

 Lebanese American University	MTH		304
School of Arts and Sciences	Course Title: Differential Equations		3 credits
Department of Computer Science and Mathematics	Hours: MTWRF 11:00 - 12:30		room: Science 406
Course syllabus	Instructor: Dr. Chadi Abou-Rjeily		term: Summer-I 2008

1. Course Description

First order differential equations and applications; linear higher order differential equations and applications; system of linear differential equations; series solutions of differential equations; Laplace transforms.

2. Course Objectives

A student who has successfully completed this course should be able to:

1. solve first-order differential equations.
2. model and solve problems leading to differential equations.
3. solve higher-order linear differential equations.
4. solve systems of differential equations.
5. solve differential equations using power series.
6. solve differential equations using Laplace transforms.
7. approximate the solution of a differential equation using numerical techniques.

3. Contribution of course to meeting the professional component

Professional Component	Credits
Mathematics and Basic Sciences	3
Engineering Topic	0
General Education	0

4. Relationship of course to program outcomes

The student will be able to:

1. draw direction fields of a 1st order differential equation.
2. solve separable, (exact) and linear equations.
3. model and solve physical phenomena using differential equations
4. solve linear differential equations with constant coefficients.
5. solve linear systems of differential equations, draw their phase portraits, and determine the type and stability of their critical points.
6. solve non-linear systems of differential equations by local linearization.
7. use power series to solve linear differential equations.
8. find Laplace transforms and inverse Laplace transforms.
9. solve linear differential equations using Laplace transforms.
10. use Euler's method for finding the numerical solution of differential equations.

5. Course Outline

First-Order Differential Equations

Basic Concepts. Modeling.
 Direction Fields.
 Separable Differential Equations.
 Exact Differential Equations.
 Linear Differential Equations.

Higher-Order Linear Differential Equations

Second-Order Homogeneous LDE.
 Second-Order Homogeneous LDE with constant coefficients.
 Modeling: Mass-Spring systems.
 Euler-Cauchy equation.
 Solution by Undetermined Coefficients.
 Modeling: Electric Circuits
 Solution by Variation of Parameters.

The Laplace Transform

Laplace Transform. Inverse Transform. Linearity. Shifting.
 Transforms of Derivatives and Integrals
 Unit Step Function. 2nd Shifting Property. Dirac's Delta Function.
 Derivative and Integral of Transforms.
 Convolution. Integral Equations.
 Systems of Differential Equations.

Systems of Differential Equations

Introduction to Matrices, eigenvalues and eigenvectors.
 Homogeneous systems with constant coefficients. Phase Plane. Critical Points.
 Criteria for Critical Points. Stability.
 Nonlinear Systems

Series Solutions of Differential Equations

Power Series Method.
 Legendre's Equation. Legendre Polynomials.

6. Required tools / software / skills

Software: Matlab.

7. Textbook[s]

Erwin Kreszig, Advanced Engineering Mathematics, 9th edition, 2006, John Wiley.

8. Schedule of Exams & Grading Percentage

Drop Quizzes	10%
Mid term 1	25%
Mid term 2	25%
Final Exam	40%

9. Course Policies

- Failure to take a test or the final exam during the assigned class period will result in a grade of zero being recorded for that test unless the student has personally contacted me and received permission to be absent from the test.
- No makeup exams will be given for the two midterms. In case a student fails to take an exam, the 25% of the final grade assigned for this midterm will be redistributed in the following manner: 10% for the other midterm (that will now count for 35% of the final grade) and 15% for the final exam (that will now count for 55% of the final grade).
- Makeup exams will be given for students who fail to attend the final exam.
- The student is responsible for all business conducted announcements made during any scheduled class period. LAU attendance policies are enforced.

10. General Comments

Homework sets will be given on a regular basis. All homeworks will be solved in class. Even though homeworks will not be graded, they are critical to learning the material and to doing well on the mid terms and final exam. Homework questions will appear regularly in drop quizzes and they may also appear in the tests. You are encouraged to discuss the homework with your colleagues.

In order to get the most out of the course, try to stay ahead. Before attending a lecture, make sure you have reviewed the material covered in the previous lectures. Read the assigned material, but at a minimum, make sure to review the transparencies handed out at lecture. This way, lectures will be much more informative and meaningful. Studying on a daily basis will be very fruitful since drop quizzes count for 10% of the final grade.

I am available at these office hours:

Office Hours: TWTH 12:30 – 01:30 or by appointment.

Office: Bassil 102.

Email: chadi.abourjeily@lau.edu.lb

Website: <http://services.sea.lau.edu.lb/faculty/carjeily/>

11. General Rules & Regulations

- A student can miss no more than 4 sessions of instruction. By the 5th session, the instructor may ask the student to drop the course.
- Plagiarism: students caught cheating on an exam receive a grade of zero on the exam in the first cheating attempt and a warning. Students caught cheating for the second time in the same course receive an F grade in the course and a second warning. A grade of zero on an exam resulting from cheating must be counted in the student's course grade. The zero cannot be dropped in computing the final grade in case the instructor has a policy of allowing students to drop their worst exam grade.
- Any student who receives 3 warnings will be suspended.