

COURSE SYLLABUS

YEAR COURSE OFFERED: 2018

SEMESTER COURSE OFFERED: Spring

DEPARTMENT: Mathematics

COURSE NUMBER: 3331

NAME OF COURSE: Differential Equations

NAME OF INSTRUCTOR: David H. Wagner

The information contained in this class syllabus is subject to change without notice. Students are expected to be aware of any additional course policies presented by the instructor during the course.

Learning Objectives

Students will be expected to learn:

1. What a differential equation is, and what a solution is.
2. Methods for solving first order differential equations.
3. Conditions for existence and uniqueness of solutions.
4. The concepts of stability and instability.
5. Various models for applications in population growth, radioactive decay, personal finance, electrical circuits, and other areas.

Major Assignments/Exams

I expect to give two exams in lecture and a final exam. Homework will be collected weekly, and will be graded.

Required Reading

“*Differential Equations*, Second Edition,” by J. Polking, A. Boggess and D. Arnold. Prentice Hall, 2006.

Recommended Reading

List of discussion/lecture topics

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Optional sections are indicated by a *.

Exams can be given at the end of Chapters 3, 6 and 9.

Section	Title	
Chapter 2	First-Order Equations	(9 lecture hours)
1.1	Differential Equation Models	
2.1	Differential Equations and Solutions (see p. 23: explain dfield, odesolver)	
2.2	Solutions to Separable Equations	
2.3	Models of Motion	
2.4	Linear Equations	
2.5	Mixing Problems	
2.7	Existence and Uniqueness of Solutions	
2.8	Dependence of Solutions on Initial Conditions	
2.9	Autonomous Equations and Stability	
Chapter 3	Modeling and Applications	(1 lecture hour)
3.1	Modeling Population Growth	
*3.2	Models and the Real World	---
*3.3	Personal Finance	
Chapter 4	Second-Order Equations	(7 lecture hours)
4.1	Definitions and Examples	
4.2	Second-Order Equations and Systems (see pplane, Ch. 7 of ODEuM)	
4.3	Linear, Homogeneous Equations with Constant Coefficients	
4.4	Harmonic Motion	
4.5	Inhomogeneous Equations; the Method of Undetermined Coefficients	
4.6	Variation of Parameters	
4.7	Forced Harmonic Motion	
Chapter 5	The Laplace Transform	(4 lecture hours)
5.1	The Definition of the Laplace Transform	
5.2	Basic Properties of the Laplace Transform	
5.3	The Inverse Laplace Transform	
5.4	Using the Laplace Transform to Solve Differential Equations	
*5.5	Discontinuous Forcing Terms	
Chapter 6	Numerical Methods	(2 lecture hours)
6.1	Euler's Method	
6.2	Runge-Kutta Methods	
6.3	Numerical Error Comparisons	
Chapter 7	Matrix Algebra (review, no lectures)	
7.3	Solving Systems of Equations	
7.5	Bases of a Subspace	
7.6	Square Matrices	
7.7	Determinants	

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Chapter 8	An Introduction to Systems	(5 lecture hours)
8.1	Definitions and Examples	
8.2	Geometric Interpretation of Solutions	
8.3	Qualitative Analysis	
8.4	Linear Systems	
8.5	Properties of Linear Systems	
Chapter 9	Linear Systems with Constant Coefficients	(8 lecture hours)
9.1	Overview of the Technique	
9.2	Planar Systems	
9.3	Phase Plane Portraits	
*9.4	The Trace-Determinant Plane	
9.5	Higher-Dimensional Systems	
9.6	The Exponential of a Matrix	
9.7	Qualitative Analysis of Linear Systems	
9.8	Higher-Order Linear Equations	
9.9	Inhomogeneous Linear Systems	
Chapter 10	Nonlinear Systems	
*10.1	The Linearization of a Nonlinear System	
*10.2	Long-Term Behavior of Solutions	
*10.3	Invariant Sets and the Use of Nullclines	
*10.4	Long-Term Behavior of Solutions to Planar Systems	

Counseling and Psychological Services

Counseling and Psychological Services (CAPS) can help students who are having difficulties managing stress, adjusting to college, or feeling sad and hopeless. You can reach CAPS (www.uh.edu/caps) by calling 713-743-5454 during and after business hours for routine appointments or if you or someone you know is in crisis. No appointment is necessary for the “Let's Talk” program, a drop-in consultation service at convenient locations and hours around campus. http://www.uh.edu/caps/outreach/lets_talk.html

Course Policies

- Late homework will not be accepted without a valid excuse. Valid excuses include documented serious illness/accident, or documented death in the student's immediate family.
- There will be no make-up exams given for the hour exams. Instead, if a student misses an hour exam, the normalized score for the final exam will replace the normalized score for the missed exam.
- Requests for grading correction must be submitted within two weeks after an exam or quiz has been returned to the class.