MAT 219 Introduction to Differential Equations – Fall 2012

Credit/ECTS: (4-0) 4 / 7.0

Prerequisites: MAT 120

Course website: http://math.ncc.metu.edu.tr (Click "Math Courses, Fall 2012, MAT 219)

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:

Şafak Alpay (sec 2,3)	(RZ-41)	salpay@metu.edu.tr
Anar Dosiev (sec 4,5)	(SZ-33)	dosiev@metu.edu.tr
Ali Ulaş Özgür Kişisel (sec 1,coord.)	(SZ-31)	akisisel@metu.edu.tr

Exams and Grading:

Exam 1	: 25 %
Exam 2	: 30 %
Final	: 35 %
Quizzes	: 10 % (based on suggested problems and problems solved in class)
Bonus	: 5 % (method varies between sections)

Textbook: "Elementary Differential Equations and Boundary Value Problems", Boyce, W. E., DiPrima, R. C. , 8th 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. Quizzes will be based on these problems along with problems solved during lectures.

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.

Syllabus:

Week 1 (Sept 24-28)
Introduction , Direction fields
2.2 Separable equations, homogenous equations.
2.1 Linear equations with variable coefficients
2.3 Modeling with first order equations (parts of)

Week 2 (Oct 1-5)
2.4 Differences between linear and nonlinear equations
2.6 Exact equations and integrating factors

Week 3 (Oct 8-12)
7.1 Introduction to Linear Systems
7.2 Review of matrices
7.3 Systems of linear algebraic equations: Linear independence, eigenvalues, eigenvectors

Week 4 (Oct 15-19)
7.4 Basic theory of systems of first order linear equations
7.5 Homogeneous linear systems with constant coefficients
7.6 Complex eigenvalues

Week 5 (Oct 22-26) (Oct 25-27 Religious Holiday (Kurban Bayramı))
7.7 Repeated eigenvalues, Jordan form of a matrix

Week 6 (Oct 29-Nov 2) (Oct 29 National Holiday (Cumhuriyet Bayramı))
7.8 Fundamental matrices
7.9 Nonhomogeneous linear systems (Variation of parameters)

Week 7 (Nov 5-Nov 9)
4.1 General theory of n'th order linear equations
4.2 Homogeneous equations with constant coefficients

Week 8 (Nov 12-16) (Nov 15 National Holiday (Republic Day of the TRNC))
3.2 Fundamental solutions of linear homogeneous equations
3.3 Linear independence and the Wronskian
3.4 Complex roots and the characteristic equation

Week 9 (Nov 19-23)
3.5 Repeated roots; reduction of order
3.6 Nonhomogeneous equations; method of undetermined coefficients

Week 10 (Nov 26-30)
4.3 The method of undetermined coefficients
3.7 Variation of parameters

Week 11 (Dec 3-7)
3.8 Mechanical and Electrical Vibrations
3.9 Forced Vibrations

Week 12 (Dec 10- 14)
6.1 Definition of the Laplace transform
6.2 Solution of initial value problems
6.3 Step functions

Week 13 (Dec 17-21)
6.4 Differential equations with discontinuous forcing functions
6.5 Impulse functions
6.6 The convolution integral

Week 14 (Dec 24-28)
10.1 Two point boundary value problems
10.2 Fourier series
10.3 The Fourier convergence theorem

Week 15 (Dec 31- Jan 4) (Jan 1 Holiday (New Year's Day)
10.4 Even and odd functions
10.5 Separation of variables, heat conduction in a rod