**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 andcorresponding matrix representation. Cayley- Hamilton Theorem (Statement only), itsapplications like inverse and powers of a matrix. Eigensystems of hermitian and unitarymatrices. Diagonalization of matrices. Normal matrices. Simultaneous diagonalizability oftwo matrices.Use of Matrices in Solving Coupled Linear first order ordinary differential equations withconstant coefficients. Minimal Polynomial, Functions of a Matrix. | (14 Lectures) | 1-31 JANDerivations 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 FEBDerivations andNumericalsClass test on unit endDiscussion ofImportant 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 marchAssignment given for IA(25-28 march HOME EXAM)28-31 marchHome exam paper discussion |
| **Matrices as Representations:** Matrix Representation of a Linear transformations,composition of linear transformations and matrix multiplication, linear algebra. Algebra ofmatrices, determinant and trace of matrix and their properties. Non-singular matrices. Rankof 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 basischange. Transpose and adjoint of a linear transformation, self-adjoint operators. Symmetricand hermitian matrices. Preservation of norms by orthogonal and unitary transformations. | 10 lectures | 1-27 APRILDiscussion of last year papers and clarification of doubts |