MATH-UA 026.001 – ORDINARY DIFFERENTIAL EQUATIONS
Spring 2018

Textbooks

- Required: Braun, *Differential Equations and Their Applications*, Springer (available online)

- Recommended: Boyce and DiPrima, *Elementary Differential Equations*, Wiley

Syllabus

1. First-order linear differential equations: Picard iteration, Euler method

2. Second-order liner differential equations: Method of variation of parameters, inhomogeneous equations, series solutions

3. Systems of linear differential equations: Matrix methods, eigenvalues and eigenvectors, fundamental matrix solutions

4. Nonlinear differential equations: Qualitative theory, phase space, stability of solutions

5. Boundary value problems: Self-adjoint operators, eigenfunction expansions, Fourier series

6. Green's functions

Assessment

- Weekly homework sets (30%, lowest homework grade dropped)

- Midterm (30%)

- Final (40%)

Contact and office hours

- Instructor: Dimitris Giannakis, dimitris@cims.nyu.edu
  Office hours: Mondays 5:00–6:00PM and Wednesdays 4:45–5:45PM, WWH 910

- Grader and Recitation Leader: Vismayie Vandanapu, vv846@nyu.edu
  Office hours: Thursdays 9:00–10:00AM, WWH 524

Lecture	Date	Topic	Textbook section (Braun)
Lecture 1	22-Jan	Introduction, first-order linear ODEs	1.1, 1.2
Lecture 2	24-Jan	Inhomogeneous problems, integrating factors, separation of variables	1.2, 1.3
Lecture 3	29-Jan	Exact differential equations	1.9
Lecture 4	31-Jan	Existence of solutions, Picard iteration	1.10
Lecture 5	5-Feb	Uniqueness of solutions	1.10
Lecture 6	7-Feb	Numerical approximation, Euler method	1.13
Lecture 7	12-Feb	Second-order linear differential equations, general solutions	2.1
Lecture 8	14-Feb	Second-order equations with constant coefficients	2.2
President's day	19-Feb		
Lecture 9	21-Feb	Second-order equations with constant coefficients	2.2
Lecture 10	26-Feb	Method of variation of parameters, judicious guessing	2.4, 2.5
Lecture 11	28-Feb	Series solutions	2.8
Lecture 12	5-Mar	Series solutions: regular singular points	2.8.1
Lecture 13	7-Mar	Midterm	
Spring break	12-Mar		
Spring break	14-Mar		
Lecture 14	19-Mar	Systems of differential equations, review of linear algebra	3.1, 3.2-3.7 (parts)
Lecture 15	21-Mar	Eigenvalue-eigenvector method	3.8
Lecture 16	26-Mar	Eigenvalue-eigenvector metod: complex roots, equal roots	3.9, 3.10
Lecture 17	28-Mar	Fundamental matrx solutions	3.11
Lecture 18	2-Apr	Inhomogeneous equations, variation of parameters	3.12
Lecture 19	4-Apr	Nonlinear differential equations, qualitative theory	4.1
Lecture 20	9-Apr	Stability of linear systems	4.2
Lecture 21	11-Apr	Stability of equilibrium solutions	4.3
Lecture 22	16-Apr	Phase space	4.4
Lecture 23	18-Apr	Introduction to Sturm-Liouville theory, inner product spaces	6.1, 6.2
Lecture 24	23-Apr	Orthogonal bases, Hermitian operators	6.3
Lecture 25	25-Apr	Sturm-Liouville theory	6.4
Lecture 26	30-Apr	Dirac delta-functions	2.12
Lecture 27	2-May	Green's functions	2.13
Lecture 28	7-May	Review lecture	