ADDIS ABABA SCIENCE & TECHNOLOGY UNIVERSITY

NATURAL AND SOCIAL SCIENCE COLLEGE

MATHEMATICS DEPARTMENT

Course title: Applied Mathematics IB

Course code: Math 1041A

Credit hours: 4 **Contact hrs:3** **Tutorial hrs: 3**

Prerequisite: None

Program: Engineering **Enrolment: Regular**

A. Year. 2020/21 semester: II

Instructor's name: [redacted].

Course Description

This course covers basic elements of vectors, vector spaces, matrices, determinants, systems of linear equations, concepts and applications of differential and integral calculus of one variable.

Course outline

Chapter 1: Vectors and Vector Spaces

1.1. Scalars and Vectors; located & position vectors in $\mathbf{R}^2$ and $\mathbf{R}^3$
1.2. Addition and scalar multiplication
1.3. Dot(Scalar) product, Magnitude of a vector , Angle between two vectors, Orthogonal projection, Direction angles & Direction cosines
1.4. Cross (Vector) product ; Triple products with applications
1.5. Lines and planes in $\mathbf{R}^3$
1.6. Vector space; Subspaces
1.7. Linear Dependence and independence
1.8. Basis of a vector space

Chapter 2: Matrices, Determinants & Systems of Linear Equations

2.1. Definition of matrix and basic operations
2.2. Product of matrices and some algebraic 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; Cramer's rule; Gaussian's method; characterization of solutions
2.8. Eigen values 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
3.4. Infinite limits, limit at infinity and asymptotes
3.5. Continuity of a function; one sided continuity; Intermediate value theorem

Chapter 4: Derivatives and Application of Derivatives

4.1. Definition, examples & properties of derivatives; basic rules; the chain rule
4.2. Derivatives of inverse functions; Inverse trigonometric functions; Hyperbolic and inverse Hyperbolic functions
4.3. Implicit differentiation; higher order derivatives
4.4. Application of derivatives: Extrema of a function; Mean value theorem; First and second Derivative tests; Concavity and inflection point; Curve sketching
4.5. Indeterminate Forms (L'Hopital's Rule)

Chapter 5: Integration

5.1. Anti-derivatives; indefinite integrals
5.2. Techniques of integration
  5.2.1 Integration by substitution, by parts and by partial fraction
  5.2.2 Trigonometric integrals
  5.2.3 Integration by trigonometric substitution
5.3. Definite integrals; Fundamental Theorem of Calculus
5.4 Improper integrals
5.5 Application of Integrals: Area; Volume of solid of revolution; Arc Length; Surface Area

Teaching- Learning Methods

Three contact hours of lectures and three contact hours of tutorials per week. Students do reading assignments.

Assessment Methods

- Continuous Assessment 50%
- Final examination 50%

Textbooks:

1. Robert Ellis and Denny Gulick, Calculus with analytic geometry, 6th ed,
2. Demissu Gemeda: An introduction to Linear Algebra, 2000, Department of Mathematics, AAU
3. Serge Lang: Linear Algebra, 1974, Springer science +Business media Inc.

References Books:

1. Shimelis Bekele: Omega Applied Mathematics I for science and technology students, 3rd edn. 2019.
2. Addisu, Bizuneh, etal, University Mathematics
3. Jonson & Kiokemiser: Calculus with analytic geometry
4. Leithold, The calculus with analytic geometry, 3rd Edition, Herper &Row, publishers.
5. Howard Anton: Calculus with analytic geometry, 2000, Anton Text Books, Inc.
6. James Stewart: Calculus, 2009, Thomson Brooks/ Cole
7. H. Anton and C. Rorres, Elementary Linear Algebra,1994, john Wiley & sons, Inc.