PharmSci 580 Syllabus
Mathematical Principles in Pharmaceutical Sciences

Fall 2023

Course Hours	MW 2:30pm – 4:00pm, 1567 NUB; F 2:00pm – 3:00pm, 2150 SKB
Description	PharmSci 580 is designed for first year graduate students in pharmaceutical sciences to provide the necessary mathematical tools for understanding and analyzing differential equations models. The course is similar to Math 216 and Math 286. PharmSci 580 does cover partial differential equations.
Prerequisites	None.
Instructor	Ruby Kim, 4843 East Hall, `rshkim@umich.edu`.
Office Hours	M 4:00pm – 5:00pm, Th 1:00pm – 3:00pm, and by appointment
Textbook	*Elementary differential equations and boundary value problems*, 11th ed., by W. E. Boyce and R. C. DiPrima, Wiley-Blackwell, 2017. Earlier editions should be fine. All homework will include a PDF of the problems to do.
Course Webpage	All documents (including homework) and grades will be made available on Canvas.

Student Learning Outcomes

After completion of this course, students should be able to...

1. Characterize ODEs and initial value problems by their types and by the qualitative behavior of their solutions.
2. Solve ODEs analytically, when possible, using a variety of methods, e.g. integrating factors, undetermined coefficients, power series, the Laplace transform, and more!).
3. Solve ODEs numerically using MATLAB.
4. Solve the heat equation using Fourier series.

How to Succeed

1. Practice, practice, practice. Do problems until you're bored by how easy they are. Then do some more.
2. Collaborate with your peers. You will learn so much from working with others.
3. Attend office hours and ask questions.

1 Grading

1.1 Homework

Homework will be posted to Canvas on Fridays and due by the following Friday in class. Solutions can be handwritten or typed, but must be submitted as a PDF on Gradescope (link found on Canvas). There will be N graded homeworks, with the lowest score dropped. The overall homework grade will be the average of the remaining $N-1$ homeworks.
Extensions on homeworks will be granted with valid reason. Please do not hesitate to discuss this possibility, even for an especially hectic week. Otherwise, homework submitted late, but no later than 24 hours late, will be graded out of a maximum of half the full points. For students who submit a small number of assignments late but with high quality, I will consider assigning a grade as if you had completed the assignments on time.

If there is a *mistake* in the grading of your assignment (e.g., points are added incorrectly) please let me know immediately. If you *disagree* with the grading of your assignment, you may submit a regrade request via Gradescope. I will look at the concerns at the end of the semester if it will possibly affect your overall grade (after the curve has been set). Please note that small changes in homework points generally do not affect an overall grade.

1.2 Quizzes

Quizzes will be given on Mondays covering material from the most recently turned-in homework. In an ideal week, you will learn material MWF, receiving homework on the Friday to turn in the following Friday, and then be quizzed on it the following Monday. The quizzes will be short and focus on conceptual understanding and computationally proficiency. The quizzes will be given at the beginning of class. There will be N graded quizzes, with the lowest score dropped. The overall quiz grade will be the average of the remaining $N-1$ quizzes.

1.3 Engagement

Learning math among peers is a proven method for increasing one's understanding. Communication skills are essential in any career. For that reason, Fridays will be spent working with your peers, practicing the new material. Some Fridays will be spent using MATLAB to explore the latest topics. Attendance and engagement on these days is required to earn the Engagement point for that week. Engagement requires communicating with your peers during this period and working through the material. On MATLAB-centric days, communication with peers will not be built into the activities, but can still provide a more fulfilling and worthwhile experience for you!

1.4 Exams

There will be no exams in this class. The quizzes will serve as the summative assessment for this class.

1.5 Grades

Numerical course grades will be calculated as the following weighted average:

Homework	Quizzes	Engagement
35%	35%	30%

Letter grades will be determined in conjunction with Dr. Steven Schwendeman.

2 Technology

We will be using MATLAB to explore differential equations numerically. Please bring a laptop to class on Fridays that have a MATLAB component. If this is not possible for you, talk to me and we will figure something out!
You will need to be able to upload PDFs onto Canvas for homework. Make sure they are PDFs, not JPEGs or other file formats.

3 Collaboration

You are highly encouraged to work with other students on homework, though each member must write and submit solutions separately. While it is understood that solutions (especially in math) will often be very similar, do not directly copy other students' answers. In cases where such copying is extremely obvious, I will issue a warning, and future incidents may be reported to the Assistant Dean.
On quizzes, no collaboration is allowed. Any indication of cheating will be thoroughly investigated. If evidence is found, it will be reported to the Assistant Dean.

4 Disability Statement

The University of Michigan recognizes disability as an integral part of diversity and is committed to creating an inclusive and equitable educational environment for students with disabilities. Students who are experiencing a disability-related barrier should contact Services for Students with Disabilities; 734-763-3000 or `ssdoffice@umich.edu`. For students who are connected with SSD, accommodation requests can be made in Accommodate. If you have any questions or concerns please contact your SSD Coordinator or visit SSD's Current Student webpage. SSD considers aspects of the course design, course learning objects and the individual academic and course barriers experienced by the student. Further conversation with SSD, instructors, and the student may be warranted to ensure an accessible course experience.

