Master Syllabus
Math 256: Intro to ODE
2022-2023

Course coordinator: Bijan Shahir, 333D Tykeson Hall, 541-346-8403.

Standard Course Description: Introduction to differential equations and applications. Linear algebra is introduced as needed. Prerequisites: MATH 253 or equivalent. A good understanding of differentiation and integration is assumed.

Textbook: The official textbook is Elementary Differential Equations, 11th edition, by William E. Boyce, Richard C. DiPrima. The subject of ODE has been around for centuries, nonetheless, this particular book has 11 editions and even the 10th newest version is expensive. (If students choose to use an older version, this should be fine, provided that they have access to the end of sections problems which will be selected for doing problems in class and using them for exams from the current version). Students can use the open access textbook https://www.jirka.org/diffyqs/. This is OK, but doesn't include discussion of the Wronskian. You can make mention this textbook to the students as a close resource.

Course Goals: An ordinary differential equation (ODE) is an equation of an unknown function with its derivatives. The primary goal of this course is to develop techniques to find exact solutions for specific ordinary differential equations. Differential equations can be used to model physical systems. ODE can be expressed as a linear (nonlinear), first order (higher orders) and with constant (variable) coefficients. We cover parts of Chapters 1, 2, 3, 4, and 7. If time permits, some parts of Chapter 6.

Prerequisites: C- in Math 253 or equivalent calculus coursework (as determined by instructor.)

Other Resources: There are tutoring and ad-hoc study groups available in the Math Library Reading Room (Fenton Hall) and also the Teaching and Learning Center (4th floor, Knight Library). For students interested in extra practice problems, there are plenty of problems in the textbook (this may seem obvious but it needs to be said explicitly.)

Learning Outcomes: The goal of this course is to teach students to work with ordinary differential equations. Students should learn all of the following:

- How to recognize them.
- How to explicitly solve simple ODEs:
  i) Basic Integrable,
  ii) 1st Order Separable,
  iii) 1st Order Linear,
  iv) 2nd Order Linear Homogeneous (with Constant Coefficients or Euler Form),
  v) 2nd Order Linear Nonhomogeneous,
  vi) Higher Order Linear Homogeneous (with Constant Coefficients or Euler Form),
  vii) 1st Order Linear Systems
- Identify when ODEs can or cannot be solved uniquely
- Linear algebra sufficient to solve linear systems of first order ODEs
- How to analyze the stability and long-time behavior of solutions of general 1st order ODEs.
- How to use ODEs for modeling and predicting the behavior of physical, biological and other systems.
- (If time permits) How to use Laplace Transform to solve ODEs.

Grading: There will be weekly assignments, two midterm exams (recommended) and a final exam. A sample breakdown is as follows.

A 5x7 inch index card with formulae on it will be allowed in exams.
No late WeBWorK assignments will be accepted.
For extreme circumstances, exceptions will be made ONLY for midterm and final exams.

WeBWorK assignments 25%
Two Midterm Exams 2 * 25%
Final Exam 25%.
Homework:  WeBWorK assignments are mandatory for this course. If there is a grader, traditional homework can be assigned on Canvas. We can use some WeBWorK problems from the open source textbook (Differential Equations for Engineers: https://github.com/jirilebl/diffyqs-webwork). There’s a specific, efficient and not necessarily intuitive process for loading in WeBWorK problems and creating assignments. I will be happy to explain to anyone who is interested in creating new assignments.

Students are encouraged to work with each other on the homework outside of class, however, each should do their own WeBWorK assignment (WeBWorK problems have been written algorithmically). Any technology useful to gain intuition or check work is not discouraged.

My general rule for fair-game material for exams is to pick problems from the textbook or some WeBWorK assignments with some alterations.

Use your judgment if group work makes sense.

Final Exam: The final exam is cumulative and scheduled by the Registrar. Faculty legislation prohibits final exams from being administered early.

Academic dishonesty: Any type of academic dishonesty will not be tolerated. In the event of academic dishonesty, the offense will be reported to the Office of Student Conduct and Community Standards and the student will be sanctioned up to receiving a failing grade in the course. Two students sitting near each other on an exam having significantly similar answers to each other will be considered evidence of dishonesty and will be reported.

Special Accommodations:
If you are currently registered with AEC (Accessible Education Center), for a documented disability, please present your paperwork to me as close to the beginning of the term as possible so that we can design a plan for you. If you have a disability but are not registered with AEC, you should contact them as soon as possible (http://aec.uoregon.edu). It is much more likely that measures can be taken to provide adequate special accommodation if the organization is done through AEC.

Sections should be covered:

Chapter 1: 1.2 and 1.3
Chapter 2: 2.1 through 2.4 and 2.6
Chapter 3: 3.1 through 3.6
Chapter 4: 4.1 through 4.3
Chapter 7: 7.1 through 7.9
Chapter 6: (if time permits) 6.1 through 6.6

Sample Schedule:

Week 1: First ½ week on Chapter 1 and the rest of the week on Chapter 2.
Week 2: Chapter 2.
Week 3: First ½ week on Chapter 2 and the rest of the week on Chapter 3.
Week 4: Chapter 3 and 1st midterm exam.
Week 5: Chapter 3.
Week 6: Chapter 3.
Week 7: Chapter 4, 2nd midterm exam.
Week 8: Chapter 7,
Week 9: Chapter 7.
Week 10 Chapter 7, Chapter 6(?) and Review.

The final exam obviously has to be a little bit heavier on the Chapter 7 material. Thanksgiving throws a special wrench in the last two weeks.