LINEAR ALGEBRA AND ORDINARY DIFFERENTIAL EQUATIONS

I Semester: Common for all Branches

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHS002	Foundation	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

I. COURSE OVERVIEW:

The Linear algebra is a sub-field of mathematics concerned with vectors, matrices, and linear trans- forms. 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. 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. Matrices are used in computer animations, color image processing. Eigen values are used by engineers to discover new and better designs for the future. The laws of physics are generally written down as differential equations. So, differential equations have wide applications in various engineering and science disciplines. This course enables the students to gain basic knowledge on the mathematics which is used in modeling the real time engineering problems very often.

II. OBJECTIVES:

The course should enable the students to:

I	The principles of Eigen value analysis and linear transformations, Matrix rankfinding methods.
II	The analytical methods for solving higher order differential equations withconstant coefficients.
III	The calculus of functions of several variables and the concept of maxima-minima for a three-dimensional surface

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Calculate** the rank and inverse of real and complex matrices with elementary transformation methods.	Apply
CO 2	**Compute** the diagonally equivalent matrix and Clayey Hamiltonian equation of the given matrix by using Eigen values and Eigen vectors.	Apply
CO 3	**Interpret** the properties of differential equation of first order and first degree and orthogonal trajectories by using integration factor method	Understand
CO 4	**Solve** the Second and higher order linear homogeneous and non homogeneous differential equations with constant coefficients by usingsubstitution method.	Apply
CO 5	**Interpret** the extreme values for functions of several variables by using partial derivatives.	Understand
CO 6	**Apply** mean–value theorems in establishing some mathematicalinequalities	Apply

IV. SYLLABUS:

UNIT-I	THEORY OF MATRICES	Classes: 08

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; Solving of linear system of equations by LU decomposition method.

UNIT-II	LINEAR TRANSFORMATIONS	Classes: 10
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; Properties of Eigen values and Eigen vectors of real and complex matrices; Diagonalization of matrix.		
UNIT-III	**DIFFERENTIAL EQUATIONS OF FIRST ORDER AND THEIR APPLICATIONS**	**Classes: 08**
Solution of first order linear differential equations by exact, non exact, linear equations; Bernoulli equation. Applications of first order differential equations: Orthogonal trajectories; Newton's law of cooling; Law of natural growth and decay.		
UNIT-IV	**HIGHER ORDER LINEAR DIFFERENTIAL EQUATIONS AND THEIR APPLICATIONS**	**Classes: 10**
Linear differential equations of second and higher order with constant coefficients, non-homogeneous term of the type $f(x)=e^{ax}, \sin ax, \cos ax$ and $f(x)=x^n, e^{ax}v(x), x^n v(x)$; Method of variation of parameters; Applications to electrical circuits and simple harmonic motion.		
UNIT-V	**FUNCTIONS OF SINGLE AND SEVERAL VARIABLES**	**Classes: 09**
Mean value theorems: Rolle's theorem, Lagrange's theorem, Cauchy's theorem-without proof; Functions of several variables: Partial differentiation, chain rule, total derivative, Euler's theorem, functional dependence, Jacobian, maxima and minima of functions of two variables without constraints and with constraints; Method of Lagrange multipliers.		

Text Books:

1. E Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons Publishers, 9th Edition, 2014.
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 42nd Edition, 2013.

Reference Books:

1. RK Jain, S R K Iyengar, "Advanced Engineering Mathematics", Narosa Publishers, 5th Edition, 2016.
2. Ravish R Singh, Mukul Bhatt, "Engineering Mathematics-1", Tata Mc Graw Hill Education, 1st Edition, 2009.
3. Srimanthapal, Suboth C. Bhunia, "Engineering Mathematics", Oxford Publishers, 3rd Edition, 2015.

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
2. https://www.e-booksdirectory.com/details.php?ebook=7400re

Course Home Page: