

SUFFOLK COUNTY COMMUNITY COLLEGE
COLLEGE-WIDE COURSE SYLLABUS
MAT204 (formerly MA90)

I. COURSE TITLE:

Differential Equations

II. CATALOG DESCRIPTION:

Introduction to differential equations and their applications. Topics include separable equations, autonomous equations, direction fields, mathematical modeling homogeneous and nonhomogeneous linear equations, linear systems of differential equations, power series solution of differential equations, nonlinear systems of equations and numerical methods. Prerequisite: C or better in MAT142. A-E-G / 4 cr. hrs.

III. COURSE GOALS:

- A. Introduce differential equations and their applications.
- B. Study basic methods of solving ordinary differential equations.
- C. This course satisfies SUNY general education requirement for mathematics.

IV. COURSE OBJECTIVES:

Upon successful completion of this course, students will be able to:

- A. construct differential equations and linear systems of differential equations that model evolutionary processes (e.g., mechanical models, population models, predator-prey interactions);
- B. identify and solve various types of first-order differential equations;
- C. recognize properties of solutions of various differential equations obtained by graphing and the use of phase portraits;
- D. solve n th order homogeneous and non-homogeneous linear differential equations with constant coefficients;
- E. solve homogeneous and non-homogeneous systems of linear differential equations.

In addition, if Laplace transforms are chosen as the additional topic, the student should be able to

- F. derive and use Laplace transforms to solve initial value problems and systems of differential equations.

If Power Series solutions are chosen as the additional topic, the student should be able to

- G. obtain power series expressions for the solutions of ordinary differential equations;
- H. solve a Cauchy-Euler equation and apply Frobenius' method to obtain solutions about a regular singular point.

If Non-Linear Differential Equations and Numerical Approximations are chosen as the additional topic, the student should be able to

- I. locate equilibria and determine their stability; linearize a nonlinear system; sketch the phase portrait of a nonlinear system;
- J. apply Euler's method and be able to obtain error estimates for it; apply the Runge-Kutta method to a system of differential equations

Revised: Fall 2008

V. Topics Outline with Timeline

Topics	Approximate Time (Including Examinations)
A. <u>First Order Differential Equations</u> 1. separation of variables 2. first order linear differential equations 3. exact differential equations 4. applications of simple differential equations	3 weeks
B. <u>Linear Differential Equations</u> 1. introduction to homogeneous linear differential equations 2. the properties of solutions of homogeneous equations 3. homogeneous linear differential equations with constant coefficients 4. non-homogeneous linear differential equations with constant coefficients a. undetermined coefficients b. variation of parameters 5. application of linear differential equations with constant coefficients	4 weeks
C. <u>Systems of Linear Differential Equations</u> 1. introduction to vectors and matrices 2. linear algebraic equations; matrix form, row reduction, Gaussian elimination, vector solutions 3. introduction to homogeneous systems of linear differential equations with constant coefficients: eigenvalues, eigenvectors and linearly independent solutions 4. homogeneous systems of linear differential equations with constant coefficients having real, complex and multiple roots for the characteristic equation 5. non-homogeneous systems of linear differential equations with constant coefficients - variation of parameters 6. applications of systems of linear differential equations	5 weeks
One or more of the following topics:	
D. <u>Laplace Transforms</u> 1. introduction to Laplace transforms 2. Laplace transforms and initial value problems 3. Laplace transforms for systems of differential equation	2 ½ weeks
E. <u>Power Series Solutions of Differential Equations</u> 1. review power series 2. solutions about ordinary points	2 ½ weeks

<ul style="list-style-type: none"> 3. the Cauchy-Euler equation 4. regular singular points: Frobenius series 5. Bessel functions of the first kind 	
<p>F. <u>Non-linear Differential Equations and Numerical Approximations</u></p> <ul style="list-style-type: none"> 1. Euler's method 2. error estimates for Euler's method 3. Runge-Kutta method 4. Runge-Kutta for systems of differential equations 	2 ½ weeks

VI. Evaluation of Student Performance:

To be determined by the instructor

VII. Programs that require this course:

Engineering Science/AS

Liberal Arts and Sciences: Mathematics Emphasis/AA(recommended)

Liberal Arts and Sciences: Science Emphasis-Physics Option/AS

VIII. Courses that require this course as a prerequisite:

EEE232 (corequisite); EEE243; PHY245; PHY248

IX. Supporting Information:

Mathematics tutoring services, as well as video and computer aids, are provided for all students through the Math Learning Center (Ammerman Campus, Riverhead 235), the Center for Academic Excellence (Grant Campus, Health, Sports and Education Center 129), and the Academic Skills Center (Eastern Campus, Orient 213).