Math 212 - INQ Differential Equations
Oxford College of Emory University
Spring 2013

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Office Hours:	To be announced on Blackboard.

Course Content: First and second-order ordinary differential equations, systems of ordinary differential equations, power series solutions, applications.

Course Objectives: At the end of the course the student should:

- Be familiar with the general ideas of ordinary differential equations;
- Be able to apply the following methods to the solution of differential equations:
  - separation of variables, integrating factor, reduction of order, undetermined coefficients, variation of parameters and power series;
- Be able to solve:
  - homogeneous linear equations with constant coefficients, system of linear first-order equations, first-order exact equations;
- Be able to apply the theory to model some real-life system and/or phenomenon.
- Be able to use technology (Eg. Sage/Wolfram Alpha) to analyze solutions to differential equations and their applications.

Text: The main text will be *Elementary Differential Equations and Boundary Value Problems* by William E. Boyce & Richard C. DiPrima; but we will also be using the free online book *Differential equations and Sage*, by Marshall Hampton, found at `http://modular.math.washington.edu/home/wdj/teaching/DiffyQ/`.

Try to read the book before coming to class: believe me, this is a very useful habit.

Any additional material needed for this class will be provided in class or via Blackboard at

`https://classes.emory.edu/`

Grading Policy: Students' grades are determined by performance on problem sets, quizzes, projects, tests, and a comprehensive final exam. All tests will be administered during class time, unless special circumstances require otherwise.

Problem Sets/Quizzes	11%
INQ Projects	12%
3 Tests	54%
Final	23%
Total	100%

Maximum grade cuts are as follows:

A	B	C	D	F
90-100%	80-89.99%	70-79.99%	60-69.99%	0-59%

Plus/minus grades may be assigned for percentages near the maximum grade cuts. Also, I reserve the right to amend, append, or otherwise make changes to the plan for the course.

Homework: Homework problems from each section that we cover in the text will be provided during class time or by email. Although the homework will not be collected, a timely completion of these assignments is crucial to success in this course in addition to serving as an excellent preparation for the tests, quizzes and problem sets.

Problem sets: Due at the BEGINNING of class on the date indicated on the assignments. The problem sets will consist primarily of the assigned homework problems, but I may add additional questions from other sources. **You are allowed to receive help from anyone/anything to complete these assignments**. This means that others are allowed to explain concepts/techniques to you, and you can compare/verify your work with other students. However, you must be actively engaged in the process of completing the assigned problems. Simply copying the work of another student and submitting it as your own will result in zero credit. **All work is expected to be professionally submitted and points will be deducted for a lack of organization, illegible or sloppy work, and the inappropriate use of mathematical symbols, even if answers found are correct**.

Quizzes: An undetermined number of quizzes will be given throughout the semester. Quizzes need not be announced ahead of time. **There is no provision for making up a quiz. You will receive a zero on any missed quiz.** Grades on problem sets are treated identically to those on quizzes.

INQ Projects: Math 212 is designated as INQ course at Oxford College. As such, I have designed a set of assignments to help you learn the ways in which mathematicians pursue knowledge in our discipline. Through them you will be evaluated on your ability to demonstrate increasing self-reliance and independence in inquiring in mathematics.

They will consist of a mix of individual and group projects. In many of these projects, you will be required to write or prepare an oral report to be presented in class. They will often involve the use of the free computer algebra system *Sage*, found at `http://www.sagemath.org/`.

The first project and an introduction on how to use Sage is posted at the Blackboard website.

Tests: Will include both in-class and take home portions. Specific directions will be provided prior to the exam being given. The Oxford Honor Code applies to all tests and is **individual effort** on all portions.

⋆ Wednesday, February 13th.

⋆ Friday, March 20th.

⋆ Friday, April 26th.

Final Exam: Comprehensive with no exemptions. *Please make sure to check your final exam schedule before making any trip arrangements.*

Class Attendance: Students are responsible for all material covered in class and any changes to the syllabus that may be announced. Any conflicts between the course schedule and religious holy days are to be negotiated in advance with one's instructor. Please be on time!

Calculators: We may use a simple scientific calculator. Calculators that compute derivatives and integrals are not allowed.

Honor Code: The Honor Code of Oxford College applies to all work submitted for credit in this course. To receive credit for work submitted you must place your name on it. By placing your name on such work, you pledge that the work has been done in accordance with the given instructions and that you have witnessed no Honor Code violations in the conduct of the assignment.

Expectations: They're high! I expect that you will read the text (several times) and attempt all the assigned homework (and more). Written responses to questions should be **grammatically correct!** I welcome your comments, criticisms, and suggestions. Please feel free to stop by my office or e-mail me with any concerns or questions that you may have.

Good luck and I hope this will be an enjoyable experience for all of you!

Student work submitted as part of this course may be reviewed by Oxford College and Emory College faculty and staff for the purposes of improving instruction and enhancing Emory education.

