WORCESTER POLYTECHNIC INSTITUTE

MA2051, Ordinary Differential Equations – D Term, 2024
Section DL03 with conferences DD11 and DD12

Syllabus

Instructors

Professor
Francesca Bernardi (*she/her/hers*) Email: fbernardi@wpi.edu

TAs/PLAs
DD11 TA - Rholee Xu (*she/her/hers*) Email: rxu3@wpi.edu
DD12 TA - Rholee Xu (*she/her/hers*) Email: rxu3@wpi.edu

Office Hours

Professor
Tuesday, 12:00-2:00PM in FL 246 (Beckett Conference Room)
Thursday, 3:30-5:30PM in WS 323

TA - starting the week of March 18th
Monday, 2:00-4:00PM in UH 446

All students are welcome at all office hours regardless of section. Students are encouraged to attend office hours as frequently as possible to ask questions and receive feedback on problems and assignments. What are office hours?

Textbook

An Introduction to Differential Equations and Their Applications by Stanley J. Farlow, Dover Publications. This book is available online for free through the George C. Gordon Library.

Class Structure

Lecture (DL03)			Instructor: Professor Francesca Bernardi
M, Tu, Th, F		9:00-9:50 AM	In person in Atwater Kent 219
Discussions			TA: Rholee Xu
DD11:	M	4:00-4:50 PM	In person in Higgins Labs 114
DD12:	M	12:00-12:50 PM	In person in Fuller Labs 311

Course Description

This course provides an introduction to ordinary differential equations. MA 2051 – Ordinary Differential Equations is a category I course, i.e. it is offered at least once a year every year at WPI. The recommended background is MA 1024 – Calculus IV. Although the course may make use of computers, no programming experience is needed or assumed.

Technology needed for this course: internet connection, computer access, access to Canvas, smartphone to take photos, and PDF file converter.

Severe Weather Impact: lectures, discussions, and office hours will be held virtually in case of severe weather events.

Course Content

The course outline is as follows (numbers in parentheses refer to book sections).

Part I: First Order Differential Equations

1. Basic definitions and concepts (1.1)
2. Some basic theory (1.2)
3. First order linear equations (2.1)
4. Separable equations (2.2)
5. Modeling with first order equations (2.3-2.6)

Part II: Homogeneous Second Order Differential Equations

6. Introduction to second order linear equations (3.1)
7. Fundamental solutions of the homogeneous equations (3.2)
8. Homogeneous equations with constant coefficients: Real roots (3.4)
9. Homogeneous equations with constant coefficients: Complex roots (3.5)

10. Reduction of order (3.3)

Part III: Nonhomogeneous Second Order Differential Equations

11. Nonhomogeneous equations (3.6)
12. Solving nonhomogeneous equations: Method of undetermined coefficients (3.7)
13. Solving nonhomogeneous equations: Method of variation of parameters (3.8)
14. Mechanical systems and simple harmonic motion (3.9)
15. Unforced damped vibrations (3.10)
16. Forced vibrations (3.11)

Part IV: The Laplace Transform

17. Definition of the Laplace transform (5.1)
18. Properties of the Laplace transform (5.2)
19. The inverse Laplace transform (5.3)
20. Initial-Value Problems (5.4)
21. Step functions and delayed functions (5.5)
22. Differential equations with discontinuous forcing functions (5.6)
23. The convolution integral (5.8)

The class schedule linked in the *Welcome and Key Files* module shows important dates and which book sections will be covered in each lecture.

Grading

There will be weekly group quizzes, weekly homework assignments, one midterm exam, and one final exam. The course grade will be determined with the following breakdown:

Group Quizzes	15%
Homework	25%
Midterm Exam + Final Exam	60%

60% = 40% highest scoring Exam + 20% lowest scoring Exam

Final letter grades will be assigned as follows:

A	90.0 – 100
B	80.0 – 89.0

C 70.0 – 79.0
NR 0 – 69.0

Rounding will be applied following the half up tie-breaking rules https://en.wikipedia.org/wiki/Rounding#Round_half_up. No scaling/curving will be applied in this course but there will be plenty of opportunities for extra credit.

A grade of I (incomplete) is available for students who encounter special medical issues or other challenges during the term. Reach out to the instructor as soon as possible if you are facing particular difficulties and want to discuss this grading option.

Homework

All homework assignments will be administered, submitted, and graded through Canvas. Each assignment should be submitted as a single PDF file with the problems solved in the correct order.

If you are not sure how to convert your homework into a PDF, check out the page titled PDF Upload Information (for Assignment Submissions) on Canvas under the *Resources and Support* module.

Weekly homework assignments (HW) will be due each Thursday at 11:59 PM. There will be no HW due on March 14th and April 4th, for a total of 5 assignments. Submissions should be neat and readable. A selection of the submitted problems will be graded each week. Written assignments are worth 25% of your class grade.

Each student is allowed one (1) extension on homework assignments, no questions asked. To use your allotted extension, please submit this Qualtrics form ahead of the HW deadline: https://wpi.qualtrics.com/jfe/form/SV_1XkzJ2LA2zDWogS. Alternatively, use the QR code on the Canvas page Homework Extension Request Form.

