LINEAR ALGEBRA AND CALCULUS

I Semester: CSE/IT/AI&ML/CS/DS/CSIT

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5BS02	BSC	3	1	-	4	30	70	100
Contact Classes: 44	Tutorial Classes: 8	Practical Classes: Nil				Total Classes: 52		

Course Objectives

To learn

1. The concept of differential equations and solve them using appropriate methods.
2. Usage of the appropriate test to find the convergence and divergence of the given series.
3. Concept of Rank of a matrix, Consistency and solving system of linear equations.
4. The Rank and Nullity of vectors.
5. Concept of eigen values, eigen vectors and diagonalization of the matrix.

UNIT-I	ORDINARY DIFFERENTIAL EQUATIONS	Classes: 12

Introduction- Exact and reducible to Exact differential equations-Newton's Law of cooling-Law of Growth and Decay. Linear differential equations of second and higher order with constant coefficients - Non-Homogeneous term of the type $Q(x) = e^{ax}$, Sin ax, Cosax, $e^{ax}v(x)$, $x^n v(x)$ - Method of variation of parameters.

UNIT-II	SEQUENCES AND SERIES	Classes: 08

Basic definitions of Sequences and series – Convergence and divergence –Comparison Test- Ratio Test –Raabe's Test - Cauchy's n^{th} root Test –Integral Test – Absolute and Conditional convergence – Power Series.

UNIT-III	THEORY OF MATRICES	Classes:12

Real matrices: Symmetric-skew-symmetric and orthogonal matrices –Complex matrices: Hermitian, Skew – Hermitian and Unitary matrices –Elementary row and column transformations –Elementary matrix-Finding rank of a matrix by reducing to Echelon form and Normal form-Finding the inverse of a matrix using elementary row/column transformations (Gauss-Jordan method)-Consistency of system of linear equations (homogeneous and non-homogeneous) using the rank of a matrix –Solving m n and n n linear system of equations by Gauss Elimination

UNIT-IV	VECTOR SPACES	Classes: 10
The n-dimensional Vectors –Vector space – linear dependence of vectors –Basis and dimensions –linear transformations-range and kernel of a linear map – rank and nullity - rank and nullity theorem – inverse of a linear transformation-composition of linear map- Matrix associated with a linear map.		
UNIT-V	**EIGEN VALUES, EIGEN VECTORS AND INNER PRODUCT SPACES**	**Classes: 10**
Eigen values and Eigen vectors of a matrix- Eigenbases - Diagonalization- Inner product space – Norm of a vector – Schwarz's Inequality – Normed vector space – Orthogonal and orthonormal sets – Gram Schmidt orthogonalization process.		

Text Books:

1. Ervin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. B.S.Grewal, Higher Engineering Mathematics, Khanna publishers, 36th Edition, 2010.
3. V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East – West press, Reprint 2005.

Reference Books:

1. G.B.Thomas, calculus and analytical geometry,9th Edition, Pearson Reprint 2006.
2. N.P Bali and Manish Goyal ,A Text of Engineering Mathematics,Laxmi publications,2008.
3. E.L.Ince, Ordinary differential Equations,Dover publications,1958.

Web references:

1. https://www.efunda.com/math/math_home/math.cfm
2. https://www.ocw.mit.edu/resources/#Mathematics
3. https://www.sosmath.com/
4. https://www.mathworld.wolfram.com/

E -Text Books:

1.https://www.e-booksdirectory.com/details.php?ebook=10166

MOOCS Course:

1. https://swayam.gov.in/
2. https://onlinecourses.nptel.ac.in/

Course Outcomes
At the end of the course, student will be able to:

1. Identify the different types of differential equations and solve them using appropriate methods
2. Apply the appropriate test to find the convergence and divergence of the given series
3. Solve the system of linear equations using rank of a matrix.
4. Find Rank and Nullity of given vectors.
5. Diagonalize the matrix using eigen values and eigen vectors.