MTH 256H: Applied Differential Equations (4 credits)
Section 001 - CRN 32181

Winter 2020

Instructor: Dr. Filix Maisch, maischf@math.oregonstate.edu

Instructor Office Hours: Kidder 368C, MWF 9:30-10:20am (Wed. hrs in MSLC – KIDD 108H)

*** Please take advantage of my office hours to get help!! I am here for you. ***

Class Meetings: MW 12-1:50 PM in LINC 343

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

Textbook: Elem. Differential Equations with Boundary Value Problems, Trench (Free! – Link on webpage)

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 256 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, group work activities, unannounced lecture discussion quizzes, an integration skills check, a midterm and a final.

The course will be graded as follows

- Syllabus quiz  2%
- Integration skills check 2%
- Online homework  10%
- Group work activities  16%
- Unannounced lecture discussion quizzes  10%
- Midterm  25%
- Final  35%

Your grade in the course will not be harder than:
A-/A 90% - 100%, B-/B/B+ 80% - 89.99%, C/C+ 70% - 79.99%, D 60%-69.99%, F 0%-59.99%.

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. 19th. 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 nor notes are NOT allowed on these exams. The final does NOT replace the midterm. Tests are not allowed to be made-up on an alternate date unless the circumstances are truly exceptional and contact requesting the accommodation is made PRIOR to the test. Gradescope will be used to grade exams. There will be an access link through Canvas (and an email sent out after the midterm for you to review your performance). Through this online platform you will be able to see your graded midterm exam and be able to request a regrade on any of the problems. In order to review your final performance, please make an appointment with me at the start of the next term.

- Midterm: Wed. Feb. 12th, 12:30-1:50 PM, LINC 343
- Final Exam: Wed. March 18th, 12:00-1:50 PM, LINC 343 (unless otherwise announced)
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 30 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 you review the appropriate integration techniques. You will **not** be given an opportunity to take it again.

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 and sometimes focus on material only introduced and covered through the activity. 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 are **NOT** accepted. If you cannot make it to class, please scan and email me your activity as a single PDF file before class.

Online Homework: Online homework is through WeBWorK and can be accessed through the webpage (linked through 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 **DOING THE HOMEWORK LATE**. Homework CANNOT be completed after the grace period ends, no exceptions.

- Homework1 - 1/17/2020
- Homework2 - 1/24/2020
- Homework3 - 1/31/2020
- Homework4 - 2/7/2020
- Homework5 - 2/21/2020
- Homework6 - 2/28/2020
- Homework7 - 3/13/2020

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!

Lecture Discussion Quizzes: Given (unannounced) during many of the lectures are questions to be answered through a Canvas quiz, which will open and close during lecture. During the window of time the quiz is open you are given unlimited chances to answer. You are encouraged to work with your fellow classmates, ask me for help and to share your work/answers. No make-ups are allowed unless you can prove you missed class due to an OSU-based obligation. The lowest 4 of these will be dropped.

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

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. The hours are MTWTh 9-5, Fri 9-4, and Sunday through Thursday evenings 7-10.
**Reach Out for Success:** University students encounter setbacks from time to time. If you encounter difficulties and need assistance, it is important to reach out. Consider discussing the situation with an instructor or academic advisor. Learn about resources that assist with wellness and academic success at oregonstate.edu/ReachOut. If you are in immediate crisis, please contact the Crisis Text Line by texting OREGON to 741-741 or call the National Suicide Prevention Lifeline at 1-800-273-TALK (8255).

**Inclusion Statement:** It is my intent that students from all diverse backgrounds and perspectives be well-served by this course, that students’ learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful of diversity: gender identity, sexual orientation, disability, age, socioeconomic status, ethnicity, race, religion, culture, perspective, and other background characteristics. Your suggestions about how to improve the value of diversity in this course are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups.

**Student Evaluation of Courses:** The online Student Evaluation of Teaching system opens to students the Monday of dead week and closes the following Sunday. Students will receive notification, instructions and the link through their ONID. They may also log into the system via Online Services. Course evaluation results are extremely important and used to help improve courses and the learning experience of future students. Responses are anonymous (unless a student chooses to sign their comments agreeing to relinquish anonymity) and unavailable to instructors until after grades have been posted. The results of scaled questions and signed comments go to both the instructor and their unit head/supervisor. Anonymous (unsigned) comments go to the instructor only.

**Course (Tentative) Calendar:**

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<thead>
<tr>
<th>Week</th>
<th>Mon.</th>
<th>Wed.</th>
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<tbody>
<tr>
<td>1</td>
<td>Basic Concepts &amp; Linear 1st order</td>
<td>Integration Skills Check &amp; Act. 1</td>
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<tr>
<td>2</td>
<td>Separable &amp; Existence/Uniqueness</td>
<td>Transformations &amp; Act. 2 (1 due)</td>
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<tr>
<td>3</td>
<td>MLK JR DAY (<strong>no class</strong>)</td>
<td>Exact and Autonomous Eq’ns &amp; Act. 3 (2 due)</td>
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<tr>
<td>4</td>
<td>Applications</td>
<td>Linear Second Order &amp; Act. 4 (3 due)</td>
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<td>5</td>
<td>Wronskian &amp; Non-homogeneous Eq’ns</td>
<td>Undetermined Coefficients &amp; Act. 5 (4 due)</td>
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<td>6</td>
<td>Undetermined Coefficients &amp; Review</td>
<td>Midterm Exam, 12:30-1:50 (Act. 5 due)</td>
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<td>7</td>
<td>Reduction of Order &amp; Euler Equations</td>
<td>Variation of Parameters &amp; Act. 6</td>
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<tr>
<td>8</td>
<td>Applications</td>
<td>Laplace transform &amp; Act. 7 (6 due)</td>
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<td>9</td>
<td>Inverse Laplace transform &amp; IVPs</td>
<td>Piecewise Forcing &amp; Act. 8 (7 due)</td>
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<td>10</td>
<td>Impulses (Dirac delta) &amp; Euler method</td>
<td>Review (Act. 8 due)</td>
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<td>Final</td>
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<td>Final, 12-1:50 PM</td>
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Note: Syllabus Quiz due Sun. 1/19/2020.

A note on course credits: *This course expects approximately 120 hours of your effort for 4 credits.*