The Governor's Scholl for Science and Technology

Differential Equations Syllabus 2022-2023

Required material:

[Elementary Differential Equations (Links to an external site.)](#) by William F Trench, Trinity University, Texas, USA:
Differential Equations: [Differential Equations Lamar.edu (Links to an external site.)](#)
MIT Open Course: [Differential Equations (Links to an external site.)](#)

INSTRUCTOR: Rimma Feygelson   **Email:** Rimma.Feygelson@nhrec.org

GSST website: [https://nhrec.org/gsst/ (Links to an external site.)](https://nhrec.org/gsst/) Students must check Canvas at least twice a day for updates and announcements.

PREREQUISITES: Successful completion of Calculus I and Calculus II

CALCULATORS: Students are NOT allowed to use ANY calculator on the test. Students are required to have a graphing calculator for this course. The TI-83Plus or TI-84Plus is recommended.

COURSE GOALS: Introduces ordinary differential equations. Includes first order differential equations, second and higher order ordinary differential equations with applications and numerical methods.

The general purpose is to give the student a solid grasp of the methods solving and applying differential equations and to prepare the student for further coursework in mathematics, engineering, computer science and the sciences.

INSTRUCTIONAL METHODS: The course content will be taught primarily through a series of lectures with ample class time being reserved for student questions and interaction.

Homework will be assigned on a regular basis covering material from the lectures and/or the textbook. Each student is expected to study the assigned material and to work all the assigned homework problems before coming to class. Some class time will be spent discussing the difficulties encountered with the homework exercises.

Classroom participation is a definite part of the instructional process and includes taking notes. Students are encouraged to ask questions in class, demonstrate their ability to solve problems, and present ideas which will assist other students in the solution of problems or the development of concepts.

Study groups are encouraged outside of classroom. Students are urged to seek help from their instructor during office hours. as needed.

Students should check the course Canvas site regularly for assignments and course materials.

Your **final course grade** is determined as the weighted average of the following:

Quarter Grade = HW (10%) + Quizzes (20%) + Projects (20%) + Tests (50%)

Semester Grade = Quarter 1 (50%) + Quarter 2 (50%)

Year Grade = Semester 1 (50%) + Semester 2 (50%)

The following scale will be used to determine your final grade:

90 - 100 % A; 80 - 89 % B; 70 - 79 % C; 60 - 69 % D; Below 60 % F

QUIZZES, TESTS, EXAM: All quizzes, tests and exam will be announced with ample opportunity for preparation. Students are expected to take quizzes, tests and exam on the specified day and time. There will be no retests. **Students are NOT allowed to use calculator on the quiz, test, exam.**

No make-up test will be given to any student who does not show up on the test date and has not contacted the instructor. Under NO circumstances will make-ups be given after the tests have been returned.

Discussions and Projects: The general purpose of Discussions/Projects is to enhance DE understanding and to prepare students for further studies in mathematics. All Discussions/Projects assignments will be announced with ample opportunity for preparation. Students are expected to complete and submit Discussions/Projects on the specified day and time. One point off per day will be taken for a late submission.

CALCULATORS: A graphing calculator is an essential tool for this class and each student is expected to have one. The TI-83 Plus or TI-84 Plus calculator is recommended for use in class activities and homework. Borrowing calculators from other students is not allowed. Calculators with Computer Algebra System (CAS) capabilities may not be used (TI-89, TI-92, etc). Cell phones cannot be used as calculators. **Students are NOT allowed to use calculator on the quiz, test, exam.**

ATTENDANCE: Regular attendance is expected.

CODE OF CONDUCT: Coming to class prepared to learn includes (but is not limited to) having all of the necessary supplies, arriving on time, staying the full time, and participating in the activities of the class.

Course Objectives

- First Order Differential Equations
    - o Classify a differential equation as linear or nonlinear.
    - o Understand and create a directional field for an arbitrary first-order differential equation.
    - o Determine the order, linearity or nonlinearity, of a differential equation.
    - o Solve first order linear differential equations.
    - o Solve Separable differential equations.
    - o Solve initial value problems.
- Numerical Approximations
    - o Use the Euler or tangent line method to find an approximate solution to a linear differential equation.
- Higher Order Differential Equations
    - o Solve second order homogenous linear differential equations with constant coefficients including those with complex roots and real roots.
    - o Determine the Fundamental solution set for a linear homogeneous equation.
    - o Calculate the Wronskian.
    - o Use the method of Reduction of order.
    - o Solve nonhomogeneous differential equations using the method of undetermined coefficients.

- o Solve nonhomogeneous differential equations using the method of variation of parameters.
- Applications of Differential Equations, Springs-Mass-Damper, Electrical Circuits, Mixing Problems
  - o Solve applications of differential equations as applied to Newton's Law of cooling, population dynamics, mixing problems, and radioactive decay. (1st order)
  - o Solve springs-mass-damper, electrical circuits, and/or mixing problems (2nd order)
  - o Solve application problems involving external inputs (non-homogenous problems).
- Laplace Transforms
  - o Use the definition of the Laplace transform to find transforms of simple functions
  - o Find Laplace transforms of derivatives of functions whose transforms are known
  - o Find inverse Laplace transforms of various functions.
  - o Use Laplace transforms to solve ODEs.

Any changes to this syllabus will be noted in class.