SYLLABUS FALL 2013

The University of Iowa
The College of Liberal Arts and Sciences
Department of Mathematics

Title of Course: 22M:034:132 (MATH:2560:0132) Engineering Math IV: Differential Equations

Building: MLH, Room Number: 105
Website address: http://homepage.math.uiowa.edu/~ichifan/index.html

Some of the policies relating to this course (such as the drop deadline) are governed by its administrative home, the College of Liberal Arts and Sciences, 120 Schaeffer Hall.

Instructor: Prof. Ionut Chifan
Office location and hours: MLH 25L; MF 3:30-5:00pm and by appointment
Phone: 319-335-0760
E-mail: ionut-chifan@uiowa.edu

DEO Contact Information:	Dan Anderson, 14 MLH, dan-anderson@uiowa.edu
Course Coordinator:	Oguz Durumeric, Director of Undergraduate Studies, Mathematics
Office and hours:	B20F MLH; Mon and Wed 10:30-11:20, Thu 9:30-10:20 or by appointment
Phone and e-mail:	335-0774 and oguz-durumeric@uiowa.edu

Description of Course: Ordinary differential equations and applications, with integrated use of computing, student projects; first-order equations; higher order linear equations; systems of linear equations, Laplace transforms; introduction to nonlinear equations and systems, phase plane, stability.

Objectives and Goals of the Course: Be able to identify and solve the following types of differential equations:
- First order linear equations including the method of integrating factors. Nonlinear equations, in particular separable, and exact equations.
- Second order linear constant coefficient equations, both homogeneous and nonhomogeneous. This includes methods of characteristic equations, undetermined coefficients, and variation of parameters.
- Generalization of the techniques for second order to higher order linear constant coefficient equations, both homogeneous and nonhomogeneous.
- Laplace transform methods, including solutions of second order problems with discontinuous forcing and impulse response.
- Systems of first order linear constant coefficient equations, both homogeneous and nonhomogeneous. This includes solutions of homogeneous problems using eigenvalues as well as extensions of the methods of undetermined coefficients and variation of parameters for nonhomogeneous problems. Equilibria and stability, phase plane dynamics for two dimensional systems.

Required Text: Boyce and DiPrima: Elementary Differential Equations and Boundary Value Problems, 10th edition. One can acquire the main textbook by one of the following three ways:

- **Hard cover,   ISBN: 978-0-470-45831-0**
- **E-book,   ISBN: 978-1-118-54397-9**
- **Binder version, ISBN: 978-0-118-15738-1**

Optional Text: Student Solutions Manual for Elementary Differential Equations and Boundary Value Problems, by Boyce and DiPrima, 10th edition: **ISBN: 978-0-470-45833-4**

All are available in the University Bookstore and Iowa Book and Supply; and hard cover by Amazon and many other possibilities for online purchases.

<u>**MATERIAL TO BE COVERED:**</u> Boyce and DiPrima. Elementary Differential Equations and Boundary Value Problems. 10Th Edition. Chapters 1-4, 6-7 and (time permitting) 9.

- Chapter1: (1.1-1.3) Introduction to differential equations, direction fields.
- Chapter2: (2.1-2.8) First order equations. Method of integrating factors for linear equations. Separable equations. Applications including well stirred tanks, compound interest, exponential growth and decay, velocity and acceleration, RC circuits, and population dynamics. Existence and uniqueness of solutions. Autonomous equations, equilibria and stability. Exact equations. Euler's method.
- Chapter3: (3.1-3.8) Second order linear constant coefficient equations. Characteristic equations with real, complex and repeated roots. Existence and uniqueness. Principle of superposition and the Wronskian. Reduction of order. Undetermined coefficients and variation of parameters. Applications including spring mass systems, acceleration problems, and LRC circuits.
- Chapter4: (4.1-4.4) Higher order equations are covered briefly to extend the theory and methods of second order equations.
- Chapter6: (6.1-6.6) Laplace transforms. Using Laplace transforms to solve second order linear initial value problems. Discontinuous forcing and impulse responses.
- Chapter7: (7.1-7.9) Homogeneous linear systems with constant coefficients including real, complex and repeated eigenvalues. Applications including mass-spring systems and parallel LRC circuits. Phaseplanes, equilibria and stability. Nonhomogeneous systems.
- Chapter9: (9.1-9.4) Phaseplanes, equilibria, nullclines, stability. Locally linear systems. Competing species.

Course Policies:
Course attendance: Students are expected to attend every class. More than 4 absences will affect your grade. If you miss a class, you are responsible for any assignments/announcements made/material covered.

Participation in class discussions: I strongly encourage you to actively participate in class discussions; ask questions or ask for more explanations whenever you feel confused; in this class there is NO stupid question! Also, as a general rule, for each lecture you should spend at least two hours on reading/homework/repeating the material, etc. You should start working over the homework problems right after the relevant sections are covered. If you encounter difficulties I strongly recommend you seek help immediately! Do NOT postpone it until one day before the exam! Also remember this: small deficiencies at the beginning tend to rapidly grow into big ones.
Homework are going to announced weekly, and brought to class and no late homework will be accepted. Homework will be assigned by Mondays, and usually due the following Mondays.
Quizzes will be given on Fridays approximately every other week.

Cell phones policy: I am expecting you to NOT use your cell phones, i-pads, or computers during the lecture time for other purposes than class related.

Complaint procedure: Any student having a problem with the course should contact the instructor. Most issues can be resolved with a straightforward discussion.

Other course resources: There is **no TA** for this course and help is not available through the Math Tutorial Lab. You are **strongly encouraged** to go to your lecturer's office hours for additional help as needed. If you have conflicts with the listed office hours, make an appointment for additional office hours.

