

MATH 219 Introduction to Differential Equations

Credit: (4-0) 4

Catalog description: First order equations and various applications. Higher order linear differential equations. Power series solutions. The Laplace transform. Solutions of initial value problems. Systems of linear differential equations. Introduction to partial differential equations.

Course Objectives: By the end of this course, a student will:

- Classify and identify different types of differential equations,
- Explicitly solve several important classes of ordinary differential equations and interpret their qualitative behavior,
- Apply ideas from linear algebra in order to solve single linear ordinary differential equations and systems of such equations,
- Model certain physical phenomena using differential equations and reinterpret their solutions physically,
- Use power series methods to solve second order linear differential equations
- Apply the Laplace transform for solving differential equations,
- Use the method of separation of variables in order to solve some basic partial differential equations via Fourier series.

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Course Website: <http://ma219.math.metu.edu.tr/> and <https://metuclass.metu.edu.tr/>

Textbook: “Elementary Differential Equations and Boundary Value Problems”, Boyce, W. E., DiPrima, R. C., 10th ed.

Office Hours: To be announced.

Exams and Grading: The grading will be based on two midterm examinations and one final examination.

- **Midterm 1:** 30 % (date to be announced)
- **Midterm 2:** 30 % (date to be announced)
- **Final:** 40 % (date to be announced)

Suggested Problems: A list of suggested problems will be announced on the course website. Students are encouraged to attempt to solve all of these problems in a timely manner, and ask the instructors about the ones that they cannot solve.

NA Policy: A student who misses all exams will receive a grade of NA for the course.

Make-up Policy: In order to be eligible to enter a make-up examination for a missed examination, a student should have a documented or verifiable, and officially acceptable excuse. A student cannot get make-up examinations for two missed exams. The make-up examination for all exams will be after the final exam, and will include all topics.

Instructor	Lecture Times and Places	Instructor e-mail, Office (Math building), office phone
S1. Özgür Kişisel	Tue 8:40-10:30 (YP-A1), Thu 10:40-12:30 (YP-A3)	akisisel@metu.edu.tr 128, (312) 210 5388
S2. Ahmet Beyaz	Tue 8:40-10:30 (YP-A4), Thu 10:40-12:30 (YP-A4)	beyaz@metu.edu.tr 123, (312) 210 5381
S3. Baver Okutmuştur	Tue 13:40-15:30 (U3) Fri 8:40-10:30 (U3)	baver@metu.edu.tr 242, (312) 210 2974
S4. Ahmet İrfan Seven	Tue 13:40-15:30 (P2) Fri 8:40-10:30 (P2)	aseven@metu.edu.tr 226, (312) 210 5391
S5. Yıldırım Ozan	Tue 13:40-15:30 (YP-A1) Fri 8:40-10:30 (YP-A1)	ozan@metu.edu.tr 217, (312) 210 5373
S6. Marat Akhmet	Tue 13:40-15:30 (U1) Fri 8:40-10:30 (U1)	marat@metu.edu.tr 121, (312) 210 5355
S7. Kostyantyn Zheltukhin	Tue 15:40-17:30 (U3) Thu 8:40-10:30 (U3)	zheltukh@metu.edu.tr 137, (312) 210 5385
S8. (closed)		
S9. İbrahim Ünal	Wed 15:40-17:30 (YP-A1) Fri 10:40-12:30 (YP-A1)	iunal@metu.edu.tr 241, (312) 210 5380

Important Dates:

- **September 30:** Classes begin
- **October 7-11:** Add-drop and advisor approvals
- **October 29:** Republic Day (Tuesday)
- **November 10:** Commemoration of Atatürk (Sunday)
- **December 2-8:** Course withdrawal applications
- **January 1:** New Year's Day (Wednesday)
- **January 3:** Last day of classes
- **January 6-18:** Final exam period
- **January 27:** The announcement of letter grades

Course Schedule:

The table below is a rough guideline for the content of course lectures. Instructors may reorder their lectures as necessary/desired. Section and page numbers below are from the textbook, *Elementary Differential Equations and Boundary Value Problems*, Boyce and DiPrima, 10th ed., 2010.

Week 1: Sep.30-Oct.4	1	§1.1, §1.3: Introduction, Direction Fields Chapter 2. First Order Differential Equations §2.2: Separable equations (also homogeneous equations - see p49 #30).
	2	§2.1: Linear equations; Method of integrating factors.
Week 2: Oct.7-11	3	§2.3: Modeling with first order equations
	4	§2.4: Differences between linear and nonlinear equations
Week 3: Oct.14-18	5	§2.6: Exact equations and integrating factors.
	6	Chapter 7. Systems of First Order Linear Equations §7.1: Introduction. §7.2: Review of matrices.

Week 4: Oct.21-25	7,8	§7.3: Systems of linear algebraic equations; Linear independence, eigenvalues, eigenvectors.
Week 5: Oct.28-Nov.1	9	§7.4: Basic theory of systems of first order linear equations. §7.5: Homogeneous linear systems with constant coefficients.
	10	§7.6: Complex eigenvalues.
Week 6: Nov.4-8	11	§7.7: Fundamental matrices. §7.8: Repeated eigenvalues.
	12	§7.9: Nonhomogeneous linear systems (variation of parameters only).
Week 7: Nov.11-15	13	Chapter 4. Higher Order Linear Equations §4.1: General theory of n^{th} order linear equations
	14	§4.2: Homogeneous equations with constant coefficients.
Week 8: Nov.18-22	15	§4.3: The method of undetermined coefficients.
	16	§4.4: The method of variation of parameters.
Week 9: Nov.25-29	17	§3.7: Mechanical and electrical vibrations. §3.8: Forced Vibrations.
	18	Chapter 5. Series Solutions of Second Order Linear Equations §5.1: Review of Power Series §5.2: Series Solutions Near an Ordinary Point, Part I
Week 10: Dec.2-6	19	§5.3: Series Solutions Near an Ordinary Point, Part II §5.4: Euler Equations, Regular Singular Points
	20	§5.5: Series Solutions Near a Regular Singular Point, Part I
Week 11: Dec. 9-13	21	Chapter 6. The Laplace Transform §6.1: Definition of the Laplace transform.
	22	§6.2: Solution of initial value problems. §6.3: Step functions.
Week 12: Dec.16-20	23	§6.4: Differential equations with discontinuous forcing functions.
	24	§6.5: Impulse functions. §6.6: The convolution integral.
Week 13: Dec.23-27	25	Chapter 10. Partial Differential Equations and Fourier Series §10.1: Two-point boundary value problems.
	26	§10.2: Fourier series.
Week 14: Jan.30-3	27	§10.3: The Fourier convergence theorem. §10.4: Even and odd functions.
	28	§10.5: Separation of variables, heat conduction in a rod.