

# MTH 279—Ordinary Differential Equations

## Spring 2009

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### **I. Course Description**

Introduces ordinary differential equations. Includes first order differential equations, second and higher order ordinary differential equations with application. Designed for mathematical, physical, and engineering science programs.

### **II. Prerequisites**

MTH 176 and 177 (Calculus of one variable I and II) or equivalent.

### **III. Specific Objectives**

For the following chapters, the student should be able to:

1. Classify a differential equation as linear or nonlinear.
2. Understand and create a directional field for an arbitrary differential equation.
3. Determine the order, linearity or nonlinearity, of a differential equation.
4. Solve linear first order differential equations.
5. Solve Separable differential equations.
6. Solve applications of differential equations as applied to Newton's Law of cooling, population dynamics, mixing problems, and radioactive decay.
7. Solve applications of differential equations as related to mechanical problems.
8. Solve differential equations using Euler's Method.
9. Solve second order linear homogeneous differential equations.
10. Determine the Fundamental solution set for a linear homogeneous equation.
11. Calculate the Wronskian.
12. Applications of the Wronskian in differential equations.
13. Solve second order linear differential equations with complex roots.
14. Solve second order linear differential equations with repeated roots.
15. Use the method of Reduction of order.
16. Solve nonhomogeneous differential equations using the method of undermined coefficients.
17. Solve nonhomogeneous differential equations using the method of variation of parameters.
18. Solve mechanical and electrical vibration problems.
19. Solve differential equations involving forced vibrations.
20. Solve homogeneous linear differential equations of higher order.
21. Solve nonhomogeneous linear differential equations of higher order.

22. Apply the rules of matrices to solving systems of equations.
23. Set up linear differential equations as a Linear First Order system of Equations.
24. Given a linear first order system of differential equations determine the eigenvalues.
25. Given a linear first order system of differential equations determine the eigenvectors.
26. Solve a linear system of equations with complex eigenvalues, and repeated eigenvalues.
27. Determine the fundamental matrix of a system of equations.
28. Solve the nonhomogeneous linear system using the variation of parameters.
29. Use the Euler or tangent line method to find an approximate solution to a linear differential equation.
30. Determine the errors on numerical procedures.
31. Use the improved Euler Method to determine an approximate solution to a linear differential equation.
32. Use the Runge-Kutta Method to determine an approximate solution to a linear differential equation.

#### **IV. Instructional Procedures**

Instruction will be primarily through lecture, making ample use of the blackboard, overhead projection system and IBM computers with Matlab software. Tests and exams are considered as an instructional device as well as a measurement device; questions will be geared toward forcing students to think for themselves and to tie together the facts and concepts presented in class. Interaction with the class is considered a valuable aid to instruction; therefore, questions and comments from students will frequently be solicited. The attempt is made to make lecture content as relevant and interesting to students as possible.

#### **V. Instructional Materials**

Textbook: W. Kohler and L. Johnson, Elementary Differential, 2<sup>nd</sup> Edition  
Calculator: Ti86 or 89 recommended  
Software: None

#### **VI. Homework and Quizzes**

Giving your best effort on homework is the single best thing you can do to help you learn mathematics. There will be at least one homework quiz every week. The homework quiz will consist of one problem from the homework assigned the previous class.

## **VII. Evaluation Criteria and Grading Scale**

The grade for this course will be derived from the quizzes, three tests and a final.

Quizzes	15%
Tests	60%
Final	25%

There will be no make-up tests. The final exam grade will be substituted for the lowest test grade if it improves your average.

Letter grades will be assigned based on your final percentage as follows:

90 – 100	=	A
80 – 89	=	B
70 – 79	=	C
60 – 69	=	D
0 – 57	=	F

Note: I do not curve grades. I do not “give” grades. You earn what you get, so plan to work accordingly.

## **VIII. E-mail Policy**

If you send me an e-mail, you should include a **descriptive** subject line. Please remember to use complete sentences and follow the rules of grammar. Do not expect a prompt reply to your e-mails concerning last minute questions about an exam the next day.

