Ordinary Differential Equation
Tentative Topics Schedule

MTH 321 Sections A & B
Fall 2024
University of Portland

See Books & Online Resources Lists for the readings & practice materials.

The reading materials are not mandatory but it is encouraged.

The "Reading" column in the table below contains page numbers (Pg.) or chapters (ch.) on which it refers to a label in the Books & Online Resources List. For example "Pg. 1-5 [H]" refers to pages 1-5 of the first item in the list, which is the textbook titled "Ordinary Differential Equations: A Primer on Dynamics and Systems".

Topics and Materials

Week	Day	Topic	Worksheet	Homework	Reading
1	Tu 8/27	Introduction and Orientation to ODEs	Review Algebra and Calculus	-	Syllabus
	Th 8/29	Modeling Physical Systems,Classification of Equations, &Principles of Solutions	Classify ODEs and Verify Solutions	-	Ch. 1.1 [T]
2	Tu 9/3	1st-Order ODEs,Existence and Uniqueness, &Analyzing Equilibriums of 1st-Order ODEs	Analyze 1st-Order ODEs Qualitatively	Assigned: Homework 1	Ch. 1.2 & 2.1 [T]
	Th 9/5	Nullclines and Isoclines &Euler's Method for solving 1st-Order ODEs	Solve 1st-Order ODEs Graphically and Numerically	-	Ch. 1.3 & 3.1 [T]
3	Tu 9/10	Separation of Variables for Solving 1st-Order ODEs	Separate the Variables	Assigned: Homework 2	Ch. 2.2 [T]
	Th 9/12	Integrating Factors for Solving 1st-Order ODEs	Choose an Integrating Factor	-	Ch. 2.6 [T]
4	Tu 9/17	Laplace Transforms for Solving 1st-Order ODEs	Introduce the Laplace Transform	-	Ch. 8.1 & Ch. 8.2 [T]

Week	Day	Topic	Worksheet	Homework	Reading
	Th 9/19	Bifurcations in One Dimension	Apply Bifurcation Analysis to Physical Systems	-	Ch. 4.1, 4.2, & 4.3 [T]
5	Tu 9/24	*Review*	Exam 1 Examples	-	Exam 1 Topics
	Th 9/26	**Exam 1**	-	-	-
6	Tu 10/1	Systems of 1st-Order ODEs,Existence and Uniqueness, &Modeling Physical Processes	Interpret 1st-Order System of ODEs	Assigned: Homework 3	TBA
	Th 10/3	Analyzing Equilibriums to 1st-Order System of ODEs	Find Equilibriums of 1st-Order System of ODEs	-	-
7	Tu 10/8	Linear Transformations & Eigentheory	Solve 1st-Order System of ODEs using Eigentheory	Assigned: Homework 4	TBA
	Th 10/10	Stability Analysis &Solutions to 1st-Order System of ODEs	Use Linearization and Stability Analysis	-	TBA
8	Tu 10/15	*Fall Vacation*	-	-	-
	Th 10/17	*Fall Vacation*	-	-	-
9	Tu 10/22	Eigenvalues and Eigenvectors for solving 1st-Order Linear Systems	Use Distinct or Repeated Eigenvalues	-	TBA
	Th 10/24	Complex Solutions of 1st-Order Linear Systems	Use Complex Exponentials	-	TBA
10	Tu 10/29	*Review*	Exam 2 Examples	-	Exam 2 Topics
	Th 10/31	**Exam 2**	-	-	-
11	Tu 11/5	Higher Order ODEs,Classification of Equations, &Modeling Physical Processes	Find Homogeneous and Particular Solutions	Assigned: Homework 5	TBA
	Th 11/7	Analyzing 2nd-Order Linear ODEs	Use Substitution and Non-Dimensionalization	-	TBA

Week	Day	Topic	Worksheet	Homework	Reading
12	Tu 11/12	Undetermined Coefficients for Solving Linear 2nd-Order ODEs	Determine the Undetermined	Assigned: Homework 6	TBA
	Th 11/14	Variation of Parameters for Solving Linear 2nd-Order ODEs	Vary the Parameters	-	TBA
13	Tu 11/19	Laplace Transforms for Solving Linear 2nd-Order ODEs	Transform the Derivatives	-	-
	Th 11/21	*Review*	Exam 3 Examples	-	Exam 3 Topics
14	Tu 11/26	**Exam 3**	-	-	-
	Th 11/28	*Thanksgiving Vacation*	-	-	-
15	Tu 12/3	Bifurcations in Two Dimensions	Apply Bifurcation Theory to Physical Systems	-	TBA
	Th 12/5	Dynamics and Chaos Theory	Analyze the Lorenz System	-	TBA
16	Tu 12/11	**Final Exam Section A**	-	-	-
	Th 12/12	**Final Exam Section B**	-	-	-

Along with the textbook [T], and websites [C] and [P], most of the course materials (contents of worksheets and homework) of each topic was taken from these following sources:

- Inquiry oriented differential equations (IODE) by Rasmussen et al. (2018)
- Differential equations and linear algebra by Strang (2014)
- Applied differential equations: The primary course by Dobrushkin (2022)
- Differential Equations by MIT Open Courseware (2015)

Books & Online Resources Lists

Click on the link to access the resources.

Textbooks

[T] Trench WF (2013). *Elementary Differential Equations*. Faculty Authored, and Edited Books & CDs. 8., https://digitalcommons.trinity.edu/mono/8/.

Websites

[C] Clontz S (2022). "Differential Equations - Checkit.", https://stevenclontz.github.io/checkit-clontz-diff-eq.

[P] Dawkins P (2023). "Paul's Online Notes on Differential Equations.", https://tutorial.math.lamar.edu/Classes/DE/DE.aspx.

References

Dobrushkin, V. A. (2022). *Applied differential equations: The primary course* (2nd ed.). Chapman; Hall/CRC.

MIT Open Courseware. (2015). *Differential equations*. https://ocw.mit.edu/courses/res-18-009-learn-differential-equations-up-close-with-gilbert-strang-and-cleve-moler-fall-2015/

Rasmussen, C., Keene, K. A., Dunmyre, J., & Fortune, N. (2018). *Inquiry oriented differential equations: Course materials*. https://iode.sdsu.edu

Strang, G. (2014). *Differential equations and linear algebra*. Wellesley-Cambridge Press.