's integral formula.
16. Using Laplace transformation method to solve the differential equation. $\mathbf{y}'' + 9\mathbf{y} = 0$; satisfying the initial conditions $y(0)=0$ and $y'(0)=2$.
17. Discuss in brief on representation of groups.

18. Find Laurent series of function $f(z) = \frac{1}{(1-z^2)}$ with centre at *z=1*.

19. Find the eigenvalue and eigenvector of $\mathbf{A}= \begin{bmatrix} \mathbf{c}os\theta & -\mathbf{s}in\theta \\ \mathbf{s}in\theta & \mathbf{c}os\theta \end{bmatrix}$.

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

Answer any **THREE** questions

20. Diagonalise the following matrices: (i) $\begin{bmatrix} 4/3 & \sqrt{2}/3 \\ \sqrt{2}/3 & 5/3 \end{bmatrix}$, and (ii) $\begin{bmatrix} cos\theta & -sin\theta & 0 \\ sin\theta & cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$.

21. (i) Find the residues of $\frac{ze^{iz}}{z^4+a^4}$ at its poles.

    (ii) Discuss in brief, Green's function for one dimensional case.

22. Evaluate the integral $\oint_c \frac{dz}{z^2+z}$ where, c is a circle defined by $|z| = |R>|$.

23. Derive convolution theorem.

24. Discuss in detail about isomorphism and homomorphism between groups.

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