Course Information

Math 441: Differential Equations (3 credits)

Course Description:

Math 441is a basic course in ordinary differential equations. Topics include existence and uniqueness of solutions and the general theory of linear differential equations. Treatment is more rigorous than that given in MATH 285.

Credit is not given for both MATH 441 and any of MATH 284, MATH 285, and MATH 286. For more details see http://catalog.illinois.edu/courses-of-instruction/math/

Prerequisites: MATH 241, MATH 347, or MATH 348 is recommended.

Course Objectives

The course covers first seven chapters of the text Elementary Differential Equations and Boundary Value Problems by William E. Boyce and Richard C. Diprima. Students will develop a working vocabulary for talking about ODEs and learn different methods for solving ODEs. They will also learn applications in the physical systems such as mechanical oscillators, population models, etc. It is important to recognize that reading a head in the textbook before viewing class videos will make the lectures more comprehensible and writing your homework solutions in your own words improves your understanding.

Course Content

1. First Order Differential Equations, Integrating Factor, Separable Equations, Exact Equations, Singular Solutions, Substitution Methods, Theorem of Existence and Uniqueness.
2. Second Order Differential Equations, Homogeneous Equations with Constant Coefficients, Variation of Parameters, Method of Undetermined Coefficients, Characteristic Method, Order Reduction, Mechanical Oscillators, Beats, Resonance, Theorem of Existence and Uniqueness.
3. Higher Order Differential Equations, Homogeneous Equations with Constant Coefficients, Method of Undetermined Coefficients, Method of Variation of Parameters, Theorem of Existence and Uniqueness.
4. Method of Successive Approximations, Linear Independence, Principle of Superposition for Linear Homogeneous Equations, Constant Coefficient Equations, Repeated Roots, Complex Conjugate Roots, Duplication Between Complementary and Particular Solutions.
5. Power Series Method for ODEs, Absolute Convergence, Ratio Test, Radius of Convergence for ODEs, Series Solution Near Ordinary Point, Regular and Irregular Singular Points.
6. Systems of Differential Equations, Solutions of a System of ODEs, Theorem of Existence and Uniqueness for Systems of ODEs, Theorem of Existence and Uniqueness for Linear Systems, Linear Homogeneous Systems, Constant Coefficient Linear Homogeneous Systems, Equilibrium Solutions, Eigenvalue Problem, Phase diagrams.

Format

- This is an online course featuring video lectures from the UIUC Summer 2017 course taught by Lecturer Aldo Manfroi.

- Required Text: William E. Boyce and Richard DiPrima. (2012). *Differential Equations and Boundary Value Problems*. (10th Edition). John Wiley & Sons, Inc.

- Students must be able view assignments online, write out solutions, then scan or take a photo of their written work and upload it to Moodle to meet set deadlines.

- This course requires multiple exams that may be taken online.