

## LINEAR ALGEBRA AND CALCULUS

<b>I Semester: Common for All Branches</b>								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AHSC02	Foundation	L	T	P	C	CIA	SEE	Total
		3	1	-	4	30	70	100
<b>Contact Classes: 45</b>		<b>Tutorial Classes: 15</b>		<b>Practical Classes: Nil</b>			<b>Total Classes: 60</b>	
<b>Prerequisite: Basic principles of algebra and calculus</b>								
<p><b>I. COURSE OVERVIEW:</b>            Linear algebra is a sub-field of mathematics concerned with vectors, matrices, and linear transforms. Calculus is the branch of mathematics which majorly deals with derivatives and integrals. Linear algebra is a key foundation to the field of machine learning. Matrices are used in computer animations, color image processing. Eigenvalues are used by engineers to discover new and better designs for the future. Differential equations have wide applications in various engineering and science disciplines as the laws of physics are generally written down as differential equations. The Fourier series has many applications in electrical engineering, image processing etc. The course includes types of Matrices, Rank, methods of finding rank, eigen values and eigen vectors, maxima and minima of functions of several variables, solutions of higher order ordinary differential equations and Fourier series.</p>								
<p><b>II. COURSE OBJECTIVES:</b>  <b>The students will try to learn:</b></p> <ol style="list-style-type: none"> <li>I. The principles of Eigen value analysis and linear transformations, Matrix rank finding methods</li> <li>II. The calculus of functions of several variables and the concept of maxima-minima for a three-dimensional surface.</li> <li>III. The analytical methods for solving higher order differential equations with constant coefficients.</li> <li>IV. Fourier series expansions in standard intervals as well as arbitrary intervals.</li> </ol>								
<p><b>III. COURSE SYLLABUS:</b></p> <p><b>MODULE-I: THEORY OF MATRICES (09)</b>            Real matrices: Symmetric, skew-symmetric and orthogonal matrices; Complex matrices: Hermitian, Skew- Hermitian and unitary matrices; Elementary row and column transformations, finding rank of a matrix by reducing to Echelon form and Normal form; Finding the inverse of a matrix using Gauss-Jordan method;</p> <p><b>MODULE –II: LINEAR TRANSFORMATIONS (09)</b>            Cayley-Hamilton theorem: Statement, verification, finding inverse and powers of a matrix; Linear dependence and independence of vectors; Linear transformation; Eigen values and Eigen vectors of a matrix; Diagonalization of matrix by linear transformation.</p> <p><b>MODULE –III: FUNCTIONS OF SINGLE AND SEVERAL VARIABLES (09)</b>            Mean value theorems: Rolle’s theorem, Lagrange’s theorem, Cauchy’s theorem-without proof.</p> <p>Functions of several variables: Partial differentiation, Jacobian, functional dependence, maxima and minima of functions with two variables and three variables. Method of Lagrange multipliers.</p> <p><b>MODULE –IV: HIGHER ORDER LINEAR DIFFERENTIAL EQUATIONS (09)</b>            Linear differential equations of second and higher order with constant coefficients.            Non-homogeneous term of the type <math>f(x) = e^{ax}</math>, <math>\sin ax</math>, <math>\cos ax</math> and <math>f(x) = x^n</math>, <math>e^{ax}v(x)</math>, Method of variation of parameters.</p> <p><b>MODULE –V: FOURIER SERIES (09)</b>            Fourier expansion of periodic function in a given interval of length <math>2\pi</math>; Fourier series of even and odd functions; Fourier series in an arbitrary interval, Half- range Fourier sine and cosine expansions.</p>								

#### **IV. TEXT BOOKS**

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36<sup>th</sup> Edition, 2010.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11<sup>th</sup> Reprint 2010.

#### **V. REFERENCE BOOKS:**

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9<sup>th</sup> Edition, John Wiley & Sons, 2006.
2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
3. D. Poole, Linear Algebra: A Modern Introduction, 2<sup>nd</sup> Edition, Brooks/Cole, 2005.

#### **VI. WEB REFERENCES:**

1. [http://www.efunda.com/math/math\\_home/math.cfm](http://www.efunda.com/math/math_home/math.cfm)
2. <http://www.ocw.mit.edu/resourcs/#Mathematics>
3. <http://www.sosmath.com>
4. <http://www.mathworld.wolfram.com>

#### **VII. E-TEXT BOOKS:**

1. <http://www.e-booksdirectory.com/details.php?ebook=10166>
2. <http://www.e-booksdirectory.com/details.php?ebook=7400re>