Applied Linear Algebra (MAT161)

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OBJECTIVES AND PRACTICE

Course Summary

Linear Algebra provides the means for studying several quantities simultaneously. The course will emphasize its computational and applied aspects. All engineering, science and economics students have to deal in one or the other way with computers, whether it is for modelling, simulations or understanding and solving real world problems through mathematics. Linear Algebra is a basic tool to tackle such problems using computational techniques. This course will involve understanding matrices, linear systems of equations and different ways of solving linear system of equations.

Course Aims

- To provide students with an understanding of the fundamental concepts of linear algebra: Linear systems, vector spaces, and linear transformations.
- To equip students with skills that will enable them to apply the concepts to topics such as numerical methods, machine learning and data analytics

Learning Outcomes

On successful completion of the course, students will be able to:

- Describe the sets of solutions of homogeneous and non-homogeneous systems of linear equations geometrically and algebraically, and be able to carry out algorithmic solutions.
- Apply matrix algebra to solving systems of linear equations.
- Understand eigenvalues and eigenvectors and apply them to problems such as diagonalization, quadratic forms, principal component analysis, etc.

Curriculum Content

Syllabus

- Systems of linear equations, Matrix decomposition, Row reduction and echelon forms
- Linear dependence and independence
- Vector spaces and subspaces

- Bases and dimensions
- Orthogonal bases and orthogonal projections, Gram-Schmidt process
- Inner product spaces
- Least-squares problems
- Eigenvalues and eigenvectors
- Diagonalization of a matrix, Symmetric matrices
- Positive definite matrices, Similar matrices
- Linear transformations
- (If time Permits) Singular Value Decomposition

Teaching and Learning Strategy

Teaching and Learning Strategy	Description of Work	Class Hours	Out-of-Class Hours
Lectures and Tutorials	**This is a basic course. The objective is to build up the concepts in the subject. The aim is to complete the first year undergraduate book of Linear Algebra with applications.**	**100% class room teaching**	**Weekly 3-4 hours.**

ASSSESSMENT

- **Assessment Strategy**
    - Mid Term examination (covering 1-6 weeks of learning)
    - Final examination
    - Continuous Evaluation: Several Quizzes

- **Mapping of Learning Outcomes to Assessment Strategy**

Assessment Scheme

Type of Assessment	Learning Outcome	Percentage
Mid-semester Examination	Based on theoretical concepts And Problem Solving	30%
End-Semester Examination	Remaining Course	30%
Quizzes	Continuous Evaluation	40%
	Total	100%

Books:

- ***Elementary Linear Algebra*** **by Ron Larson and David C Falvo. Brooks/Cole.**
- ***Introduction to Linear Algebra*** **by Gilbert Strang. Wellesley-Cambridge Press.**
- ***Linear Algebra Done Right by Sheldon Axler.***