

ADDIS ABABA UNIVERSITY
COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCES
DEPARTMENT OF MATHEMATICS

Academic year 2021/22

Course Outline: Applied Mathematics IB (Math 1041)

Chapter 1: Vectors and Vector Spaces

- 1.1 Scalars and Vectors; Location and position vectors in $\mathbb{R}^2$ and $\mathbb{R}^3$
- 1.2 Addition and Scalar Multiplication
- 1.3 Dot (Scalar) Product: Magnitude of a vector, Angle between two vectors, Orthogonal projection, Direction Cosines.
- 1.4 Cross (Vector) product; Triple products with applications
- 1.5 Lines and Planes in $\mathbb{R}^3$
- 1.6 Vector Spaces; Subspaces
- 1.7 Linear Dependence and Independence of vectors
- 1.8 Basis and Dimension of a Vector Space

Chapter 2: Matrices, Determinants and Systems of Linear Equations

- 2.1 Definition of a matrix and basic operations
- 2.2 Product of matrices and some properties; transpose of a matrix
- 2.3 Elementary row operations and echelon forms
- 2.4 Rank of a matrix
- 2.5 Inverse of a matrix and its properties
- 2.6 Determinant of a matrix and its properties
- 2.7 System of linear equations; Gauss's Method; Cramer's rule; Characterization of solutions
- 2.8 Eigenvalues and eigenvectors

Chapter 3: Limit and Continuity

- 3.1 Definition of Limit
- 3.2 Examples of limit of a function (linear, quadratic, rational with linear denominator)
- 3.3 Basic Limit Theorems
- 3.4 One-Sided limits
- 3.5 Infinite limits; limit at infinity and asymptotes
- 3.6 Continuity of a function; One-sided Continuity; Intermediate Value Theorem

Chapter 4: Derivatives and Application of derivatives

- 4.1 Definition, examples and properties; Basic rules; The Chain rule

- 4.2 Derivatives of inverse functions, Inverse trigonometric, Hyperbolic and inverse hyperbolic functions
- 4.3 Implicit differentiation; Higher-order derivatives
- 4.4 Applications of the derivative: Extrema of a function; Mean Value Theorem; First and Second Derivative Tests; Concavity and inflection points; Curve sketching;
- 4.5 Indeterminate forms and L'Hopital's rule

Chapter 5: Integration

- 5.1 Antiderivatives; Indefinite integrals
- 5.2 Techniques of integration: Integration by substitution and Integration by parts, trigonometric integrals; Integration by Trigonometric substitution; Integration by partial fractions
- 5.3 Definite integrals: Fundamental Theorem of Calculus
- 5.4 Application of the integral: Area (Review). Volume of solid of revolution; Arc length
- 5.5 Improper integrals

Text Books:

1. Robert Ellis and Denny Gulick, *Calculus with analytic geometry*, 6th ed, Harcourt Brace Jovanovich, Publishers, 5th ed, 1993.
2. Demissu Gameda: *An Introduction to Linear Algebra*, 2000, Department of Mathematics, AAU.
3. Serge Lang: *Linear Algebra*, 1974, Springer Science + Business Media Inc.

References:

1. Johnson and Kiokemister: *Calculus with Analytic Geometry*
2. Howard Anton: *Calculus with Analytic Geometry*, 2000, Anton Text Books, Inc.
3. James Stewart: *Calculus*, 2009, Thomson Brooks/Cole.
4. Semu Mitiku Kassa, Berhanu Guta Wordofa and Tilahun Abebaw Kebede, *Engineering Mathematics I*, Galaxy University Books Series, 2017.
5. Bizuneh Minda, Temesgen Alemu, Getachew Bitew, Tilahun Esayiyas, and Addisu W/Meskel, *University Mathematics I*, Revised Edition, 2016.
6. H. Anton and C Rorres, *Elementary linear algebra*, 1994, John Wiley & Sons, Inc.

Assessment methods of the course

- Continuous Assessment 50%
 - Minimum two Assignments.....20%
 - Tests and quizzes (at least two) 30%
- Final 50%