5 Sexual Misconduct Policy

Title IX prohibits discrimination on the basis of sex, which includes sexual misconduct — including harassment, domestic and dating violence, sexual assault, and stalking. We understand that sexual violence can undermine students' academic success and we encourage anyone dealing with sexual misconduct to talk to someone about their experience, so they can get the support they need. Confidential support and academic advocacy can be found with the Sexual Assault Prevention and Awareness Center (SAPAC) on their 24-hour crisis line, 734.936.3333 and at `sapac.umich.edu`.

6 Mental Health and Well-Being

University Students may experience stressors that can impact both their academic experience and their personal well-being. These may include academic pressures and challenges associated with relationships, mental health, alcohol or other drugs, identities, finances, etc. If you are experiencing concerns, seeking help is a courageous thing to do for yourself and those who care about you. If the source of your stressors is academic, please contact me so that we can find solutions together. For personal concerns, U-M offers a variety of resources, many which are listed on the Resources for Student Well-being webpage. You can also search for additional well-being resources on that website.

7 Expectations for Classroom Safety

LSA is committed to delivering our mission while aiming to protect the health and safety of the community. Our entire LSA community is responsible for protecting the collective health of all members by being mindful and respectful in carrying out the guidelines laid out on the University's Health Response page.
In our classrooms all students are expected to adhere to the required safety measures and guidelines of the State of Michigan and the University of Michigan, such as not coming to class when ill or in quarantine. It is important to also be thoughtful about group gatherings as well as about classroom activities and exercises that require collaboration.
Any student who is not able and willing to comply with campus safety measures for this course should contact the course instructor or their academic advisor to discuss alternate participation or course options. For additional information refer to the University of Michigan's Heath Response website and the OSCR Addendum to the Statement of Student Rights and Responsibilities on the OSCR website.

8 Schedule

Date	Section	Topic
08/28	Chapter 1	Introduction
08/30	2.1-2.2	Linear Equations, Method of Integrating factor, Separable Equations
09/01	2.3	Discussion: Modeling with first order equations
09/04		Labor Day
09/06	2.4-2.5	Differences Between Linear and Nonlinear Equations, Autonomous Equations and Population Dynamics
09/08		Activity: Practice solving first-order ODEs
09/11	2.6-2.7	Exact Equations and Integrating Factors, Numerical Approximations: Euler's Method
09/13	3.1-3.2	Homogenous Equations with Constant Coefficients, Solutions of Linear Homogenous Equations; the Wronskian
09/15		Lab: Simulating with Euler's method
09/18	3.3	Complex Roots of the Characteristic Equation
09/20	3.4-3.5	Repeated Roots, Nonhomogeneous Equations; Method of Undetermined Coefficients
09/22		Activity: Practice solving second-order ODEs
09/25	3.6	Variation of Parameters
09/27	Chapter 4	Higher Order Linear Differential Equations
09/29		Activity/Lab: Practice solving higher-order ODEs
10/02	7.1-7.3	Introduction to Systems of Equations, Linear Algebra Background
10/04	7.4-7.5	Basic Theory of Systems of First Order Linear Equations, Homogeneous Linear Systems with Constant Coefficients
10/06		Lab: Practice solving systems of equations with computing resources
10/09	9.1-9.3	Nonlinear Systems of Equations
10/11	6.1-6.2	Definition of the Laplace Transform, Solution of Initial Value Problems
10/13		Lab: Numerically solve and analyze systems of differential equations
10/16		FALL BREAK
10/18	6.3-6.5	Step Functions, Impulse Functions, Differential Equations with Discontinuous Forcing Functions
10/20		Activity/Lab: Solving ODEs with discontinuous forcing functions
10/23	5.1-5.2	Review of Power Series, Series Solutions Near an Ordinary Point, Part I
10/25	5.3	Series Solutions Near an Ordinary Point, Part II
10/27		NO CLASS
10/30	5.4-5.5	Euler Equations; Regular Singular Points, Series Solutions Near a Regular Singular Point, Part I
11/01	5.6-5.7	Series Solutions Near a Regular Singular Point, Part II, Bessel's Equation
11/03		Activity/Lab: Solving ODEs near regular singular points
11/06	8.1	The Euler or Tangent Line Method
11/08	8.2-8.3	Improvements on the Euler Method, The Runge-Kutta Method
11/10		Lab: Comparing numerical methods
11/13	10.1	Two-Point Boundary Value Problems
11/15	10.2-10.3	Fourier Series, The Fourier Convergence Theorem
11/17		Activity/Lab: Practice computing Fourier series and manipulating them
11/20	10.4-10.5	Even and Odd Functions, Separation of Variables; Heat Conduction in a Rod
11/22		Thanksgiving Break
11/24		Thanksgiving Break
11/27		NO CLASS
11/29	10.6	Other Heat Conduction Problems
12/01		Lab: Approximating solutions to the heat equation
12/04		Special topic, flex day, review, or other
12/06		Special topic, flex day, review, or other