

**COURSE OUTLINE FOR MATH 215, SECTION 202:
ELEMENTARY DIFFERENTIAL EQUATIONS I**

- **Text:** *Elementary Differential Equations and Boundary Value Problems (Ninth Edition)* by W. Boyce and R. DiPrima.

- **Topics:**
 - Jan. 4: **Introduction to Differential Equations:** What is a differential equation; differences between linear and nonlinear; general and particular solutions. (chapter 1)
 - Jan. 6–16th; **First order differential equations:** existence uniqueness, integrating factors, separable equations, homogeneous equations, applications. (**section 2.1–2.6**).
 - Jan. 18th–23rd; **Second order linear differential equations:** linear operators, existence uniqueness, linear homogeneous equations, linear inhomogeneous equations (**sections 3.1,3.2**).
 - Jan. 25th–30th; **Second order linear differential equations:** Wronskians and linear independence (fundamental set of solutions), constant coefficient linear homogeneous equations (characteristic equation; real roots, double roots, complex roots), linear nonhomogeneous equations (method of undetermined coefficients). (**sections 3.2–3.5**).
 - Feb. 1st–Feb. 6th; **Second order linear differential equations:** Linear homogeneous equations and the method of variation of parameters; applications to electrical circuits and mechanical vibrations. (**sections 3.6–3.8**).
 - Feb. 8th–13th; **The Laplace Transform:** definition and examples, solution of initial value problems. (**sections 6.1–6.4**).
 - Feb. 15th–27th; **The Laplace Transform:** discontinuous functions, impulse functions, convolutions (**sections 6.5–6.6**).
 - Feb. 29th–March 7th; **Linear Systems:** the homogeneous case (**sections 7.5,7.6,7.8**).
 - March 9th–March 16th; **Linear Systems:** the inhomogeneous case (**sections 7.9**).
 - March 19th–March 23rd; **Nonlinear Systems:** the introduction (**sections 9.1, 9.2**).

- March 26th–April 4th; **Nonlinear Systems:** linearization, critical points, population dynamics and the nonlinear pendulum (**sections 9.3–9.5**).

- **Grading:** There will be two 55 minute quizzes given during the course at times to be announced. They will count for 40% of your grade. The final will count for 50% of your grade. I will assign homework every week and will provide detailed solutions. Please make sure to do the homeworks and examine the solutions. The HW will count for 10% of your grade.

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