LINEAR ALGEBRA AND CALCULUS
(Common to CSE, CSE (AI & ML), CSE (DS), IT, ECE, EEE, BME, CE, ME, CHE, PHE, AI & DS)

Regulation	Year-Sem	Course Code	Category	Periods/ Week			Credits	Maximum Marks		
				L	T	P	C	CIA	SEE	Total
R20A	I – I	A51NB	BS	3	-	-	3	30	70	100

Course Objectives: To learn
1. Concept of a rank of the matrix and applying this concept to know the consistency and solving the system of linear equations.
2. Concept of Eigen values and Eigenvectors, Methods of reduction of quadratic form to canonical form.
3. Geometrical approach to the mean value theorems and their application to mathematical problems and finding maxima and minima of function of two and three variables.
4. Methods of solving the ordinary differential equations of first order.
5. Methods of solving the ordinary differential equations of higher order.

Unit-I: Matrices **(10 Periods)**
Matrices: Types of Matrices, Symmetric, Skew-symmetric, Orthogonal, Hermitian, Skew-Hermitian, Unitary; Rank of a matrix by Echelon form and Normal form, Inverse of non-singular matrices by Gauss-Jordan method, System of linear equations: solving system of homogeneous and non-homogeneous equations by Gauss elimination method.

Unit-II: Eigenvalues and Eigenvectors **(10 Periods)**
Eigenvalues and Eigenvectors and their properties; Diagonalization of a matrix; Cayley-Hamilton Theorem (without proof), finding inverse and powers of a matrix by Cayley-Hamilton Theorem, Real Quadratic form, Matrix representation, Reduction of Quadratic form to canonical form by orthogonal transformation, rank and nature of the quadratic form.

Unit-III: **Mean value theorems and Functions of Several Variables** **(9 Periods)**
Mean value theorems: Rolle's Theorem, Lagrange's Mean value theorem with their Geometric and Algebraic Interpretations, Cauchy's Mean value theorem, Taylor's and Maclaurin's series, Partial differentiation, Total derivative,Jacobians, Functional dependence, Maxima and Minima of functions of two and three variables, Lagrange's method of undetermined multipliers.

Unit-IV: First Order Ordinary Differential Equations and Applications **(8 Periods)**
Review of first order ODE, Exact, Reducible to exact equations, linear and Bernoulli's equations, Orthogonal Trajectories, Newton's law of cooling, law of natural growth and decay.

Unit-V: Higher Order Ordinary Differential Equations **(11 periods)**
Second and higher order linear differential equations with constant coefficients, Non-Homogeneous terms of the type,$e^{ax}, \sin(ax+b), \cos(ax+b)$,Polynomials in$x$,$e^{ax}V(x)andx^m V(x)$, method of variation of parameters, equations reducible to linear equations with constant coefficients: Cauchy-Euler and Legendre's linear equations.

Course Outcomes:
After completing the course, the students will be able to:
1. Apply matrix techniques to solve system of linear equations.(L3),
2. Find the Eigen values and Eigenvectors. Reduce the Quadratic form to canonical form.(L3)
3. Apply Mean value theorems for given functions and also find maxima and minima for functions of two and three variables.(L3)
4. Formulate an ODE and solve real time engineering problems. (L3)
5. Solve higher Ordinary differential equations by analytical methods.(L3)

Text Books:
1. B.S. Grewal, Higher Engineering Mathematics, 42nd Edition, Khanna Publishers
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

Reference Books:
1. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.
2. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
3. S.L. Ross, Differential Equations, 3rd Edition, Wily India, 1984.
4. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson,Reprint, 2002.
5. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi,2008.
6. R. K. Jain and S. R. K. Iyengar, "Advanced Engineering Mathematics", Fifth Edition, Narosa Publishing House, 2016.
7. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010