MA1003E MATHEMATICS I
(Common to CE/ME/PE/MSE branches)

Pre-requisites: Nil

L	T	P	O	C
3	1	0	5	3

Total Lecture sessions: 39

Course Outcomes:

CO1: Find the limits, check for continuity and differentiability of real valued functions of one variable.

CO2: Find the limits, check for continuity and differentiability of real valued functions of two variables.

CO3: Find the maxima and minima of real valued functions of one or two variables.

CO4: Test the consistency of the systemof linear equations and then solve it.

CO5: Diagonalise symmetric matrices and use it to find the nature of quadratic forms.

System of linear equations: Gauss elimination method, row echelon form, row space, row rank, existence and uniqueness, homogeneous system, Linear independence and span of row vectors, Linearly independent solutions, rank-nullity relation for homogeneous linear system. Eigenvalues and eigenvectors of a matrix, Cayley-Hamilton theorem, eigenvectors associated with distincteigenvalues, diagonalisation of matrices, symmetric, skew-symmetric and orthogonal matrices and their eigenvalues, orthogonal diagonalisation of symmetric matrices, bilinear and quadratic forms, definiteness of quadratic forms, transformation into principal axes.

Functions of one variable: limit, continuity, differentiability, local maxima and local minima, mean value theorems, Taylor's theorem, indeterminate form, L'hôpital's rule, integration, fundamental theorem of calculus, applications: finding volume and area, improper integrals, Gamma and Beta functions. Parameterised curves in space, arc length, tangent and normal vectors, curvature and torsion.

Functions of several variables: limit, continuity, partial derivatives, partial differentiation of composite functions, directional derivatives, gradient, applications like finding local maxima and local minima of functions of two variables, critical point, saddle point, Taylor's formula for two variables, Hessian, second derivative test, method of Lagrange multipliers, Evaluation of double integral, improper integrals, change of variables, Jacobian, polar coordinates, triple integral, cylindrical and spherical coordinates, applications:mass of a lamina, centre of gravity, moments of inertia.

References:
 [1] Anton, H., Bivens, I., and Davis, S., 2015, *Calculus*, 10th ed., John Wiley & Sons, New York.
 [2] Thomas, G. B., Weir, M.D., and Hass, J., 2015, *Thomas' Calculus*, 12th ed., India: Pearson Education, New Delhi.
 [3] Kreyszig, E., 2015, *Advanced Engineering Mathematics*, 10th ed., John Wiley & Sons, New York.
 [4] G. Strang, 2016, *Introduction to Linear Algebra*, Wellesley-Cambridge Press, Wellesley, MA.