KOTEBE METROPOLITAN UNIVERSITY
COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCES
DEPARTMENT OF MATHEMATICS
Course syllabus

Course title: Advanced Linear Algebra
Course code: Math 501
Program: M.Sc. degree in Mathematics (Ext.)
Credit hours: 3 cr.
Course type: Compulsory
Tutorial/Lab Hr: 1hr/week
Prerequisite: Math 500
Instructor's name: Fufa Beyene **Email:** fbbeyenefufa1@gmail.com

Course description: The course mainly covers Matrices and matrix norm, Matrix decomposition, direct and indirect method of solving systems of linear equations, Inner product space, Eigen value and Eigen vectors (Jacobi, Given Householder, QR, Inverse methods), Conjugate Gradient methods and its preconditions.

Course objective and competency acquired
On the successful completion of this course students will be expected to:

. comprehend basic properties of matrices,

. comprehend the notion of matrix decomposition,

. apply the methods of solving systems of linear equations,

. comprehend the notion of inner product spaces,

. comprehend the notion of eigen values and eigen vectors,

. understand Jacobi, Given Householder QR, and Inverse methods,

. apply these methods to find eigen values and eigen vectors,

. comprehend the conjugate gradient methods,

. solve problems involving linear algebra courses,

. apply important techniques in this course in other mathematical disciplines.

Course outline
Chapter-1: Matrices
1.1 Definition of matrix and its operations
1.2 Elementary row operations
1.3 Power and polynomials of matrices
1.4 Invertible matrix
1.5 Square and complex matrices
1.6 Block matrices

1.7 Jordan Canonical Forms
Chapter-2: Matrix decomposition
2.1 QR decomposition
2.2 LU factorization
2.3 Singular value decomposition
Chapter-3: System of Linear Equations
3.1 Introduction to linear equations
3.2 solving system of linear equations
3.3 Direct method
3.4 Indirect method
3.4.1 Jacobi method
3.4.2 Gauss-Jordan mathod
Chapter-4: Inner product space and Diagonalization
4.1 Inner Products
4.2 Length, angle and orthogonality in inner product space
4.3 gram-Schmidt orthogonalization process
4.4 Orthogonal and Unitary matrices
4.5 Properties of Symmetric and Hermitian Operators
4.6 Shur's Theorem
4.7 Diagonalization of symmetric matrix and the Spectral Theorem
Chapter-5: Eigen values and Eigen vectors
5.1 Given method
5.2 Householder method
5.3 QR method
5.4 Inverse method, Power method
5.5 Conjugate Gradient method and its preconditions

Method of teaching: The following active teaching-learning methods will be employed: Gap lecture, Question and answering, Tutorial classes where students will discuss and solve problems, Group work, and Discussion and presentation in group.
Class attendance: At least 85% of class attendance is mandatory to be seated for final exam.
Assessments:
Assignments(20%),
Tests(30%), and
Final Exam(50%).
References:
S. Lang, Linear Algebra, second edition.
Derek J. S. Robinson, A course in linear algebra with application, second ed. World scientific publishing.
Carl D. Meyer(2000), Matrix Analysis and Applied Linear Algebra