MATH 2250

Division: Natural Science and Mathematics
Department: Mathematics
Course: MATH 2250
Title: Linear Algebra and Differential Equations
Catalog Description:

This course explores methods of solving ordinary differential equations which describe much of the physical phenomena in our world. The course introduces principles of linear algebra to facilitate the analysis of systems o f differential equations. Linear algebra topics will include matrix operations, vector spaces, systems of linear e quations, and eigensystems. The course will examine techniques for solving linear and nonlinear first-order di fferential equations as well as higher-order linear equations. Other topics will include initial-value and boundary-value problems, Laplace transforms, numerical methods, and modeling.

The course is designed for students with majors in specific engineering and science disciplines. Students with m ajors in other science and engineering disciplines, and students with a mathematics major should take Math 2270 (Linear Algebra) and Math 2280 (Differential Equations) instead of Math 2250.

General Education Requirements: N/A
Semesters Offered: TBA
Credit/Time Requirement: Credit: 4; Lecture: 4; Lab: 0
Clock/Hour Requirements: 0
Offered for Non-Credit: No
Prerequisites: MATH 2210

Justification:

This class is required for students in specific engineering and science majors, such as chemistry, mechanical engineering, and civil engineering, at the senior institutions of Utah, particularly Utah State University, University of Utah, and Weber State University. The course lays a foundation in linear algebra and differential eq uations for students entering science-related fields. Knowledge and ability to solve systems of linear equations and differential equations are crucial to success in many engineering, mathematics, and science courses at the upper-division level.

Currently most of Utah's universities provide two routes for students needing linear algebra and differential equations. Students majoring in mathematics, computer science, electrical engineering, etc. must take Linear A lgebra (Math 2270) and Differential Equations (Math 2280) as separate courses. Students studying chemistry, m echanical engineering, civil engineering, etc. typically take Math 2250 (Linear Algebra & Differential Equations) as a combination class. Historically, Snow College students were forced to study linear algebra and d ifferential equations in the separate courses since the combined course (Math 2250) was not offered. Some s tudents were disadvantaged by this fact.

The mathematics and engineering faculty have collaborated to develop an innovative solution to provide students with both educational routes with minimal increase in faculty workload.

Student Learning Outcomes:

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

- solve foundational linear algebra problems
- use standard methods to solve differential equations
- apply linear algebra to solve systems of differential equations
- utilize differential equations to model and solve typical physical phenomena
- show an increase in their problem-solving ability and mathematical maturity

Content:

Linear Algebra topics will include:

- introduction to linear systems and matrices
- matrix operations, Gaussian elimination, and reduced row echelon form
- determinants and matrix inversion
- vectors and vector spaces
- linear combinations, dependence, and independence
- bases/dimension, row/column spaces, and general vector space

Differential Equation topics will include:

- introduction to differential equations and mathematical modeling
- initial-value problems
- first-order equations and solution techniques
- higher-order equations and solution techniques
- boundary-value problems
- modeling differential equations
- an introduction to numerical solution
- systems of differential equations
- eigensystems
- Laplace transforms

General Education Outcomes:

6) Apply computational skills to a variety of contexts.

Mathematics, science, and engineering students must be able to utilize the techniques taught in linear algebra

and differential equations to solve problems modeling physical phenomena. Students typically solve 10-20 h omework problems per section; many of which require computation. Many solutions are not numerical and r equire students to think abstractly. For example, students are challenged to consider the existence of solutions y et to be discovered. Students also expand their skill set using graphing calculators and standard software packages.

Key Performance Indicators:

Students will demonstrate competency of the Student Learning Outcomes by:

- completion of homework
- tests and quizzes
- comprehensive final exam

Representative Text and/or Supplies:

The text will be selected by the instructor with departmental approval. A representative textbook is " Differential Equations and Linear Algebra" by C. Henry Edwards and and David E. Penney.

Optimum Class Size: 25
Maximum Class Size: 40

Signatures:

I hereby submit this course syllabus:

Brian Newbold, M.S., Associate Professor

I hereby find this course consistent with the goals and resources of the Mathematics Department:

Kari Arnoldsen, PhD, Professor, Chair

I hereby find this course consistent with the goals and resources of the Natural Science and Mathematics Division:

Dan Black, EdD, Associate Professor, Dean

I have discussed the need for library resources related to this class with the person submitting the syllabus:

Lynn Anderson, MLIS, Technical Services Librarian (Main Campus)

Michelle Olsen, MLS, Campus Librarian (Richfield Campus)