All other late homework assignments will be graded for up to 50% of the points as long as they are submitted before solutions are posted. The lowest homework score will be dropped. Homework assignments will be graded for correctness. Students experiencing extenuating circumstances preventing them from submitting homework following the prescribed deadlines should contact their instructor as soon as possible.

Quizzes

Weekly group quizzes (GQ) will be taken in class in groups on Tuesdays, 9:00-9:15 AM. The first GQ will be on March 19th; there will be no group quizzes on March 12th, March 26th, April 2nd, and April 30, for a total of 4 group quizzes. Each student will be responsible for their own submission but problems will be solved in groups. Groups will be shuffled every week. Group quizzes are worth 15% of the class grade.

The lowest group quiz score will be dropped. Please review the How Will Group Quizzes Work? page in the *Welcome and Key Files* module on Canvas for important information about exams. Students with academic accommodations on exams who are concerned about completing the assignment in class within the allotted time should contact the instructor.

Exam Policies

The two exams for this course are scheduled as follows:

Midterm Exam: Friday, March 29th, 9:00-9:50 AM -- **In person, AK 219**
Final Exam: Wednesday, May 1st, 9:00-9:50 AM -- **In person, AK 219**

Please review the How Will Exams Be Administered? page in the *Welcome and Key Files* module on Canvas for important information about exams. Students must contact their instructor as soon as possible if they have scheduling conflicts on either of the exam dates. If possible, a make-up exam will be offered.

Inclusive Classroom Environment

You deserve to be addressed in the manner you prefer. To guarantee that I address you properly, you are welcome to tell me your pronoun(s) and/or preferred name at any time, either in person or via email. I will not ask students directly in class to avoid putting anyone on the spot.

We embrace diversity of gender, gender expression, sex, sexual orientation, race, ethnicity, national origin, age, religion, disability status, family status, socioeconomic background, and other visible and non-visible categories. I do not tolerate discrimination.

You deserve a community free from discrimination, sexual harassment, a hostile environment, sexual assault, domestic violence, dating violence, and stalking. If you experience or know of a Title IX violation, you can find many options for support and/or reporting at https://www.wpi.edu/offices/title-ix.

Accessibility Services

Students with approved academic accommodations should plan to submit their accommodation letters through the Office of Accessibility Services Student Portal as soon as possible. Should you have any questions about how accommodations can be implemented in this particular course, please contact Prof B as soon as possible.

Students who are not currently registered with the Office of Accessibility Services (OAS) but who would like to find out more information about requesting accommodations, documentation guidelines, and what the accommodated interactive process entails should plan to contact OAS either by email AccessibilityServices@wpi.edu, by phone (508) 831-4908, or by stopping by the office on the 5th floor of Unity Hall.

Generative AI and Academic Integrity[1]

This course operates on trust and integrity. You can trust me to give feedback on your work, to structure policies to support your learning as best I can, and to give my honest opinion on your usage of AI in whatever circumstance you choose. I trust you not to pass off generated content as your own, and overall to act with integrity and the intent to further your learning if you choose to experiment with generative AI systems. Specifically:

- If you decide to use generative AI in a project or assignment, please disclose how you have used it in a supplemental document that you upload with your submission. At a minimum, clarify: which tool(s) you used and for what, what you perceive as the pros and cons of having used it, how you incorporated generative AI into your process, and whether there remains any content generated by the system in your final submitted product.
- If you use a generative AI system and do not understand its output (e.g. it creates mathematical or written language you do not understand), please make

[1] The generative AI policy is built on work by Gillian Smith, Associate Professor of Computer Science and Director of the IMGD program at WPI.

your best attempt at understanding it. You can always bring it to me with questions.
- Generative AI usage should be supplemental to your own work. Do: feel free to experiment with it for brainstorming, use it to embellish work you have done, or significantly modify its output (with disclosure!). Don't: give an assignment prompt as input and paste the output as your submission.
- Using generative AI is absolutely not mandatory or even expected. It is completely up to you whether to use or avoid these tools and the choice itself will not affect the grading of your work.

The honor code is a cornerstone of our learning community and of this course. It is your responsibility to know and follow academic integrity policies available on the WPI website at https://www.wpi.edu/about/policies/academic-integrity. I will gladly answer any questions you have.

Additional Resources

WPI has some available resources to support you in this class and beyond. Here are some to check out:

Academic Resources Center, https://arc.wpi.edu/
IT Service & Support, https://www.wpi.edu/offices/services-support
Student Development and Counseling Center, https://www.wpi.edu/offices/student-development-counseling-center
Office of Accessibility Services, https://www.wpi.edu/offices/office-accessibility-services
Health Services, https://www.wpi.edu/student-experience/health-counseling/health-services
Office of Diversity, Inclusion, and Multicultural Education, https://www.wpi.edu/offices/office-diversity-inclusion-and-multicultural-education-odime
LGBTQ+ Support, https://www.wpi.edu/student-experience/resources/lgbtq-support
International House, https://www.wpi.edu/offices/international-house

Syllabus Change Policy

Except for changes that substantially affect grading policies, this syllabus is a guide for the course and is subject to change. All changes will be communicated by the instructor in writing with advance notice.