

MATH-108 Differential Equations

Course Name: **Differential Equations**

Credit Hours: 3-0

Contact Hours: 3-0

Pre-requisites: Calculus-1

Course Introduction:

In this course first order and higher order differential equations are included so that the students feel comfortable in making mathematical models of physical systems. Laplace Transform and its applications to solve Ordinary Differential equations are included to give them an additional tool to apply in their engineering studies like circuit analysis etc. Fourier series are included to make them capable of tackling periodic signals etc. The course introduces partial differential equations with main focus on solutions of the Wave, heat and Laplace equations using separation of variables.

CLO No	Course Learning Outcomes	Bloom Taxonomy
CLO-1	Classify and find solutions of first order ordinary differential equations.	C2 (Understand)
CLO-2	Solve the second and higher order ordinary differential equations.	C3 (Apply)
CLO-3	Apply analytical techniques to solve partial differential equations arising in engineering and sciences	C3 (Apply)

Course Plan:

Sr. No	Main Topics to be covered	Estimated Contact Hours
1	<u>First Order Ordinary Differential Equations.</u> Basic concept and Modeling. Separable Equations.	4
2	Exact ODEs. Linear ODEs. Bernoulli Equation. Orthogonal	6

	Trajectories	
3	<u>Second Order Linear ODEs</u> Linear ODEs of Second and Higher Order with constant coefficient using Differential Operators.	4
4	Method of Undetermined Coefficients, Cauchy Euler Equations, Method of Variation of Parameters, applications.	5
5	Introduction of Laplace Transform, Laplace Transform of elementary functions. First shifting theorem & its application Laplace Transform of derivatives Laplace Transform of Integral, Inverse Transforms	4
6	Solution of differential Equations by Laplace Transform. Unit step function, second shifting Theorem, Dirac delta function, initial & final Value Theorem, Laplace Transform of Periodic functions, Convolution, System of differential Equations.	6
7	Systems of Differential Equations. Series Solutions of Differential Equations.	5
8	Partial differential equations solvable as ODEs (separation of variables)	3
9	Solution by the Method of Separation of Variables using Fourier Series.	4
10	Wave equation, Heat Equation; their Solution by Fourier Series.	4
11	Laplace Equation in Cartesian	2

Reference Materials:

- Advanced Engineering Mathematics, 10th edition, Erwin, K. 2011, John Wiley & Sons Inc.
- A First Course in Differential Equation Zill. Prindle. Weber. Schmidt.1996. Brooks/Cole Publishing.
- Differential Equations with Boundary-Value Problems, Dennis. G. Zill, Michael, R. Cullen. 1996, Brooks/Cole Publishing,
- Elementary Differential Equations with Applications C. H. Edwards. David, E. 1993. Penney, Prentice Hall.