JOHN CABOT UNIVERSITY

COURSE CODE: MA 495
COURSE NAME: Differential Equations
Summer Sample Syllabus

TOTAL NO. OF CONTACT HOURS: 45
CREDITS: 3
PREREQUISITES: MA 299, MA 491 (Multivariable calculus and Matrix Algebra)

COURSE AIMS:

This course provides an introduction to ordinary differential equations. These equations contain a function of one independent variable and its derivatives. The term "*ordinary*" is used in contrast with the term partial differential equation which may be with respect to *more than* one independent variable.

COURSE SUMMARY:

Ordinary differential equations and applications, with integrated use of computing, student projects; first-order equations; higher order linear equations; systems of linear equations, Laplace transforms; introduction to nonlinear equations and systems, phase plane, stability.

LEARNING OUTCOMES:

Upon successful completion of this course, the student will:

1. solve first order linear equations including the method of integrating factors
2. solve non-linear equations, in particular separable and exact equations
3. solve second-order linear constant coefficient equations, both homogeneous and non-homogeneous including methods of characteristic equations, undetermined coefficients, and variation of parameters
4. learn generalization of the techniques for second order to higher order linear constant coefficient equation, both homogeneous and non-homogeneous
5. learn Laplace Transform methods, including solutions of second order problems with discontinuous forcing and impulse response
6. solve systems of first-order linear constant coefficient equations, both homogeneous and non-homogeneous. This includes solutions of

homogeneous problems using eigenvalues as well as extensions of the methods of undetermined coefficients and variation of parameters for non-homogeneous problems.

TEXTBOOK: Boyce, Di Prima, and Haines. Elementary Differential Equations and Elementary Differential Equations w/Boundary Value Problems, 10 Edition, John Wiley & Sons.

GRADING POLICY

-ASSESSMENT METHODS:

Assignment	Guidelines	Weight
Homework	Homework assignments will be graded: the average grade weighs 10 percent of the final grade.	10%
Quizzes	Every week, starting from the second week, students will be asked to solve and hand in a simple, fifteen-to-twenty-minute quiz. The average quiz score weighs fifteen percent of the final grade.	25%
Mid-term exam		25%
Final exam (comprehensive)		40%

LIST OF TOPICS COVERED

Classification of differential equations; direction fields; exponential growth and decay; related physical phenomena; linear equations and integrating factors; separate equations; reduction of order, application of nonlinear equations: Bernoulli and logistic equations, gravitation; sample computer lab assignment; direction fields; integration and differentiation; solution of first-order differential equations and initial value problems. Mechanical and electrical oscillation: modeling by initial value problems; linear, constant-coefficient second-order equations; homogeneous case; the characteristic polynomial; method of undetermined coefficients; oscillation and resonance (plus amplitude modulation and other phenomena); the Laplace transform L; definition and foundations; table entries; first differential rule; solving initial value problems using Laplace and inverse Laplace; sample computer assignment: Laplace transform (beyond constant-coefficient equations and beyond the familiar table entries); undetermined coefficients; amplitude modulation; more on the Laplace transform: first and second shift rules; second differentiation convolution; impulse

response; transfer function; linearity; the Wronskian; use of a known homogeneous solution to find another; variation of parameters; systems: generalities, reduction of higher-order equations to first-order systems; linear systems: homogenous with constant coefficients; eigenvalues; the cases of complex and repeated eigenvalues; non-homogeneous systems; equilibria and stability, phase plane dynamics for two dimensional systems.