MATH C285: INTRODUCTION TO LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS

Item	Value
Curriculum Committee Approval Date	09/25/2017
Top Code	170100 - Mathematics, General
Units	5 Total Units
Hours	90 Total Hours (Lecture Hours 90)
Total Outside of Class Hours	0
Course Credit Status	Credit: Degree Applicable (D)
Material Fee	No
Basic Skills	Not Basic Skills (N)
Repeatable	No
Grading Policy	Standard Letter (S), • Pass/No Pass (B)
Local General Education (GE)	• CL Option 1 Math Competency (CA3)
California General Education Transfer Curriculum (Cal-GETC)	• Cal-GETC 2A Math Concepts (2A)
Intersegmental General Education Transfer Curriculum (IGETC)	• IGETC 2A Math Concepts (2A)
California State University General Education Breadth (CSU GE-Breadth)	• CSU B4 Math/Quant.Reasoning (B4)

Course Description

Introduction to linear algebra and differential equations, matrices, determinants, eigenvectors and eigenvalues, inverse and implicit function theorems, linear methods and numerical methods, and Laplace transforms. PREREQUISITE: MATH C185. Transfer Credit: CSU; UC. C-ID: MATH 910 S.**C-ID:** MATH 910 S.

Course Level Student Learning Outcome(s)

1. Solve ordinary differential equations using elementary techniques including Laplace transformations.
2. Find eigenvalues and eigenvectors and use them in applications.
3. Prove basic results in linear algebra using appropriate proof-writing techniques such as linear independence of vectors; properties of subspaces; linearity of transforms and operators; and properties of eigenvectors and eigenvalues.

Course Objectives

• 1. Create and analyze mathematical models using ordinary differential equations;
• 2. Verify solutions of differential equations;
• 3. Identify the type of a given differential equation and select and apply the appropriate analytical technique for finding the solution of first order and selected higher order ordinary differential equations;
• 4. Apply the existence and uniqueness theorems for ordinary differential equations;

• 5. Find power series solutions to ordinary differential equations;
• 6. Determine the Laplace Transform and inverse Laplace Transform of functions;
• 7. Solve Linear Systems of ordinary differential equations.
• 8. Find solutions of systems of equations using various methods appropriate to lower division linear algebra;
• 9. Use bases and orthonormal bases to solve problems in linear algebra;
• 10. Find the dimension of spaces such as those associated with matrices and linear transformations;
• 11. Find eigenvalues and eigenvectors and use them in applications; and
• 12. Prove basic results in linear algebra using appropriate proof-writing techniques such as linear independence of vectors; properties of subspaces; linearity, injectivity and surjectivity of functions; and properties of eigenvectors and eigenvalues.

Lecture Content

First order differential equations including separable, homogeneous, exact, and linear Existence and uniqueness of solutions Applications of first order differential equations such as circuits, mixture problems, population modeling, orthogonal trajectories, and slope fields Second order and higher order linear differential equations Fundamental solutions, independence, Wronskian Nonhomogeneous equations Applications of higher order differential equations such as the harmonic oscillator and circuits Methods of solving differential equations including variation of parameters, Laplace transforms, and series solutions Systems of ordinary differential equations Techniques for solving systems of linear equations including Gaussian and Gauss-Jordan elimination and inverse matrices Matrix algebra, invertibility, and the transpose Relationship between coefficient matrix invertibility and solutions to a system of linear equations and the inverse matrices Special matrices: diagonal, triangular, and symmetric Determinants and their properties Vector algebra for Rn Real vector spaces and subspaces, linear independence, and basis and dimension of a vector space Matrix-generated spaces: row space, column space, null space, rank, nullity Change of basis Linear transformations, kernel and range, and inverse linear transformations Matrices of general linear transformations Eigenvalues, eigenvectors, eigenspace Diagonalization including orthogonal diagonalization of symmetric matrices Dot product, norm of a vector, angle between vectors, orthogonality of two vectors in Rn Orthogonal and orthonormal bases: Gram-Schmidt process

Method(s) of Instruction

• Lecture (02)
• DE Online Lecture (02X)

Instructional Techniques

1. Deliver lectures of course content. 2. Assign homework and quizzes. 3. Relate material in the course to real life and the outside world. 4. Require participation including student-to-student and student-to-instructor interaction through the use of small-group activities and whole-class discussion. 5. Apply technologies to increase learner motivation such as Scientific and/or Graphing Calculator and computer software such as Wolfram

Reading Assignments

Alpha. 6. Objective Examinations 7. Midterm Exam (comprehensive) 8.
Final Exam (comprehensive)

Writing Assignments

MyMathLab online homework assignments

Out-of-class Assignments

Textbook on ordinary differential equations and their applications

Demonstration of Critical Thinking

Final Exam Midterm Exam Objective Examinations Problem Solving
Exercises Projects (ind/group) Report Short Quizzes Skills Demonstration
Written Assignments

Required Writing, Problem Solving, Skills Demonstration

Critical thinking and problem solving skills are required in solving
homework assignments, quizzes, and exams.

Eligible Disciplines

Mathematics: Masters degree in mathematics or applied mathematics
OR bachelors degree in either of the above AND masters degree in
statistics, physics, or mathematics education OR the equivalent. Masters
degree required.

Manuals Resources

1. Required Lay, D. Linear Algebra and Its Applications, 5th ed. Pearson/
Prentice-Hall, 2016 Rationale: - 2. Required Nagle, Saff. Fundamentals of
Differential Equations, 9th ed. Pearson Education, 2018