MAT 219 Introduction to Differential Equations – Fall 2013

Prerequisites: MAT 120 **Credit/ECTS:** (4-0) 4

Course website: http://math.ncc.metu.edu.tr/math219

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,
- apply the Laplace transform for solving differential equations,
- use the method of separation of variables in order to solve some basic partial differential equations.

Course Coordinator and Instructors:

Instructor	Section(s)	Office	Phone	E-mail
Anar Dosiev	1,2	SZ-33	2943	dosiev@metu.edu.tr
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Exams and Grading:

- **Two Midterm Exams** : 30 % each
- **Final** : 40 %
- **Bonus** : 5 % (method varies between sections)

Textbook: "Elementary Differential Equations and Boundary Value Problems", Boyce, W. E., DiPrima, R. C. , 9th ed., (available at the bookstore)

Suggested Problems: A list of suggested problems is 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. ***At least 25% of the exam problems will be chosen among these problems***.

NA Policy: If you miss all midterm exams and final exam, you 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.

Mathematics Help Room: Office hours will be held in the **Mathematics Help Room (T-103).** The timetable can be found at the course website. Students are encouraged to visit the help room both at the office hours of their own instructors, and others. The room can also be used for studying and for working in groups.

Important Dates:

- **September 23**: Classes Start
- **October 15-18**: HOLIDAY (Kurban Bayram; Tues-Fri)
- **November 15**: HOLIDAY (Friday)
- **January 1**: HOLIDAY (Wednesday)
- **January 14-25**: Finals Period
- **September 30-October 4**: Add-Drop
- **October 29**: HOLIDAY (Tuesday)
- **November 29: Withdrawal Deadline**
- **January 10**: Classes End
- **February 3**: Grades Announced

COURSE SCHEDULE

Week 1: Sep.23-27	1	Introduction, Directional 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. **§2.3:** Modeling with first order equations (tank problems, temperature problems).
Week 2: Sep.30-Oct.4	3	**§2.4:** Differences between linear and nonlinear equations (existence and uniqueness theorems).
	4	**§2.6:** Exact equations and integrating factors.
Week 3: Oct.7-11	5	**Chapter 7. Systems of First Order Linear Equations** **§7.1:** Introduction. **§7.2:** Review of matrices.
	6	**§7.3:** Systems of linear algebraic equations; Linear independence, eigenvalues, eigenvectors.
HOLIDAY (Kurban Bayram)Tuesday-Friday, 15-18 October		
Week 4: Oct.21-25	7	**§7.4:** Basic theory of systems of first order linear equations. **§7.5:** Homogeneous linear systems with constant coefficients.
	8	**§7.5:** Homogeneous linear systems with constant coefficients. **§7.6:** Complex eigenvalues.
Week 5: Oct.28-Nov.1	**Holiday: Tuesday, 29 October**	
	9	**§7.7:** Fundamental matrices.
	10	**§7.8:** Repeated eigenvalues. **§7.9:** Nonhomogeneous linear systems (variation of parameters only).
Week 6: Nov.4-8	11	**Chapter 4. Higher Order Linear Equations** **§4.1:** General theory of n^{th} order linear equations.
	12	**§4.2:** Homogeneous equations with constant coefficients.
Week 7: Nov.11-15	13	**Chapter 3. Second Order Linear Equations** **§3.2:** Fundamental solutions of linear homogeneous equations.
	14	**§3.3:** Linear independence and the Wronskian. **§3.4:** Complex roots of the characteristic equation.
	Holiday: Friday, 15 November	
Week 8: Nov.18-22	15	**§3.5:** Repeated roots; Reduction of order.
	16	**§3.6:** Nonhomogeneous equations; Method of undetermined coefficients.
Week 9: Nov.25-29	17	**§4.3:** The method of undetermined coefficients.
	18	**§3.7:** Variation of parameters.
Week 10: Dec.2-6	19	**§3.8:** Mechanical and electrical vibrations.
	20	**§3.9:** Forced Vibrations.
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.A:** Derivation of the Heat Conduction Equation. **§10.1:** Two-point boundary value problems.
	26	**§10.2:** Fourier series. *§10.3: The Fourier convergence theorem (briefly)*.
Week 14: Dec.30-Jan.3	27	**§10.4:** Even and odd functions.
	Holiday: Wednesday, 1 January	
	28	**§10.5:** Separation of variables, heat conduction in a rod.
Week 15: Jan.6-10	29	
	30	
FINAL EXAM		