Date: 15-11-2024          Dept. No.          Max. : 100 Marks
Time: 01:00 pm-04:00 pm

## SECTION A

**Answer ANY FOUR of the following**                                    **4 x 10 = 40 marks**

1.  State and prove Cauchy-Riemann conditions from first principles.

2.  Derive any two recurrence relations of Hermite polynomials.

3.  Explain metric tensor.

4.  Prove that the eigenvalues of a Hermitian matrix are real and any two eigenvectors belonging to distinct eigenvalues are orthogonal to each other.

5.  Apply Newton- Raphson method to find an approximate solution of the equation $e^X - 3^X = 0$

6.  Write all the Recurrence formulae of Legendre Polynomials.

7.  Obtain the D'Alembert's solution of 1D wave equation.

8.  Use residue calculus to evaluate the following integral $\int_0^{2\pi} \dfrac{1}{(5 - 4\sin\theta)} d\theta$.

## SECTION B

**Answer ANY THREE of the following**                                    **3 x 20 = 60 Marks**

9.  Compute the real root of x log x − 1.2 = 0 using Newton - Raphson method.

10. Find the metric tensor and the expression for the line element in cylindrical coordinates.

11. Obtain the contravariant components of the metric tensor in terms of spherical polar coordinates.

12. Obtain the generating function of Hermite Polynomials (Rodrigue Formula).

13. Evaluate $\int_0^{2\pi} \dfrac{1}{(a + b\sin\theta)} d\theta$ if a >|b|.

14. Find the Eigen values and Eigen vectors of matrix
$$A = \begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{bmatrix}.$$

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