APPLIED DIFFERENTIAL EQUATIONS - MTH 256H (4 credits)

Winter 2019

CRN: 36476 and 37162

- Class meetings: MWF 2-2:50 and W 3-3:50 in Waldo Hall 132
- Instructor: Filix Maisch
- E-mail: maischf@math.oregonstate.edu
- Office and Office Hours: Kidder 368C, MW 4-4:50pm and F 3-3:50pm (Fri. in MSLC – Kidder 108H)

Prerequisites: Math 254 (or 254H) with a C- or better.

Textbooks: Elem. Differential Equations w/ Boundary Value Problems, *Trench* (See link on webpage and Canvas.)

Student Conduct Code: Students are expected to be familiar with Oregon State University's Expectations for Student Conduct. Please review these at the following web link:

http://studentlife.oregonstate.edu/code

Catalog Course Description: We cover first order linear and nonlinear equations, as well as second order linear equations, with a little bit on higher order equations mixed in throughout. Applications include mixing problems, motion with resistance, springs, as well as others appropriate for science and engineering. We end with an introduction to the Laplace transform.

Course Content: Basic terms and definitions, linear first order equations, separable equations, existence and uniqueness of solutions, Bernoulli equations and transformations, exact equations, autonomous equations and asymptotic stability, applications of first order equations, linear second order (and higher) equations, the Wronskian, constant coefficient equations, non-homogeneous equations, method of undetermined coefficients, reduction of order, Euler equations, variation of parameters, applications of second order equations, the Laplace transform, inverse Laplace transforms, IVP solutions, piecewise continuous forcing functions, impulses, convolution, integral equations, numerical methods.

Course Specific Learning Outcomes: A successful student in Math 251 will be able to:

1. Identify and solve first order differential equations that are separable, exact, homogeneous, or linear or can be reduced to such equations by a simple change of variable.
2. Construct and analyze models for physical systems (such as for mixing, cooling, radioactive decay) that can be described by first order linear or nonlinear differential equations.
3. Describe the basic structure of the solution space for linear differential equations (principally of second order) and be able to use this structure to solve such equations.
4. Construct and analyze models for physical systems that can be described by second order linear differential equations.
5. Use Laplace transforms to solve initial value problems.

Grading: Your grade is determined by a syllabus quiz, online homework, recitation group work activities, two evening midterms, and a final. There may also be extra credit based on participation in lecture (see below).

The course will be graded as follows

- Syllabus Quiz 2%
- Homework 15%
- Recitation Activities (8 in total) and the "Integration Skills Check": 18%
- Midterm 30%
- Final 35%

Your grade in the course ***will not be harder than***:
A-/A 90% - 100%, B-/B/B+ 80% - 89.9%, C-/C/C+ 70% - 79.9%, D-/D/D+ 60%-69.9%, F 0%-59.9%.

Syllabus Quiz: A short (canvas) quiz testing your knowledge of *this syllabus* will be available during weeks 1 and 2. It's due on Sunday, Jan. 20th. *It is a quiz* in the sense that you get 1 attempt per problem to get it right (just like as if you turned it in on paper).

Exams: There will be one midterm and a cumulative final exam. Calculators are **NOT** allowed on exams. The final does **NOT** replace the midterm. You are allowed both sides of one 3 inch by 5 inch inch handwritten page on the midterm. The size increases to 4 inch by 6 inch for the final. Tests are not allowed to be made-up unless the circumstances are truly exceptional and contact requesting the accommodation is made PRIOR to the test. Contact your instructor to request an accommodation. ***We will use Gradescope to grade exams***. There will be an access link through Canvas (and an email sent out to encourage you to sign up). Through this online platform you will be able to see your graded exam and be able to request a regrade on any of the problems.

