COURSE SYLLABUS

LAST REVIEW	Fall 2021
COURSE TITLE	Differential Equations
COURSE NUMBER	MATH 0227
DIVISION	Math, Science, Business & Technology
DEPARTMENT	Mathematics
CIP CODE	24.0101
CREDIT HOURS	3
CONTACT HOURS/WEEK	Class: 3
PREREQUISITES	MATH0123 Calculus and Analytic Geometry II earning a grade of "C" or better. May be taken concurrently with MATH0224 Calculus and Analytic Geometry III.
COURSE PLACEMENT	None

COURSE DESCRIPTION
Differential Equations is designed for students in mathematics, hard sciences, and engineering. Content includes standard types of ordinary differential equations, (first, second, and higher order), systems of differential equations, and applications to geometry and physical science. Students will be expected to use appropriate technology as one tool to achieve competency in Differential Equations.

GENERAL EDUCATION LEARNING OUTCOME
☐ Basic Skills for Communication
☒ Mathematics
☐ Humanities
☐ Natural and Physical Sciences
☐ Social and Behavioral Sciences

INSTITUTIONAL LEARNING OUTCOMES
☐ Communication
☒ Computation and Financial Literacy
☒ Critical Reasoning
☒ Technology and Information Literacy
☐ Community and Civic Responsibility
☐ Personal and Interpersonal Skills

TEXTBOOKS
http://kckccbookstore.com/

METHODS OF INSTRUCTION

A variety of instructional methods may be used depending on content area. These include but are not limited to: lecture, multimedia, cooperative/collaborative learning, labs and demonstrations, projects and presentations, speeches, debates, panels, conferencing, performances, and learning experiences outside the classroom. Methodology will be selected to best meet student needs.

COURSE OUTLINE

I. Introduction to Differential Equations
   - A. Classification
   - B. Solutions
   - C. Existence
   - D. Models

II. First-Order Differential Equations
   - A. Separation of variables
   - B. Exact equations
   - C. General solutions
   - D. Substitutions

III. Modeling with First-Order Differential Equations
   - A. Linear equations
   - B. Non-linear equations
   - C. System of equations

IV. Differential Equations of Higher Order
   - A. Initial-value equations
   - B. Boundary-value equations
   - C. Linear independence
   - D. Fundamental set
   - E. Undetermined coefficients
   - F. Variation of parameters
   - G. Systems of equations
   - H. Non-linear equations
   - I. Applications

V. Series Solutions of Linear Equations
   - A. Interval of convergence
   - B. Solution of equations

VI. Laplace Transform
   - A. Transforms
   - B. Inverse transforms

C. Solution of equations

VII. Numerical Methods of Ordinary Differential Equations
A. Direction fields
B. Euler's method
C. Runge-Kutta methods

COURSE LEARNING OUTCOMES AND COMPETENCIES

Upon successful completion of this course, the student will:

A. be able to identify and classify differential equations (DE).
1. to classify a differential equation (DE) by type, order, and linearity.
2. to show that a given function is a solution to an ordinary differential equation (ODE).
3. to determine the existence of a unique solution to a ODE.
4. to construct ODE's as mathematical models.

B. be able to solve first-order ordinary differential equations (ODE).
5. to solve a ODE by separation of variables with or without an initial condition.
6. to determine if a ODE is exact and solve it if it is exact.
7. to find the general solution of a linear ODE with and without initial conditions.
8. to solve a homogeneous and Bernoulli ODE using a substitution.

C. be able to solve first-order ODE in applications.
9. to construct a linear ODE as a mathematical model.
10. to construct a non-linear ODE as a mathematical model.
11. to construct a system of linear ODE's as a mathematical model.

D. be able to solve higher-order ODE in applications.
12. to solve a nth-order initial-value problem (IVP).
13. to solve a nth-order boundary-value problem (BVP).
14. to determine whether given functions are linearly independent or dependent.
15. to verify that given functions form a fundamental set of solutions.
16. to solve ODE's using undetermined coefficients.
17. to solve ODE's by variation of parameters.
18. to solve a system of ODE's by systematic elimination or determinants.
19. to solve non-linear equations using a substitution.
20. to construct ODE's as mathematical models to initial-value problems.

E. be able to find power series solutions to ODE.
21. to find the interval of convergence of a power series.
22. to solve ODE's using power series.

F. be able to solve ODE using the Laplace transform.
23. to find the Laplace transform of a given function.

24. to find the inverse Laplace transforms.
25. to solve ODE's using Laplace transforms.

G. be able to approximate a solution to ODE using numerical methods.

26. to create direction fields for ODE's.
27. to approximate a solution to a ODE using Euler's and the improved Euler's method.
28. to approximate a solution to a ODE using Runge-Kutta methods.

ASSESSMENT OF COURSE LEARNING OUTCOMES AND COMPETENCIES

Student progress is evaluated through both formative and summative assessment methods. Specific details may be found in the instructor's course information document.

COLLEGE POLICIES AND PROCEDURES

Student Handbook
https://www.kckcc.edu/files/docs/student-resources/student-handbook-and-code-of-conduct.pdf

College Catalog
https://www.kckcc.edu/academics/catalog/index.html

College Policies and Statements
https://www.kckcc.edu/about/policies-statements/index.html

Accessibility and Accommodations
https://www.kckcc.edu/academics/resources/student-accessibility-support-services/index.html.