## **IX. Withdrawal Policy**

### **Student Initiated Withdrawal Policy:**

A student may drop or withdraw from a class without academic penalty during the first sixty percent (60%) of the session. For purposes of enrollment reporting, the following procedures apply:

- a. If a student withdraws from a class prior to the termination of the add/drop period for the session, the student will be removed from the class roll and no grade will be awarded.
- b. After the add/drop period, but prior to completion of sixty percent (60%) of a session, a student who withdraws or is withdrawn from a course will be assigned a grade of “W”
- c. After that time, if a student withdraws from a class, a grade of “F” will be assigned.

A student may be awarded, retroactively, a grade of “W”, if and only if, the student would have been eligible under the previously stated policy to receive a “W” on the last date that he/she attended class.

1. The student must appeal for a grade of “W” based on attendance.
2. The admissions and Records staff will collect the relevant documentation for the appeal, including the last date of attendance, from the instructor of the course that is being appealed and other relevant documentation when mitigating circumstances are to be considered. For an appeal related to a distance education course (IDL), the last date that the work was submitted will be considered the last date of attendance.
3. All relevant documentation will be reviewed by the Director of Student Development and the withdrawal policy strictly applied in determination of changing the grade to “W”.
4. If the student ceased attending class during the first 60% of the semester, a grade of “W” will be given. If the last date of attendance falls beyond the sixty percent mark, the student must demonstrate mitigating circumstances and must have been passing before a grade of “W” will be awarded.
5. Appeals asserting mitigating circumstances must be further reviewed by and a determination made by a committee of faculty appointed by the Dean of Instruction and Student Services.

A grade of withdrawal implies that the student was making satisfactory progress in the class at the time of withdrawal, or that the withdrawal was officially made before the deadline date published in the college calendar, or that the student was administratively transferred to a different program.

### **Instructor Initiated Withdrawal Policy**

A student who adds a class or registers after the first day of class is counted absent from all class meetings missed. Each instructor is responsible for keeping a record of student attendance in each class.

Students who have not attended class by the last day to drop class and receive refund must be deleted by the instructor during the following week. No refund will be applicable.

When a student’s absences equal twice the number of weekly meetings of a class, the student may be dropped for unsatisfactory attendance in the class by the instructor.

When an instructor determines that absences constitute unsatisfactory attendance, a Faculty Withdrawal Form should be completed and submitted to the Admissions

and Records Office. The last date of attendance must be documented. A grade of “W” will be recorded during the first sixty percent (60%) period of the course. Students withdrawn after the sixty percent (60%) period will receive a grade of “F” except under mitigating circumstances, which must be documented. A copy of this documentation must be placed in the student’s academic file.

The student will be notified of the withdrawal by the Admissions and Records Office. An appeal for reinstatement into the class may be approved only by the instructor.

#### **X. Cheating**

The giving or receiving of any help on any graded portion (computer or written) of the course is considered cheating and will not be tolerated. Any student found cheating will receive a grade of “0” on that portion and possibly and “F” for the course. This “0” will not be replaced by the final exam score. When you are doing a computer Evaluate you are not allowed to use your book or notebook.

#### **XI. DIVERSITY STATEMENT**

The NRCC community values the pluralistic nature of our society. We recognize diversity including, but not limited to, race, ethnicity, religion, culture, social class, age, gender, sexual orientation and physical or mental capability. We respect the variety of ideas, experiences and practices that such diversity entails. It is our commitment to ensure equal opportunity and to sustain a climate of civility for all who work or study at NRCC or who otherwise participate in the life of the college.

#### **XII. DISABILITY STATEMENT**

If you are a student with a documented disability who will require accommodations in this course, please register with the Disability Services Office located in the Counseling Center in Rooker Hall for assistance in developing a plan to address your academic needs.

#### **XIII. Additional Information:**

- Any student with special needs or circumstances should feel free to meet with me during office hours.
- I will be happy to schedule a time to help you with this course at times other than my scheduled office hours. The best way to get in touch with me is via email.