- Midterm: Wednesday, Feb. 13th, 2:30-3:50 PM (in Waldo 132)
- Final Exam: Friday, March 22nd, 7:30-9:20 AM (in Waldo 132)

Group Work Activities: Most weeks, on Wednesdays, you will be asked to work on a group-work activity, due at the start of the following week's Wednesday meeting. See the term calendar. The activities are only to be released during class. Every group member individually is required to submit an activity. Each activity will be graded as follows: 50% for completion and 50% for correctness on a **randomly chosen subset** of the problems. Late activities accepted up to two days late (by 5PM) for half-credit.

Integration Skills Check: A 10-question integration skills quiz will be given in week 1's Wednesday meeting and you just get whatever proportion of the credit that corresponds to your score (no partial credit given). You will be given 40 minutes to complete it. No calculators nor notes are allowed. While not a major component of your grade (2%) it is a good way to check your integration abilities. If you do poorly on this quiz, it is imperative that your review the appropriate integration techniques. *You will **not** be given an opportunity to take it again.*

Homework: Homework is online (WeBWorK) and can be accessed through the webpage and Canvas. Your username is the same as for your onid account. So if your OSU e-mail address is smitha@oregonstate.edu then your username is smitha. Your password is your OSU student ID number (no dashes). E-mail me ASAP if it doesn't work. Due dates below have a 48 hour grace period, and if you run into any issues (questions, server crashes, etc.) working on the problems during the grace period, no accommodation will be made as you are already *TECHNICALLY DOING THE HOMEWORK LATE.* Homework CANNOT be completed after the grace period ends, no exceptions. You should attempt Homework 4 before the first midterm and Homework 6 before the second midterm.

Homework1 - 1/18/2019 Homework2 - 1/25/2019 Homework3 - 2/1/2019 Homework4 - 2/8/2019
Homework5 - 2/22/2019 Homework6 - 3/1/2019 Homework7 - 3/15/2019

Each assignment is equally weighted. Getting 80% or better on each is enough for full credit. Below that you start to lose credit prorated to 80%. You should be able to easily get all this credit!

Extra Credit – Lecture Participation: There may be up to a maximum of 5% of extra credit available in lecture. This will consist of up to 5 pop-discussion quizzes (where you can discuss the problems with your fellow students) given during some of the lectures (unannounced).

Students With Disabilities: Accommodations for students with disabilities are determined and approved by Disability Access Services (DAS). If you, as a student, believe you are eligible for accommodations but have not obtained approval please contact DAS immediately at 541-737-4098 or at http://ds.oregonstate.edu. DAS notifies students and faculty members of approved academic accommodations and coordinates implementation of those accommodations. While not required, students and faculty members are encouraged to discuss details of the implementation of individual accommodations.

MSLC: The Math and Statistics Learning Center (MSLC) is in Kidder 108H. You can go there for free drop-in tutoring. It is open STARTING week 2 going through Dead Week. The hours are MTWTh 9-5, Fri 9-4, and Sunday through Thursday evenings 7-10.

Course (Tentative) Calendar:

Week	Monday	Wednesday first hour	Wednesday second hour	Friday
1	Basic Concepts	Integration Skills Check	Linear First Order Eq'ns	Separable Eq'ns
2	Existence and Uniqueness	Activity 1	Transformations	Exact Eq'ns
3	MLK JR DAY (**no class**)	Act. 2 (1 due)	Autonomous Eq'ns	Applications
4	Applications	Act. 3 (2 due)	Linear Second Order Eq'ns	The Wronskian
5	Non-homogeneous Eq'ns	Act. 4 (3 due)	Undetermined Coeff.	Undetermined Coeff.
6	Review	Review (Act. 4 due)	MIDTERM (12:30-1:50)	Reduction of Order
7	Euler Eq'ns	Act. 5	Variation of Parameters	Applications
8	Applications	Act. 6 (5 due)	Laplace Transformations	Inverse Laplace
9	IVP Solutions	Act. 7 (6 due)	Piecewise Cont. Forcing	Impulses (Dirac Delta)
10	Convolution	Act. 8 (7 due)	Numerical Methods	Final Review

Notes: Syllabus Quiz due Sun. 1/20/2019. The final is Friday, March 22nd, at 7:30 AM (in Waldo 132). Activity 8 is due at the final.