UNIVERSITY OF CALGARY

FACULTY OF SCIENCE
Department of Mathematics and Statistics

Mathematics 375 Differential Equations For Engineers and Scientists

Calendar Description: H(3-1.5T)

Definition, existence and uniqueness of solutions; first order and higher order equations and applications; Homogeneous systems; Laplace transform; partial differential equations of mathematical physics.

Prerequisite(s): Applied Mathematics 219 or Mathematics 277; or both Mathematics 267 and 177; or both Mathematics 253 and 114.

Antirequisite(s): Credit for more than one of Mathematics 375 or Applied Mathematics 307 or 311 will not be allowed.

Syllabus

Topics	**Number of Hours**
First order differential equations	7
Higher order differential equations	7
Laplace transform	9
System of first order equations	6
Boundary value problems of mathematical physics	8
TOTAL HOURS	**37**

See accompanying page for a detailed breakdown of instructional hours and course outcomes.

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MATH 375 Differential Equations for Engineers and Scientists

1. First Order Differential Equations :

Linear Equations; Method of integrating Factors.	1 Hour
Separable Equations.	1 Hour
Modeling with First Order Equations.	3 Hours
Exact Equations and Integrating Factors.	2 Hours

2. The nth Order Linear Equations:

Homogeneous Equations with Constant Coefficients.	2 Hours
Nonhomogeneous Equations; Undetermined Coefficients / Variation of parameters	2.5 Hours
Generalization to differential Equations of order n	2.5 Hours

3.The Laplace Transform :

Definition of the Laplace Transform , properties	3 Hours
Solution of Initial Value Problems.	2 Hours
Differential Equations with Discontinuous Forcing Functions.	2 Hours
Applications	2 Hours

4. Systems of First Order Linear Equations :

Basic|Theory of systems of first order linear equations	1.5 Hours
Review of systems of linear equation , eigenvalues and eigenvectors	1.5 Hours
Homogeneous linear systems with constant coefficients (only distinct eigenvalues case)	2 Hours
Applications	1 Hour

5. Boundary value problems of Mathematical Physics:

Introduction to Diffusion, wave, and Laplace equation. Boundary and initial conditions	1 Hour
Fourier Series	2 Hours
The method of separation of variables	1 Hour
Solution to the one dimensional Heat equation	1 Hour
Solution to the one dimensional wave equation	1.5 Hours
Solution to the two dimensional Laplace equation	1.5 Hours
	Total: 37 Hours

MATH 375 course outcomes

Upon successfully completing the course, students should be able to

1. classify ordinary and partial differential equations, check whether a given function is a solution of a given equation or a given initial value problem, distinguish between general and particular solutions;
2. solve certain types of first order ordinary differential equations (linear, separable, Bernoulli and exact equations), develop and solve equations arising in various field of science and engineering;
3. apply the general theory of second and higher order linear ordinary differential equations to write the characteristic equation for equations with constant coefficients and Cauchy-Euler equations, construct the general solution, solve non-homogeneous equations using methods of undetermined coefficients or variation of parameters;
4. compute and utilize eigenvalues and eigenvectors to solve a system of linear homogeneous first order differential equations with constant coefficients;
5. construct Fourier, sine and cosine series for a given piecewise continuous function on an open interval and identify their limit function, find eigenvalues and eigenfunctions of Sturm-Liouville problems, set up and solve boundary value problems for the three second order linear partial second order differential (the heat, wave and potential) equations using the method of separation of variables;
6. use direct and inverse Laplace Transform to solve initial value problems for linear ordinary differential equations with constant coefficients, including equations with a discontinuous non-homogeneous term.