Tompkins Cortland Community College

Master Course Syllabus

Course Discipline and Number: MATH 206 **Year: 2024-2025**
Course Title: Differential Equations **Credit Hours: 4**

Attendance Policy: *To maintain good grades, regular attendance in class is necessary. Absence from class is considered a serious matter and absence never excuses a student from class work. It is the responsibility of all instructors to distribute reasonable attendance policies in writing during the first week of class. Students are required to comply with the attendance policy set by each of their instructors. Students are not penalized if they are unable to attend classes or participate in exams on particular days because of religious beliefs, in accordance with Chapter 161, Section 224-a of the Education Law of the State of New York. Students who plan to be absent from classroom activity for religious reasons should discuss the absence in advance with their instructors. See college catalog for more information.*

Services for Students with Disabilities: *It is the College's policy to provide, on an individual basis, appropriate academic adjustments for students with disabilities, which may affect their ability to fully participate in program or course activities or to meet course requirements. Students with disabilities should contact the Coordinator of Access and Equity Services, to discuss their particular need for accommodations. All course materials are available in alternate formats upon request.*

Course Description

An introduction to solution methods for ordinary differential equations and partial differential equations. Topics include separable equations, exact equations, linear equations, numerical approximations, reduction of order, undetermined coefficients, Cauchy-Euler equations, variation of parameters, power series solutions, Laplace transforms, unit step function, Dirac delta, and introduction to partial differential equations. Applications discussed include orthogonal trajectories, growth and decay, springs, beams, heat flow, and the wave equation. MATH 206 fulfills the SUNY General Education Mathematics requirement. Prerequisites: C or better grade in MATH 203, or B or better grade in MATH 202, or equivalent; RDNG 116 if required by placement testing; prior completion or concurrent enrollment in ENGL 100. 4 Cr. (4 Lec.) Spring semester.

Course Context/Audience

Required in the engineering science degree program, students studying physics, computer science, or another technical field may find the course helpful, both in other courses at this college, and at their transfer institution.

Basic Skills/Entry Level Expectations

Writing: WC College level writing skills are required. See course co-requisites or pre-requisites.

Math: MC College level math skills – Course requires college level math skills. See course description for co-requisite and/or prerequisite requirement(s).

Reading: R4 Before taking this course, students must satisfactorily complete RDNG 116 or have assessment indicating that no reading course was required.

Course Goals

By successfully completing this course, the student will

1. Learn what a differential equation is and what it means to solve it;

2. Learn the basic classical methods for solving first order differential equations and second order linear differential equations;

3. Learn to apply Laplace transforms to solve beam problems and spring problems not easily handled by classical methods;

4. Learn how to apply separation of variables to solve the heat and wave equations.

Course Objectives/Topics

Objective/Topic	# Hours
Unit I: First order differential equations - The student will: 1. Understand what a differential equation is and what it means to solve it; 2. Understand that exact equations form the theoretical basis for the classical methods of solving first order differential equations, and be able to solve exact equations; 3. Understand the concept of integrating factor, and be able to use integrating factors to solve first order linear differential equations; 4. Be able to solve first order separable differential equations; 5. Be able to use first order differential equations to solve orthogonal trajectories, growth and decay, and other applied problems; 6. Understand that a given initial value problem may not have a unique solution or any solution; 7. Understand that even when a solution exists, a given initial value problem may not have an exact solution, and that it must be solved by graphical or numerical approximation methods.	16 Hours
Unit II: Second order linear differential equations--classical methods - The student will: 1. Understand that second order linear differential equations can be solved by adding together partial solutions to form complete solutions; 2. For a second order homogenous linear differential equation, know how to find a second solution, knowing a first solution; 3. Know how to solve homogenous linear differential equations with constant coefficients using the auxiliary equation method; 4. Understand when and how to solve second order non-homogeneous linear differential equations by the method of undetermined coefficients. Also understand how the equation can be deduced from the solution for simple examples of this type of problem; 5. Understand what second order linear differential equations can be used to model spring problems and electrical circuit problems; 6. Understand that the method of variation of parameters can be used to solve non-homogeneous linear differential equations as long as the complementary solution is known; 7. Know how to solve second order Cauchy-Euler equations; 8. Know how to solve second order homogeneous linear differential equations having polynomial coefficients and for which x = 0 is an ordinary point by using power series. (Optional topic)	16 Hours
Unit III: Laplace transforms - The student will: 1. Know how to use the definition of Laplace transform to find the transform of functions; 2. Know how to write the Laplace transform of the derivatives of an unknown function, y, up to 4th order; 3. Understand how to manipulate table formulas to find inverse Laplace transforms; 4. Understand, and be able to use, the unit step function and the Dirac delta function; 5. Be able to use Laplace transforms to solve spring problems and beam problems, particularly those that involve the unit step function or the Dirac delta function.	16 Hours
Unit IV: Partial differential equations - The student will: 1. Understand the concepts of a partial differential equation and a boundary-value problem; 2. Be able to solve partial differential equations by direct integration; 3. Understand the method of separation of variables for solving boundary-value problems; 4. Be able to solve the heat equation and the wave equation for cases that do not require Fourier series.	12 Hours

General Education Goals - Critical Thinking & Social/Global Awareness

CRITICAL THINKING OUTCOMES	HOW DOES THE COURSE ADDRESS THE OUTCOMES (Include required or recommended instructional resources, strategies, learning activities, assignments, etc., that must or could be used to address the goal/outcomes)
Students will be able to ➢ develop meaningful questions to address problems or issues.	Students learn to solve higher level mathematics/engineering problems via various techniques. Lecture, examples, drill.
➢ gather, interpret, and evaluate relevant sources of information.	Students learn that calculators can give erroneous results.
➢ reach informed conclusions and solutions.	Students need to consider the reasonableness of their solutions, “Does the answer make sense?”

consider analytically the viewpoints of self and others.	
SOCIAL/GLOBAL AWARENESS OUTCOMES	**HOW DOES THE COURSE ADDRESS THE OUTCOMES** (Include required or recommended instructional resources, strategies, learning activities, assignments, etc., that must or could be used to address the goal/outcomes)
➢ Students will begin to understand how their lives are shaped by the complex world in which they live.	Smart phone apps can be used by students and are more readily available than computer software programs.
Students will understand that their actions have social, economic and environmental consequences.	Cheating is discussed.

Instructional Methods
The usual instruction mode should be lecture

Methods of Assessment/Evaluation

Method	% Course Grade
Four unit exams	75-100%
Final exam may be treated as optional and used only to raise a student's course grade	0-25%

Text(s)

Differential Equations withBoundary-Value Problems, Dennis G. Zill andWarren Wright, 8th Edition, © 2013 Thomson Learning, Brooks Cole

Bibliography
Available in the TC3 library:

Schaum's Easy Outline of Differential Equations

Rainville and Bedient, Elementary Differential Equations

Other Learning Resources

Audiovisual No resources specified
Electronic DERIVE computer software MatLab Computer program
Other No resources specified