Differential Equations
MATH 230
Fall 2015

This course is an introductory study of ordinary differential equations of the first and higher orders. Topics include linear differential equations with constant coefficients, power series solutions, Fourier Series solutions, Laplace transforms, higher-order forced linear equations with constant coefficients, and applications with numerical methods. Prerequisite: C- or higher in MATH 222 Calculus II; waiver by placement testing results; or departmental approval.

COURSE OUTCOMES	OUTCOMES ACTIVITIES
At the end of this course, students will be able to:	
Demonstrate an understanding of the basic properties of differential equations.	1. Classify a differential equation as an ordinary differential equation or a partial differential equation. (CT, QS, R) 2. Classify a differential equation as linear or nonlinear. (CT, QS, R) 3. Identify the order of a differential equation. (CT, QS, R) 4. Classify a solution to a differential equation as explicit or implicit. (CT, QS, R) 5. Identify solutions to differential equations as general solutions or solutions satisfying specific initial conditions (initial value problems). (CT, QS, R)
Demonstrate an understanding of various techniques used to solve first order differential equations.	1. Examine the existence and uniqueness theorem for initial value problems involving first order differential equations. (CT, QS, R) 2. Solve first order differential equations by direct integration. (CT, QS, R) 3. Solve first order differential equations by separation of variables. (CT, QS, R) 4. Solve first order linear differential equations. (CT, QS, R) 5. Solve exact first order differential equations. (CT, QS, R) 6. Use substitution and transformation to solve first order differential equations. (CT, QS, R)

Demonstrate an understanding of various techniques used to solve linear differential equations of higher order.	1. Examine the existence and uniqueness theorem for initial value problems involving higher order linear differential equations. (CT, QS, R) 2. Examine the representation of solutions to higher order linear differential equations in both the homogeneous and non-homogeneous cases. (CT, QS, R) 3. Solve homogeneous linear equations of higher order with constant coefficients. (CT, QS, R) 4. Solve linear differential equations of higher order using the method of undetermined coefficients. (CT, QS, R) 5. Solve linear differential equations of higher order using the method of variation of parameters. (CT, QS, R)
Demonstrate an understanding of the Laplace transform.	1. Find the Laplace transform of a function using the definition. CT, QS, R) 2. Use the properties of the Laplace transform and a table to find the Laplace transform of a given function. (CT, QS, R) 3. Find the inverse Laplace transform of a function. (CT, QS, R) 4. Solve initial value problems using Laplace transforms. (CT, QS, R) 5. Find Laplace and inverse Laplace transforms for discontinuous and periodic functions. (CT, QS, R) 6. Examine impulses and the Dirac delta function. (CT, QS, R)
Demonstrate an understanding of series solutions to differential equations.	1. Determine singular points of a differential equation and classify them as regular or irregular. (CT, QS, R) 2. Find power series solutions to linear differential equations. (CT, QS, R) 3. Use the method of Frobenius to find series solutions to differential equations about a regular singular point. (CT, QS, R) 4. Finding general solutions of a given equation using Bessel functions. (CT, QS, R)
Demonstrate an understanding of the techniques used to solve linear systems of differential equations.	1. Solve a linear system of differential equations using the method of elimination. (CT, QS, R) 2. Solve a homogeneous linear system of differential equations with constant coefficients using eigenvalues/eigenvectors. (CT, QS, R) 3. Solve a non-homogeneous linear system of differential equations. (CT, QS, R)

Solve various applied and numerical problems involving differential equations.	1. Solve applied problems involving motion with variable acceleration. (CT, QS, R, TS) 2. Solve applied problems involving forced oscillation and resonance. (CT, QS, R, TS) 3. OPTIONAL: Use Euler's method to approximate solutions to initial value problems involving first order differential equations. (CT, QS, R, TS) 4. OPTIONAL: Use the Runge-Kutta method to approximate solutions to differential equations. (CT, QS, R, TS)
OPTIONAL: Demonstrate an understanding of introductory techniques used to solve partial differential equations.	1. Solve heat flow problems using the method of separation of variables. (CT, QS, R) 2. Solve vibrating string problems using the method of separation of variables. (CT, QS, R)
Strengthen Core Competencies** in order to increase success in this and other courses and in the workplace.	Referenced above.

**Indicate the Core Competencies that apply to the outcomes activities and assessment tools: Critical Thinking (CT); Technology Skills (TS); Oral Communications (OC); Quantitative Skills (QS); Reading (R); Writing (W).