List of Topics
Math 212
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1. Sage Notes: Introduction - Motivation
2. Section 1.3: Classification and Solutions of a DE
3. Section 2.2: IVP & Separation of Variables
4. Section 2.8: Existence and Uniqueness of solutions
5. Section 2.1: Integrating Factors
6. Section 2.6: Exact Equations
7. Sage Notes: Solutions by substitutions
8. Section 3.1: 2nd Order ODEs - Linear Homogeneous Equations
9. INQ Project: Slope Fields and Modeling with 1st order DEs
10. TEST 1
11. Section 3.2: The Wronskian and independence of solutions
12. Section 3.1, 3.3: Homogeneous Equations with Constant coefficients - Complex Roots
13. Section 3.4: Reduction of Order
14. Section 3.5: Undetermined coefficients
15. Section 3.6: Variation of Parameters
16. Section 4.1: Higher order linear ODE
17. Section 4.2: Homogeneous with constant coefficients
18. Section 4.3: Undetermined Coefficients
19. INQ Project: Euler's Method and Spring-mass models
20. TEST 2
21. Section 5.1: Power Series - Review
22. Section 5.2, 5.3: Power series solution: Ordinary points
23. Section 5.4, 5.5, 5.6: Euler Equations and Regular singular points
24. Section 7.1, 7.2 , 7.3: Algebra of Matrices
25. Section 7.4, 7.5, 7.6, 7.8: Systems of first order linear DEs
26. INQ Project: Modeling with system of linear equations
27. TEST 3

Proposed Calendar
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Monday	Tuesday	Wednesday	Thursday	Friday
Jan 14th	Jan 15th	Jan 16th **1** §Sage Notes Introduction - Motivation	Jan 17th	Jan 18th **2** §1.3 Classification and Solutions of a DE
Jan 21st *No class Martin Luther King Jr. holiday*	Jan 22nd	Jan 23rd **3** §2.2 IVP & Separation of Variables	Jan 24th	Jan 25th **4** §2.8 Existence and Uniqueness of solutions
Jan 28th **5** §2.1 Integrating Factors	Jan 29th	Jan 30th **6** §2.6 Exact Equations	Jan 31st	Feb 1st **7** §Sage notes Project 1 - Slope fields
Feb 4th **8** §Sage notes Project 1 - Slope fields	Feb 5th	Feb 6th **9** §2.6 Exact Equations & Solutions by substitutions	Feb 7th	Feb 8th **10** §Sage Notes Exact Equations & Solutions by substitutions (cont.)
Feb 11th **11** §Sage Notes Review	Feb 12th	Feb 13th **Test 1**	Feb 14th	Feb 15th **12** §3.1 2nd Order ODEs - Linear Homogeneous Equations
Feb 18th **13** §3.2 The Wronskian and independence of solutions	Feb 19th	Feb 20th **14** §3.1 Homogeneous Equations with Constant coefficients	Feb 21st	Feb 22nd **15** §3.3 Homogeneous Equations with Constant coefficients - Complex Roots

Monday	Tuesday	Wednesday	Thursday	Friday
Feb 25th **16** §3.4 Reduction of Order	Feb 26th	Feb 27th **17** §3.5 Undetermined coefficients	Feb 28th	Mar 1st **18** §3.6 Variation of Parameters
Mar 4th **19** §4.1 Higher order linear ODE	Mar 5th	Mar 6th **20** §4.2 Homogeneous with constant coefficients	Mar 7th	Mar 8th **21** **Last day for dropping.** §4.3 Undetermined Coefficients
Mar 11th *Spring Break*	Mar 12th *Spring Break*	Mar 13th *Spring Break*	Mar 14th *Spring Break*	Mar 15th *Spring Break*
Mar 18th **22** §Sage Notes Review	Mar 19th	Mar 20th **Test 2**	Mar 21st	Mar 22nd **23** §5.4 Cauchy-Euler Equation
Mar 25th **24** §5.1 Review Power Series	Mar 26th	Mar 27th **25** §5.1 - 5.2 Power Series Solutions	Mar 28th	Mar 29th **26** §5.2 - 5.3 Power Series Solutions - Ordinary Points
Apr 1st **27** §5.4 Power Series Solutions - Singular Points	Apr 2nd	Apr 3rd **28** §5.5 Power Series Solutions - Regular Singular Points	Apr 4th	Apr 5th **29** **Freshmen withdraw.** §5.6 Power Series Solutions - Frobenius Method
Apr 8th **30** §7.1 Introduction to System of 1st order Linear Equations	Apr 9th	Apr 10th **31** §7.2 Matrices - Review	Apr 11th	Apr 12th **32** §7.3 Linear Algebraic Equations - Eigenvalues and Eigenvectors

Monday	Tuesday	Wednesday	Thursday	Friday
Apr 15th **33** §7.4 - 7.5 Basic Theory of systems of linear DEs	Apr 16th	Apr 17th **34** §7.6 System of linear DEs - Complex Eigenvalues	Apr 18th	Apr 19th **35** §7.8 System of linear DEs - Repeated Eigenvalues
Apr 22nd **36** §7.8 System of linear DEs - Repeated Eigenvalues	Apr 23rd	Apr 24th **37** §Sage Notes Review	Apr 25th	Apr 26th **Test 3**
Apr 29th **38** **Last day of classes.** Review and goodbye	Apr 30th *Reading Day*	May 1st	May 2nd	May 3rd