

Syllabus: ES.1803 Differential Equations - ESG Spring 2024

Instructors: Jeremy Orloff, Jonathan Bloom

Class information: See the class information on the class website for details about texts, grading etc.

Solution Methods for Linear DEs

M	Feb. 5	1.	Introduction to DEs; modeling; separable equations.
T	Feb. 6		Continue Topic 1
W	Feb. 7		Problem section
R	Feb. 8	2.	Linear systems: input-response models.
F	Feb. 9	3.	Input-response models continued.
M	Feb. 12	4.	Complex numbers and exponentials.
T	Feb. 13		Continue Topic 4
W	Feb. 14		Problem section
R	Feb. 15	5.	Linear DEs, CC homogeneous case. Pset 1 due
F	Feb. 16		Continue Topic 5
M	Feb. 19		 Holiday
T	Feb. 20		 Quiz 1 on Topics 1-3
W	Feb. 21		Problem section
R	Feb. 22	6.	Operators, inhomogeneous DEs, exponential response formula.
F	Feb. 23		Continue Topic 6 Pset 2 due
M	Feb. 26	7.	Inhomogeneous DEs: UC methods; Theory.
T	Feb. 27	8.	Applications: stability.
W	Feb. 28		Problem section
R	Feb. 29	9.	Applications: frequency response. Pset 3 due
F	Mar. 1		Continue Topic 9
M	Mar. 4		 Quiz 2 on Topics 4-8
T	Mar. 5		Continue Topic 9
W	Mar. 6		Problem section

First-Order Differential Equations

R	Mar. 7	10.	Direction fields, integral curves, existence of solutions.
F	Mar. 8	11.	Numerical methods for 1 st order ODEs. Pset 4 due
M	Mar. 11	12.	Autonomous DEs and bifurcation diagrams.
T	Mar. 12		Continue Topic 12
W	Mar. 13		Problem section
R	Mar. 14		 Quiz 3 on Topic 9

Linear Algebra

F	Mar. 15	13.	Linear algebra: vector spaces, matrices and linearity
M	Mar. 18	14.	Linear algebra: row reduction, column spaces, null space
T	Mar. 19		Continue Topic 14
W	Mar. 20		Problem section
R	Mar. 21	15.	Linear algebra: transpose, inverse, determinant Pset 5 due
F	Mar. 22	16.	Linear algebra: eigenvalues, diagonalization, decoupling

Spring break March 25-29

M	Apr. 1		Continue Topic 16
T	Apr. 2	17.	Matrix methods of solving systems, the companion matrix.
W	Apr. 3		Problem section
R	Apr. 4		Continue Topic 17
Delta functions			
F	Apr. 5	20.	Step and delta functions. Pset 6 due
M	Apr. 8		Class is eclipsed No class
T	Apr. 9		Continue Topic 20
W	Apr. 10		 Quiz 4 on Topics 13-17
Fourier Series and Partial Differential Equations			
R	Apr. 11	21.	Fourier series: basics.
F	Apr. 12		Continue Topic 21
M	Apr. 15		Patriots day.....Holiday
T	Apr. 16	22.	Fourier series introduction: continued.
W	Apr. 17		Problem section
R	Apr. 18	23.	Sine and cosine series; calculation tricks.
F	Apr. 19		Discussion, review and catch up. Pset 7 due
M	Apr. 22	24.	Linear ODEs with periodic input.
T	Apr. 23	25.	PDEs; separation of variables.
W	Apr. 24		Problem section
R	Apr. 25		 Quiz 5 on Topics 20-23
F	Apr. 26		Continue Topic 25
Qualitative Descriptions of Systems of Ordinary Differential Equations			
M	Apr. 29	27.	Qualitative behavior of linear systems.
T	Apr. 30		Continue Topic 27
W	May 1		Problem section
R	May 2	28.	Qualitative behavior of non-linear systems; linearization..... Pset 8 due
F	May 3		Continue Topic 28
M	May 6	29.	Structural stability.
T	May 7	30.	Applications to population models: Volterra's principle.
W	May 8		Problem section
R	May 9		 Quiz 6 on Topics 24-26
F	May 10		Discussion, review and catch up. (Do Pset 9 in class)
M	May 13		Discussion, review and catch up.
T	May 14		Discussion, review and catch up.

Last quiz: Topics 27-30 + Unit 1 (Topics 1-9) + one other unit of your choice. During finals week: Friday, May 17 (makeup on the day of the 18.03 final: TBA)

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