COURSE CONTENT

ORDINARY DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS								
II Semester: CE/CSD/CSE/CSM/ECE/EEE/ME								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
2520002	**Basic sciences**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
ContactClasses:48	**Tutorial Classes:Nil**	**Practical Classes:Nil**				**TotalClasses:48**		
Prerequisites: Mathematics courses of 10+2 year of study.								

Course Overview:

This course is a foundation for all engineering branches. This course serves as a foundation course on differential equations and vector calculus. It includes techniques for solving ordinary differential equations, Laplace Transform, vector differentiation and vector integration. It is designed to extract the mathematical developments, skills, from basic concepts to advance level of engineering problems to meet the technological challenges.

Course Objectives:

1. Methods of solving the differential equations of first order and first degree.
2. Concept of higher order liner differential equations.
3. Concept, properties of Laplace transforms, solving ordinary differential equations by using Laplace transforms techniques.
4. The physical quantities involved in engineering field related to vector valued functions.
5. The basic properties of vector valued functions and their applications to line, surface and volume integrals.

Course Outcomes: After Completion of the Course, Students should be able to

1. Utilize the methods of differential equations for solving Newton's law of cooling and Law of Natural growth and decay.
2. Understand the solutions of linear differential equations with constant coefficients.
3. Explain the concept of the Laplace transforms and its significance in solving differential equations and evaluating integrals.
4. Interpret the vector differential operators and their relationships for solving engineering problems.
5. Apply the integral transformations to line, surface and volume of different geometrical models.

UNIT-I: First Order ODE

Exact differential equations, equations reducible to exact differential equations, linear and Bernoulli's equations, Orthogonal Trajectories (only in Cartesian Coordinates). Applications:

Newton's law of cooling, Law of natural growth and decay.

UNIT-II: Ordinary Differential Equations of Higher Order

Second order linear differential equations with constant coefficients: Non-Homogeneous terms of the type e^{ax}, sin ax, cos ax, polynomials in x, e^{ax} V(x) and x V(x), method of variation of parameters, Equations reducible to linear ODE with constant coefficients: Cauchy-Euler equation, Legendre's equation.

UNIT-III: Laplace transforms

Laplace Transforms: Laplace Transform of standard functions, First shifting theorem, Second shifting theorem, Unit step function, Dirac delta function, Laplace transforms of functions when they are multiplied and divided by 't', Laplace transforms of derivatives and integrals of function (All without proof), Evaluation of integrals by Laplace transforms, Laplace transform of periodic functions, Inverse Laplace transform by different methods, convolution theorem (without proof). Applications: solving Initial value problems by Laplace Transform method.

UNIT-IV: Vector Differentiation

Vector point functions and scalar point functions, Gradient, Divergence and Curl, Directional derivatives, Vector Identities, Scalar potential functions, Solenoidal and Irrotational vectors.

UNIT-V: Vector Integration

Line, Surface and Volume Integrals, Theorems of Green's, Gauss and Stokes's (without proof) and their applications.

TEXTBOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5thEditon, 2016.

REFERENCEBOOKS:

1. Erwin kreyszig, Advanced Engineering Mathematics, 9thEdition, John Wiley & Sons, 2006.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
4. H. K. Dassand Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

ELECTRONIC RESOURCES:

1. https://www.youtube.com/watch?v=wtUk7CqbAt4
2. https://www.youtube.com/watch?v=OZ0JM9RAa00
3. https://www.youtube.com/watch?v=vTUPQq2mdbY
4. https://www.youtube.com/watch?v=oVLhKP_JfnE&t=2s
5. https://www.youtube.com/watch?v=fOdM9HKRtbs&t=122s

MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Definitionsandterminology
4. Assignments
5. Modelquestionpaper–I
6. Modelquestionpaper–II
7. Lecturenotes
8. E-LearningReadinessVideos(ELRV)