MATH A285H: INTRODUCTION TO LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS HONORS

Item	Value
Curriculum Committee Approval Date	02/23/2022
Top Code	170100 - Mathematics, General
Units	6 Total Units
Hours	108 Total Hours (Lecture Hours 108)
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)
Associate Arts Local General Education (GE)	• OC Comm/Analytical Thinking - AA (OA2)
Associate Science Local General Education (GE)	• OCC Comm/AnalyticalThinking-AS (OAS2) • OCC Mathematics (OMTH)
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. Topics include matrices, determinants, vector spaces, linear systems of equations, linear product spaces, first and second order differential equations, systems of differential equations, and Laplace transforms. Additional honors topics include Jacobian matrices, properties of R3 and simple abstract topological spaces, and some exterior algebra. Enrollment Limitation: MATH A285; students who complete MATH A285H may not enroll in or receive credit for MATH A285. PREREQUISITE: MATH A185, MATH A185H, MATH A182H, MATH A280, or MATH A280H. Transfer Credit: CSU; UC.

Course Level Student Learning Outcome(s)

1. Use matrix algebra and row-reduction methods to solve linear systems.
2. Solve linear systems, including under- and over-determined systems.
3. Prove lemmas and corollaries in linear algebra.
4. Relate linear transformations to their matrices with respect to given bases.
5. Describe linear transformations as functions mapping an n-dimensional space to an m-dimensional space.

Course Objectives

- 1. Use matrix algebra and row reduction methods to solve linear systems.
- 2. Prove basic properties of linear spaces and linear maps, including spans, independence and basic dimension theorems.
- 3. Compute null spaces and images of linear functions, and apply this to superposition of solutions in applications.
- 4. Compute change of bases.
- 5. Explore consequences of the Rank Nullity Theorem.
- 6. Work with inner product and orthogonality, including abstract Fourier coefficients, and the Gramm Schmidt processes.
- 7. Define n.n determinants and explore their elementary properties.
- 8. Use linear theory to solve first and second order ordinary differential equations and linear systems of ordinary differential equations.
- 9. Compute eigenvalues and eigenvectors.
- 10. Use appropriate technology to enhance understanding of differential equations and linear algebra.

Lecture Content

Row-reduction methods, including elementary row operations, Gauss-Jordan elimination, and echelon matrices Matrix algebra including matrix addition, scalar multiplication, multiplication of matrices, identities, inverses, and proofs of some of the properties of these operations Using the inverse of a matrix and transpose of a matrix to solve systems of linear equations Linear spaces with focus on subspaces, spans, independence, bases, and dimension theory Linear functions with emphasis on null spaces, images, fundamental theorems including the Rank-Nullity Theorem, and change of basis Introduction to Inner Product Spaces including definitions, examples, norms, orthogonality, Fourier coefficients and the Gramm-Schmidt processes Determinants with emphasis on multilinear functions, elementary properties of determinants, adjoints, and Cramers rule First Order Differential Equations Separable Linear Exact Homogeneous Second Order and Higher Order Differential Equations Homogeneous linear Non-homogeneous linear Eigenvalues and eigenvectors: definitions, computation, and eigenbases Introduction to systems of ordinary differential equations using elimination, eigen methods, and the exponential matrix Introduction to Laplace transforms and their use in the solution of linear and non-linear differential equations Numerical methods for solution of ordinary differential equations such as Eulers method, an improved Eulers method, or the Runge-Kutta method Series solutions to differential equations Introduction to Fourier series Introduction to Jacobian matrices in the discussion of differentiability of mappings from Euclidean n-space to m-space with extension to a general analysis of the chain rule, i mplicit function theorem and the inverse function theorem

Method(s) of Instruction

- Lecture (02)

Instructional Techniques

Lecture, discussion

Reading Assignments

Students will spend approximately 1 hour per week reading from assigned text.

Writing Assignments

Students will spend approximately 1 hour per week on writing assignments, including written definitions, theorems, proofs, and justifications.

Out-of-class Assignments

Students will spend approximately 8 hours per week on out-of-class assignments, including reading, written defintions, justifications, and test preparation.

Demonstration of Critical Thinking

Students write definitions, theorems, proofs, and justifications.

Required Writing, Problem Solving, Skills Demonstration

Several written tests and a comprehensive final

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.

Textbooks Resources

1. Required Goode, Stephen . Differential Equations and Linear Algebra, 4th ed. Pearson, 2017 Rationale: -