Grades: Plus/minus grading will be used.

       40%   2 midterms
       30%   Final exam
       10%   5-6 Quizzes
       20%   Homework
       +/- 5% Attendance and class participation

ALL EXAMS ARE COMPREHENSIVE, unless specified otherwise.

Grade cuts and Grade Distribution: Two midterms and the final exam are going to be common exams for all sections, and they will be curved together following the grade distribution for intermediate level courses recommended by College of Liberal Arts and Sciences as much as possible.

EXAM DATES:

MIDTERM 1: Wednesday October 2, 2013, 6:30-8:00 pm, MH Auditorium

MIDTERM 2: Wednesday November 6, 2013, 6:30-8:00 pm, MH Auditorium

FINAL EXAM: The final examination schedule for each class is announced by the Registrar generally by the tenth day of classes. Final exams are offered only during the official final examination period. **No exams of any kind are allowed during the last week of classes.** All students should plan on being at the UI through the final examination period. Once the Registrar has announced the date, time, and location of each final exam, the complete schedule will be published on the Registrar's web site and will be shared with instructors and students. It is the student's responsibility to know the date, time, and place of the final exam.

TENTATIVE TIMETABLE:

Week1: Go over syllabus. Chapter 1.1-1.3, Start 2.1 on Friday (Week 2 has only 2 meetings)

Week2: First order equations. Chapter 2.2-2.3

Week3: More first order equations Chapter 2.4-2.6

Week4: Finish first order equations Chapter 2.7-2.9

Week5: Second order linear equations Chapter 3.1-3.3

Exam 1: Chapters 1 and 2. Wed of the 6th week

Week6: Wednesday Review; More second order Chapter 3.4-3.5

Week7: Finish second order techniques. Applications of second order equations Chapter 3.6-3.8

Week8: Higher order equations Chapter 4.1-4.4 Very briefly.

Week9: Laplace Transforms Chapter 6.1-6.3

Week10: More Laplace Transforms Chapter 6.4-6.6

Exam 2: Chapters 1, 2, 3, 4 and 6 Wed of the 11th week

Week11: Wednesday Review; Intro to systems, review Linear Algebra Chapter 7.1-7.3

Week12: Solving systems Chapter 7.4-7.5

Week13: Finish systems Chapter 7.6-7.9

Thanksgiving Break

Week14: Nonlinear systems Chapter 9.1-9.3

Week15: Applications of nonlinear systems Chapter 9.4; Review and wrap up.

Final exam will be comprehensive: Chapters 1, 2, 3, 4, 6, 7 and 9

Rules on Student Collaboration: In this class, students are allowed to talk with others about homework. However, do not share your written work with others or ask others to see their completed assignments since both are considered academic misconduct. In other words, you can discuss a problem with other students, but you write your solution alone. If you worked/discussed a problem with others, you must state their names on your homework before the beginning of that problem, even if you wrote the solution yourself. HWs showing duplication will be considered as the result of academic dishonesty. If you need help, please stop by during my office hours. Students are responsible for understanding this policy; if you have questions, ask for clarification.

UI and CLAS Policy & Procedures:

Teaching Policies & Resources — Syllabus Insert

Administrative Home

The College of Liberal Arts and Sciences is the administrative home of this course and governs matters such as the add/drop deadlines, the second-grade-only option, and other related issues. Different colleges may have different policies. Questions may be addressed to 120 Schaeffer Hall, or see the CLAS Academic Policies Handbook at http://clas.uiowa.edu/students/handbook.

Electronic Communication

University policy specifies that students are responsible for all official correspondences sent to their University of Iowa e-mail address (@uiowa.edu). Faculty and students should use this account for correspondences (Operations Manual, III.15.2, k.11).

Accommodations for Disabilities

A student seeking academic accommodations should first register with Student Disability Services and then meet privately with the course instructor to make particular arrangements. See www.uiowa.edu/~sds/ for more information.

Academic Honesty

All CLAS students or students taking classes offered by CLAS have, in essence, agreed to the College's Code of Academic Honesty: "I pledge to do my own academic work and to excel to the best of my abilities, upholding the IOWA Challenge. I promise not to lie about my academic work, to cheat, or to steal the words or ideas of others; nor will I help fellow students to violate the Code of Academic Honesty." Any student committing academic misconduct is reported to the College and placed on disciplinary probation or may be suspended or expelled (CLAS Academic Policies Handbook).

CLAS Final Examination Policies

The final examination schedule for each class is announced by the Registrar generally by the tenth day of classes. Final exams are offered only during the official final examination period. **No exams of any kind are allowed during the last week of classes.** All students should plan on being at the UI through the final examination period. Once the Registrar has announced the date, time, and location of each final exam, the complete schedule will be published on the Registrar's web site and will be shared with instructors and students. It is the student's responsibility to know the date, time, and place of a final exam.

Making a Suggestion or a Complaint

Students with a suggestion or complaint should first visit with the instructor (and the course supervisor), and then with the departmental DEO. Complaints must be made within six months of the incident (CLAS Academic Policies Handbook).

Understanding Sexual Harassment

Sexual harassment subverts the mission of the University and threatens the well-being of students, faculty, and staff. All members of the UI community have a responsibility to uphold this mission and to contribute to a safe environment that enhances learning. Incidents of sexual harassment should be reported immediately. See the UI Comprehensive Guide on Sexual Harassment for assistance, definitions, and the full University policy.

Reacting Safely to Severe Weather

In severe weather, class members should seek appropriate shelter immediately, leaving the classroom if necessary. The class will continue if possible when the event is over. For more information on Hawk Alert and the siren warning system, visit the Department of Public Safety website