**CURRICULAM PLAN OF Dr. VARSHA**

**FOR EVEN SEMESTER 2024-25**

**B.Sc. (H) PHYSICS (IIND YEAR)**

**PAPER-DSE-Advanced Mathematical Physics-I (2223012003)**

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| CONTENT | ALLOCATION OF LECTURES | SCHEDULE FOLLOWED |
| **Eigen-values and Eigenvectors:** Eigen-values and eigen vectors of a transformation and  corresponding matrix representation. Cayley- Hamilton Theorem (Statement only), its  applications like inverse and powers of a matrix. Eigensystems of hermitian and unitary  matrices. Diagonalization of matrices. Normal matrices. Simultaneous diagonalizability of  two matrices.  Use of Matrices in Solving Coupled Linear first order ordinary differential equations with  constant coefficients. Minimal Polynomial, Functions of a Matrix. | (14 Lectures) | 1-31 JAN  Derivations and Numericals |
| **Vector Spaces as Algebraic Structures:** Definition and examples of groups, rings, fields and vector spaces. Real and Complex fields, Use of ket notation |𝛼𝛼 > for vectors. Subspaces, Linear combination of vectors, Linear dependence and independence of vectors, span of a subset of vectors, Bases and dimension of vector space, direct sum of spaces, representation of vectors as column vectors with Rn as example. Inner Product Spaces: Inner product of vectors (< 𝛼𝛼|𝛽𝛽 >) and norm of a vector, euclidean spaces and unitary spaces. Cauchy-Schwartz inequality, concept of length and distance, metric spaces. Hilbert Space (definition only). Linear functional, dual space, dual basis (< 𝛼𝛼| notation); Orthogonality of vectors, orthonormal basis, Gram-Schmidt procedure to construct an orthonormal basis. | (13 Lectures) | 1-28 FEB  Derivations and  Numericals  Class test on unit end  Discussion of  Important questions |
| **Linear Transformation:** Linear Mappings and Examples, Homomorphism and Isomorphism of vector space, rank and nullity of a linear mapping, Range space and Kernel (null space) of a linear mapping, non-singular transformations, Nilpotent and Idempotent Transformations. | (8 lectures) | 1-16 march  Assignment given for IA  (25-28 march HOME EXAM)  28-31 march  Home exam paper discussion |
| **Matrices as Representations:** Matrix Representation of a Linear transformations,  composition of linear transformations and matrix multiplication, linear algebra. Algebra of  matrices, determinant and trace of matrix and their properties. Non-singular matrices. Rank  of a matrix and invertibility of matrices. Direct sum and direct product of matrices.  Change of basis transformation, similar matrices, trace and determinant as invariants of basis  change. Transpose and adjoint of a linear transformation, self-adjoint operators. Symmetric  and hermitian matrices. Preservation of norms by orthogonal and unitary transformations. | 10 lectures | 1-27 APRIL  Discussion of last year papers and clarification of doubts |