Calculus I – Course Outline
MTS-101

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1 Course Description

This course is the first in a three-course sequence of a systematic introduction to calculus. It introduces the basic notions of calculus and their applications. The course begins with a review of fundamental concepts related to functions, including their types, properties, and basic operations. The course then introduces the most fundamental concept of calculus, i.e., the idea of limit. It then moves on to a thorough discussion of single-variable differential calculus, the focus area of this course, along with its applications.

2 Course Objectives

- Learn the theory and methods of calculus, focusing on single-variable differential calculus.
- Develop a conceptual understanding of functions, derivatives, and integrals, and their applications.
- Introduce students to the fundamental language of university-level mathematics.

3 Learning Outcomes

- Develop a solid understanding of limits, continuity, and derivatives, and apply them to analyze functions.
- Apply differentiation techniques to solve problems in optimization, related rates, and curve sketching.

4 Academic Misconduct

- Plagiarism of any sort will be reported to the Dean of Students' Affairs for disciplinary action.
- Use of mobile phones, laptops, tablets, or any electronic devices during quizzes or examinations is strictly prohibited.
- **If a mobile phone is visible during class, one (01) mark will be deducted.**
- The verdict of the Disciplinary Committee will be binding in all cases of academic misconduct.

5 Attendance Policy

Attending lectures is required according to IBA rules and policies. The maximum number of absences allowed in a course is five (05).

6 Course Overview

6.1 Functions and Graphs (6 lectures)

- Functions and Function Notation
- Domain and Range
- Rates of Change and Behavior of Graphs
- Composition of Functions
- Transformation of Functions
- Inverse Functions

6.2 Limits (6 lectures)

- A Preview of Calculus
- The Limit of a Function
- The Limit Laws
- Continuity
- The Precise Definition of a Limit
- Infinite Limits and Limits at Infinity

6.3 Derivatives (8 lectures)

- Defining the Derivative
- The Derivative as a Function
- Differentiation Rules
- Derivatives as Rates of Change
- The Chain Rule
- Implicit Differentiation

6.4 Applications of Differentiation (8 lectures)

- Maxima and Minima
- Mean Value Theorem
- Curve Sketching
- Optimization Problems
- Newton's Method
- L'Hospital's Rule

7 Books

7.1 Text Book

- Calculus: Early Transcendentals by James Stewart (9th Edition)
- Calculus Volume 1 by OpenStax (Online)

7.2 Reference Book

- Calculus: Early Transcendentals by Anton, Bivens, Davis (10th Edition)

8 Grading Components

- Sessional: 25%
- Midterm Exam: 30%
- Final Exam: 45%