Ordinary Differential Equations
Spring 2012
MATH 365.01 (3 credits), Tu_Th, 11:00AM-12:15PM, Wickersham 112

Prerequisites: A grade of C- or better in MATH 311 (*Calculus III*) is the prerequisite for this course.[1]

Instructor: Dr. Buchanan
Office: Wickersham 217-1, Phone: 872-3659, FAX: 871-2320
Office Hours: 10:00AM-11:00AM (M–F), or by appointment
Email: Robert.Buchanan@millersville.edu
Course URL: http://banach.millersville.edu/~bob/math365/

Textbook: *Elementary Differential Equations and Boundary Value Problems*, 9th edition, William E. Boyce and Richard C. DiPrima, John Wiley & Sons, Inc., New York, 2009, ISBN: 978-0-470-38334-6

Objectives: MATH 365 provides an introduction to ordinary differential equations and their applications. Upon completion of this course the student will:

- be able to solve a variety of ordinary differential equations,
- appreciate the theory underlying the techniques of solution,
- be conversant with methods of applying ordinary differential equations in various applications.

Course Contents: Topics covered in this course may include the following.

- First order ordinary differential equations
  - Linear equations with variable coefficients
  - Separable equations
  - Modeling with first order equations
  - Autonomous equations and population dynamics
  - Exact equations and integrating factors
  - Existence and uniqueness theory
- Linear differential equations of second order
  - Homogeneous equations with constant coefficients
  - Fundamental solutions of linear homogeneous equations
  - Linear independence and the Wronskian
  - Complex roots of the characteristic equation
  - Repeated roots; reduction of order
  - Non-homogeneous equations; method of undetermined coefficients
  - Variation of parameters
  - Mechanical and electrical vibrations

[1] Previously *Calculus III* was numbered as MATH 261.

  - Forced vibrations
- Series solutions of second order linear equations
  - Series solutions near an ordinary point
  - Regular singular points
  - Euler equations
  - Series solutions near a regular singular point
  - Bessel's equation
- The Laplace transform
  - Definition of the Laplace transform
  - Solution of initial value problems
  - Step functions
  - Differential equations with discontinuous forcing
  - Impulse functions
  - The convolution integral
- Systems of first order linear equations
  - Review of matrices
  - Systems of linear algebraic equations; linear independence, eigenvalues, eigenvectors
  - Basic theory of systems of first order linear equations
  - Homogeneous linear systems with constant coefficients
  - Complex eigenvalues
  - Fundamental matrices
  - Repeated eigenvalues

If time permits other topics may be covered as well.

Attendance: Students are expected to attend all class meetings per the University Approved Guidelines. If you know beforehand that you will be absent from class on the day an assignment is due, you must complete and hand in the assignment prior to the absence. If you are unexpectedly absent the day that an assignment is due you must hand in the assignment at the beginning of the class hour on the first day that you return to class. If you know you will be absent on the day of a test, you must notify me before the time the test is scheduled in order to schedule a make-up test. Students who miss a test should provide a valid excuse, otherwise you will not be allowed to make up the test. No final exam exemptions.

Homework: Students are expected to do their homework and participate in class. Students should expect to spend a minimum of three hours outside of class on homework and review for every hour spent in class. Homework exercises help students review and reinforce concepts covered in class. The textbook exercises are arranged in generally increasing level of difficulty. Working only the low-numbered exercises will not prepare a student sufficiently for the test and final examination exercises. All assigned homework exercises must be worked until successful completion.

Throughout the semester, homework problems from sources outside the textbook will be assigned for presentation in front of your peers and grading. Typically once per week 25–30

minutes of class time will be given to students presenting their exercises and solutions to the class. Volunteers will be given first choice of exercises, but all students will be expected to present the same quantity of exercises by the end of the semester. This parity condition may require calling on some students to present exercises. Exercises will be graded on a scale of 0–4.

0: student absent when called on or unable to begin exercise.

1: student able to begin exercise only (may choose to complete exercise at a future class meeting).

2: student able to partially complete exercise, though portions of the solution are missing or unjustified.

3: student able to complete exercise, though some details of the solution are missing or unjustified.

4: student able to complete exercise with all details presented and full justification.

Tests: There will be three 75-minute in-class tests and a final examination. The tests are tentatively scheduled for

- Thursday, February 16, 2012
- Tuesday, March 27, 2012
- Thursday, April 26, 2012

The comprehensive final examination is scheduled for Monday, May 7, 2012 from 2:45PM–4:45PM. I will not "curve" test or exam grades.

Grades: Course grade will be calculated as follows.

Tests	55%
Homework	20%
Exam	25%

Tests and the final examination will be graded individually on a 100-point scale. I keep a record of students' test, homework, and exam scores. Students should also keep a record of graded assignments, tests, and other materials. As an example of the calculation of the numerical course grade, suppose a student's three test grades were 87, 78, and 65 (out of a maximum of 100 points on each test), the student's final examination grade was 71 (again, out of a maximum of 100), and five homework exercises were presented yielding grades of 3/4, 2/4, 3/4, 4/4, and 3/4. This student's test average is $76.\overline{6}$. The homework grade is calculated as

$$20 \cdot \frac{\frac{3}{4} + \frac{2}{4} + \frac{3}{4} + \frac{4}{4} + \frac{3}{4}}{5} = 15.$$

The student's numerical course grade is then

$$(76.\overline{6})(0.55) + 15 + (71)(0.25) = 74.92.$$

For the purposes of determining the final grade, any fraction is rounded up to the nearest whole number.

The course letter grade will be assigned as follows. I will not "curve" course grades.

90-92	A−	93-100	A		
80-82	B−	83-86	B	87-89	B+
70-72	C−	73-76	C	77-79	C+
60-62	D−	63-66	D	67-69	D+
		0-59	F		

Course Repeat Policy An undergraduate student may not take an undergraduate course of record more than three times. A course of record is defined as a course in which a student receives a grade of A, B, C, D, (including + and −) F, U, Z or W. The academic department offering a course may drop a student from a course if the student attempts to take a course more than three times.[2]

The last day to withdraw from a course (and receive the W grade) is April 6, 2012.

Inclement Weather Policy: If we should miss a class day due to a school delay or cancellation, any activities planned for that missed day will take place the next time the class meets. For example, if a test is scheduled for a day that class is canceled on account of snow, the test will be given the next time the class meets.

Final Word: Mathematics is not a spectator sport. What you learn from this course and your final grade depend mainly on the amount of work you put forth. Daily contact with the material through homework assignments and review of notes taken during lectures is extremely important. Organizing and conducting regular study sessions with other students in this class will help you to understand the material better.

No one can guarantee you success in this course. Your responsibilities and the instructor's expectation are outlined above. There will be no second chances, "do-overs", or extra credit assignments.

[2]Memorandum to mathematics faculty from Dr. Charles G. Denlinger, Assistant Chair, Department of Mathematics, August 30, 2004.