Administrative Master Syllabus

Course Information

Course Title	Differential Equations
Course Prefix, Num. and Title	MATH 2320
Division	Math & Physical Sciences
Department	Mathematics
Course Type	Academic General Education Course (from ACGM, but not WCJC Core)
Course Catalog Description	Ordinary differential equations, including linear equations, systems of equations, equations with variable coefficients, existence and uniqueness of solutions, series solutions, singular points, transform methods, and boundary value problems; application of differential equations to real-world problems.
Pre-Requisites	MATH 2414 Calculus II
Co-Requisites	None

Semester Credit Hours

Total Semester Credit Hours (SCH): Lecture Hours: Lab/Other Hours	3:3:0
Equated Pay Hours	3
Lab/Other Hours Breakdown: Lab Hours	0
Lab/Other Hours Breakdown: Clinical Hours	0
Lab/Other Hours Breakdown: Practicum Hours	0
Other Hours Breakdown	0

Approval Signatures

Title	Signature	Date
Department Head:		
Division Chair:		
VPI:		

Additional Course Information

Topical Outline: Each offering of this course must include the following topics (be sure to include information regarding lab, practicum, and clinical or other non-lecture instruction).

Chapter 1 – Introduction
Section 1.1 – Background
Section 1.2 – Solutions and Initial Value Problems
Section 1.3 – Direction Fields
Section 1.4 – The Approximation Method of Euler

Chapter 2 – First-Order Differential Equations
Section 2.2 – Separable Equations
Section 2.3 – Linear Equations
Section 2.4 – Exact Equations
Section 2.5 – Special Integrating Factors
Section 2.6 – Substitutions and Transformations

Chapter 3 – Mathematical Models and Numerical Methods Involving First-Order Equations
Section 3.1 – Mathematical Modeling
Section 3.2 – Compartmental Analysis
Section 3.3 – Heating and Cooling of Buildings
Section 3.4 – Newtonian Mechanics
Section 3.5 – Electrical Circuits

Chapter 4 – Linear Second-Order Equations
Section 4.2 – Homogeneous Linear Equations: The General Solution
Section 4.3 – Auxiliary Equations with Complex Roots
Section 4.4 – Nonhomogeneous Equations: The Method of Undetermined Coefficients
Section 4.5 – The Superposition Principle and Undetermined Coefficients Revisited
Section 4.6 – Variation of Parameters

Chapter 6 – Theory of Higher-Order Linear Differential Equations
Section 6.1 – Basic Theory of Linear Differential Equations
Section 6.2 – Homogeneous Linear Equations with Constant Coefficients
Section 6.3 – Undetermined Coefficients and the Annihilator Method
Section 6.4 – Method of Variation of Parameters

Chapter 7 – LaPlace Transforms
Section 7.2 – Definition of the LaPlace Transform
Section 7.3 – Properties of the LaPlace Transform
Section 7.4 – Inverse LaPlace Transform
Section 7.5 – Solving Initial Value Problems
Section 7.6 – Transforms of Discontinuous Functions

Chapter 8 – Series Solutions of Differential Equations
Section 8.1 – Introduction: The Taylor Polynomial Approximation
Section 8.2 – Power Series and Analytic Functions
Section 8.3 – Power Series Solutions to Linear Differential Equations

Rev. June 2023

Chapter 9 – Matrix Methods for Linear Systems
Section 9.1 – Introduction
Section 9.2 – Review 1: Linear Algebraic Equations
Section 9.3 – Review 2: Matrices and Vectors
Section 9.4 – Linear Systems in Normal Form
Section 9.5 – Homogeneous Linear Systems with Constant Coefficients
Section 9.6 – Complex Eigenvalues
Section 9.7 – Nonhomogeneous Linear Systems

Course Learning Outcomes:

Learning Outcomes – Upon successful completion of this course, students will:

1. Identify Homogeneous equations, homogeneous equations with constant coefficients, and exact and linear differential equations.
2. Solve ordinary differential equations and systems of equations using:
   a) Direct integration
   b) Separation of variables
   c) Reduction of order
   d) Methods of undetermined coefficients and variation of parameters
   e) Series solutions
   f) Operator methods for finding particular solutions
   g) LaPlace transform methods
3. Determine particular solutions to differential equations with given boundary conditions of initial conditions.
4. Analyze real-world problems in fields such as Biology, Chemistry, Economics, Engineering, and Physics, including problems related to population dynamics, mixtures, growth and decay, heating and cooling, electronic circuits, and Newtonian mechanics.

Methods of Assessment:

Final Exam (Required)

Other Methods of Assessment:
- Hour Exams
- Homework
- Quizzes
- Short Answer
- Discussion Board
- Participation
- Projects

Required text(s), optional text(s) and/or materials to be supplied by the student:

"Fundamentals of Differential Equations and Boundary Value Problems" by Nagle, Saff, and Snider, 7th edition; Pearson

Students must have computer access to the WCJC website, their WCJC student email and online accounts. WCJC has open computer labs, with internet access, on all campuses for students to use.

Suggested Course Maximum:

35

List any specific or physical requirements beyond a typical classroom required to teach the course.

None

Course Requirements/Grading System: Describe any course specific requirements such as research papers or reading assignments and the generalized grading format for the course.

    A.   Final Exam: 15 – 30%
    B.   Other Course Requirements: 70 – 85%

A = 90 – 100
B = 80 – 89
C = 70 – 79
D = 60 – 69
F = 59 or below

Curriculum Checklist:

☒**Administrative General Education Course** (from ACGM, but not in WCJC Core) – No additional documents needed.

☐**Administrative WCJC Core Course** – Attach the Core Curriculum Review Forms

        ☐Critical Thinking

        ☐Communication

        ☐Empirical & Quantitative Skills

        ☐Teamwork

        ☐Social Responsibility

        ☐Personal Responsibility

☐**WECM Course** – If needed, revise the Program SCANS Matrix and Competencies Checklist