MA 214 CALCULUS IV (UK Course) (3 credit hours)

Official Course Description	MA 214 is a course in ordinary differential equations. Emphasis is on first and second order equations and applications. The course includes series solutions of second order equations and Laplace transform methods. Prerequisites: MA 213 or equivalent.

OFFICIAL COURSE COMPETENCIES/OBJECTIVES (Approved Fall 2017)

1. Identify and classify differential equations.
2. Solve differential equations by separation of variables.
3. Solve homogeneous, exact, and linear differential equations.
4. Solve differential equations with constant coefficients.
5. Solve differential equations using reduction of order and variation of parameters.
6. Solve application problems using differential equations of first order.
7. Solve application problems using differential equations involving simple and damped harmonic motion.
8. Find the Laplace transforms of common functions, and use Laplace Transforms to solve differential equations.
9. Find series solutions to differential equations.
10. Solve linear systems of differential equations.

OFFICIAL COURSE OUTLINE (Approved Fall 2017)

I. Classification of Differential Equations
II. First Order Differential Equations
    - A. Linear Equations with Variable Coefficients
    - B. Separable Equations
    - C. Exact Equations and Integrating Factors
    - D. Existence and Uniqueness of Solutions
    - E. Applications of First Order Equations
III. Second Order Linear Differential Equations
    - A. Homogeneous Equations with Constant Coefficients
    - B. Fundamental Solutions of Linear Homogeneous Equations
    - C. Linear Independence and the Wronskian
    - D. Complex Roots of the Characteristic Equation
    - E. Repeated Roots of the Characteristic Equation
    - F. Solution of Nonhomogeneous Equations using Method of Undetermined Coefficients
    - G. Variation of Parameters Method
    - H. Applications of Second Order Equations
    - I. Series Solutions near an Ordinary Point
IV. Higher Order Linear Differential Equations
    - A. General Theory of nth Order Linear Equations
    - B. Homogeneous Equations with Constant Coefficients
    - C. Method of Undetermined Coefficients
V. Laplace Transforms
    - A. Definition of Laplace Transform
    - B. Solution of Initial Value Problems using Laplace Transforms
    - C. Step Functions
    - D. Differential Equations with Discontinuous Forcing Functions
    - E. Impulse Functions
VI. Eigenvalues and Eigenvectors
    - A. Linear Dependence / Independence of Vectors
    - B. Definition of Eigenvalues and Eigenvectors
    - C. Solve Linear Systems with Constant Coefficients
    - D. Complex Eigenvalues

GENERAL EDUCATION COMPETENCIES

A. Knowledge of human cultures and the physical and natural worlds through study in the sciences and mathematics, social sciences, humanities, histories, languages, and the arts.
B. Intellectual and practical skills, including
    - inquiry and analysis
    - critical and creative thinking
    - written and oral communication
    - quantitative literacy
    - information literacy
    - teamwork and problem solving
C. Personal and social responsibility, including
    - civic knowledge and engagement (local and global)
    - intercultural knowledge and competence
    - ethical reasoning and action
    - foundations and skills for lifelong learning
D. Integrative and applied learning, including synthesis and advanced accomplishment across general and specialized skills.

STUDENT LEARNING OUTCOMES FOR QUANTITATIVE REASONING (Approved Fall 2017)

In MA 214, students will learn to:

1. Interpret information presented in mathematical and/or statistical forms by (Gen Ed Comp B):
    • Identifying and classifying differential equations.
2. Illustrate and communicate mathematical and/or statistical information symbolically, visually, and/or numerically by (Gen Ed Comp A, B, C):
    • Solving application problems using differential equations involving simple and damped harmonic motion.
3. Determine when computations are needed and execute the appropriate computations by (Gen Ed Comp A, B):
    • Solving differential equations by separation of variables.
    • Solving homogeneous, exact, and linear differential equations.
    • Solving differential equations with constant coefficients.
    • Solving differential equations using reduction of order and variation of parameters.
4. Apply an appropriate model to the problem to be solved by (Gen Ed Comp A, B, C):
    • Solving application problems using differential equations of first order.
5. Make inferences, evaluate assumptions, and assess limitations in estimation modeling and/or statistical analysis by (Gen Ed Comp A, D):
    • Finding the Laplace transforms of common functions, and use Laplace transforms to solve differential equations.