

## MA1002D MATHEMATICS II

Pre-requisites: Nil

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3	1	0	3

**Total hours: 39**

### Module 1: (16 hours)

System of Linear equations, Gauss elimination, Solution by LU decomposition, Determinant, Rank of a matrix, Linear independence, Consistency of linear system, General form of solution.

Vector spaces, Subspaces, Basis and dimension, Linear transformation, Rank-nullity theorem, Inner-product, Orthogonal set, Gram-Schmidt orthogonalisation, Matrix representation of linear transformation, Basis changing rule.

Types of matrices and their properties, Eigenvalue, Eigenvector, Eigenvalue problems, Cayley-Hamiltonian theorem and its applications, Similarity of matrices, Diagonalisation, Quadratic form, Reduction to canonical form.

### Module 2: (13 hours)

Ordinary Differential Equations (ODE): Formation of ODE, Existence and uniqueness solution of first order ODE using examples, Methods of solutions of first order ODE, Applications of first order ODE.

Linear ODE: Homogenous equations, Fundamental system of solutions, Wronskian, Solution of second order non-homogeneous ODE with constant coefficients: Method of variation of parameters, Method of undetermined coefficients, Euler-Cauchy equations, Applications to engineering problems, System of linear ODEs with constant coefficients.

### Module 3: (10 hours)

Gamma function, Beta function: Properties and evaluation of integrals.

Laplace transform, Necessary condition for existence, General properties, Inverse Laplace transform, Transforms of derivatives and integrals, Differentiation and Integration of transform, Unit-step function, Shifting theorems, Transforms of periodic functions, Convolution, Solution of differential equations and integral equations using Laplace transform.

### References:

1. E. Kreyszig, Advanced Engineering Mathematics, 10<sup>th</sup> edition, New Delhi, India: Wiley, 2015.
2. G. Strang, Introduction to Linear Algebra, Wellesley MA: Cambridge Press, 2016.
3. R. P. Agarwal and D. O 'Regan, An Introduction to Ordinary Differential Equations, New York: Springer, 2008.
4. V. I. Arnold, Ordinary Differential Equations, New York: Springer, 2006.
5. P. Dyke, An Introduction to Laplace Transforms and Fourier Series, New York: Springer, 2014.