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SAMPLE SYLLABUS
This document is published as an indication of what is typically taught in this course. Instructors have the responsibility of deciding on topics to be omitted, additional topics to be included and the emphasis, ordering and pacing of presentation.

Course Number: **MTH 306**

Course Title: **Introduction to Differential Equations**

Credit Hours: **4.0**

Textbook: **C. Edwards, D. Penney, D. Calvis, *Differential Equations, Computing and Modeling*, 3nd custom UB edition**.

3nd custom UB edition consists of chapters 1-8 of the 5th standard edition of the book *Differential Equations and Boundary Value Problems: Computing and Modeling* by the same authors.

Prerequisites: MTH 141-142

Notes: MTH 241 is not a prerequisite for this course: it cannot be assumed that all students have knowledge of multivariable calculus. This course is approved for satisfying the "Computer Applications" requirement in the Math Major. It is therefore expected that students receive substantial exposure to computing.

This schedule is written for 13 weeks of instruction. In a typical semester there are 14 teaching weeks, thus some flexibility is built in.

Week	Sections	Topics
1	1.1 - 1.3	General introduction to DE. General and particular solutions for 1st order DEs. Slope fields.
2	1.4 - 1.6	Solution techniques: separable DEs, exact DEs, integrating factor, substitution methods.
3	2.2 - 2.4	Mathematical Modeling. Stability. Acceleration-velocity models. Euler's method.
4	3.1 - 3.3	**Midterm Exam I** Introduction to 2nd order linear equations. General solution and homogeneous linear DEs.
5	3.4, 3.5	Mechanical vibrations. Non-homogeneous DEs and undetermined coefficients.
6	3.6, 4.1, 4.2	Forced oscillations and resonance. First-order systems. Method of elimination.
7	5.1	Matrices and Linear systems.
8	5.2, 5.5	The eigenvalue method for homogeneous systems. Multiple eigenvalues.
9	6.1, 6.2	**Midterm Exam II** Nonlinear systems. Stability and the phase plane. Critical points. Almost linear systems.
10	6.3 or 6.4. 8.1, 8.2	Applications of nonlinear system. Power series, Taylor series, Radius of convergence. Series solutions near ordinary points.
11	8.3, 7.1, 7.2	Series for singular points. Laplace transform. Inverse Laplace transform. Laplace transform for initial value problems.
12	7.3, 7.4	Properties of Laplace transform: translation, derivatives, integrals, products.
13	7.5, 7.6	Periodic and piecewise continuous functions. Impulse functions. **Final Exam Review**

Student Learning Outcomes for
MTH 306 Introduction to Differential Equations

Assessment measures: weekly homework assignments, 2 midterm exams, final exam.

At the end of this course a student will be able to:	Assessment
– understand the concept of existence and uniqueness of solutions of a DE – understand the concept of a general solution, a particular solution and initial conditions – draw slope fields by hand and also by computer using Maple, Matlab, or Mathematica	HW# 1 Midterm I Final Exam
– solve 1st order DEs (both nonlinear and linear) using various techniques: integrating factor, separable DE, substitution method, exact DE	HW# 2 Midterm I Final Exam
– understand the equilibrium solutions – draw the phase diagram – perform the stability analysis: identify stable points, unstable points, saddle points, and bifurcation points	HW# 3 Midterm I Final Exam
– solve 2nd order constant coefficient homogenous DEs – understand the concept of linear independence and determine if functions are linearly independent using Wronskian. – understand that linear combinations of two linearly independent solutions give the general solution	HW# 4 Midterm I Final Exam
– solve non-homogeneous 2nd order DEs – use the method of undetermined coefficients to find the particular solution	HW# 5 Midterm II Final Exam
– understand the "resonance" and "beat" phenomena – understand what the system of equations is – solve DEs using the method of elimination (convert two DEs into one and vice versa).	HW# 6 Midterm II Final Exam
– understand the basic notions of linear algebra such as vector, matrix, determinant, and eigenvalue	HW# 7 Midterm II Final Exam
– rewrite the system of DEs in the matrix form – compute eigenvectors and eigenvalues for the derived matrix – solve the system equation using the eigenvalues in three different cases: real distinct roots, repeated roots, and complex roots	HW# 8 Midterm II Final Exam
– sketch the direction fields and indicate stability on the phase plane – perform the stability analysis of a linear system using eigenvalues – draw slope fields and solution curves using a computer.	HW# 9 Final Exam
– predict behavior of solutions of some nonlinear system using analysis of eigenvalues – set up a power series and the Taylor series of a function – compute the radius of convergence of a power series	HW# 10 Final Exam

The table below indicates to what extent this course reflects each of the learning objectives of the undergraduate mathematics program. A description of learning objectives is available online at http://www.math.buffalo.edu/undergraduate/undergrad_programs.shtml.

Computational Skills:	Analytical Skills:	Practical Problem Solving:	Research Skills:	Communication Skills:
extensively	little or not at all	extensively	little or not at all	moderately