National University of Engineering (UNI)
School of Computer Science
Syllabus 2024-II

1. COURSE

MA102FCCS. Integral Calculus (Mandatory)

2. GENERAL INFORMATION

2.1 Course	:	MA102FCCS. Integral Calculus
2.2 Semester	:	1^{st} Semester.
2.3 Credits	:	3
2.4 Horas	:	2 HT; 2 HP;
2.5 Duration of the period	:	16 weeks
2.6 Type of course	:	Mandatory
2.7 Learning modality	:	Face to face
2.8 Prerrequisites	:	None

3. PROFESSORS

Meetings after coordination with the professor

4. INTRODUCTION TO THE COURSE

Differential calculus is a fundamental tool in computer science for understanding and modeling change. This course introduces the main concepts of differential calculus, including limits, derivatives, applications of the derivative, and optimization.

5. GOALS

- Understand the concept of a limit and its application to calculating derivatives.
- Apply differentiation rules to calculate derivatives of various functions.
- Use the derivative to solve optimization problems, rates of change, and function analysis.

6. COMPETENCES

1) Analyze a complex computing problem and apply principles of computing and other relevant disciplines to identify solutions. (Assessment)

6) Apply computer science theory and software development fundamentals to produce computing-based solutions. (Assessment)

AG-C07) Computing Knowledge: Applies appropriate knowledge of mathematics, science, and computing. (Assessment)

AG-C12) Applies computer science theory and software development fundamentals to produce computer-based solutions. (Assessment)

7. TOPICS

Unit 1: Functions and Limits (6 hours)	
Competences Expected: 1,6,AG-C07	
Topics	**Learning Outcomes**
• Review of functions. • Definition of a limit. • Properties of limits. • Limits involving infinity. • Continuity.	• Evaluate limits graphically and numerically. [Familiarizarse] • Apply the properties of limits to evaluate limits algebraically. [Usar] • Determine the continuity of a function. [Evaluar]
Readings : [Ste15], [LE14]	

Unit 2: The Derivative (6 hours)	
Competences Expected: 1,6,AG-C07	
Topics	**Learning Outcomes**
• Definition of the derivative. • Geometric interpretation of the derivative. • Derivatives of polynomial and exponential functions. • Differentiation rules: sum, product, quotient, and chain rule.	• Calculate the derivative of a function using the definition. [Familiarizarse] • Interpret the derivative as the slope of the tangent line. [Usar] • Apply differentiation rules to find derivatives of functions. [Evaluar]
Readings : [Ste15], [LE14]	

Unit 3: Applications of the Derivative (12 hours)	
Competences Expected: 1,6,AG-C07,AG-C12	
Topics	**Learning Outcomes**
• Related rates. • Maximum and minimum values. • Mean Value Theorem. • Concavity and inflection points. • Optimization.	• Solve related rates problems. [Familiarizarse] • Find maximum and minimum values of a function. [Usar] • Apply the Mean Value Theorem. [Evaluar] • Determine the concavity and inflection points of a function. [Evaluar] • Solve optimization problems. [Evaluar]
Readings : [Ste15], [LE14]	

Unit 4: Transcendental Functions (12 hours)	
Competences Expected: 1,6,AG-C07	
Topics	**Learning Outcomes**
• Inverse trigonometric functions. • Hyperbolic functions. • Derivatives of inverse trigonometric and hyperbolic functions.	• Evaluate inverse trigonometric functions. [Familiarizarse] • Define and manipulate hyperbolic functions. [Usar] • Differentiate inverse trigonometric and hyperbolic functions. [Evaluar]
Readings : [Ste15], [LE14]	

Unit 5: Applications in Computing (12 hours)	
Competences Expected: 1,6,AG-C07,AG-C12	
Topics	**Learning Outcomes**
• Algorithm optimization. • Modeling dynamic systems. • Machine learning (e.g., gradient descent).	• Use derivatives to optimize algorithms. [Familiarizarse] • Model dynamic systems using differential equations. [Usar] • Apply differential calculus in machine learning algorithms. [Evaluar]
Readings : [Ste15]	

8. WORKPLAN

8.1 Methodology

Individual and team participation is encouraged to present their ideas, motivating them with additional points in the different stages of the course evaluation.

8.2 Theory Sessions

The theory sessions are held in master classes with activities including active learning and roleplay to allow students to internalize the concepts.

8.3 Practical Sessions

The practical sessions are held in class where a series of exercises and/or practical concepts are developed through problem solving, problem solving, specific exercises and/or in application contexts.

9. EVALUATION SYSTEM

********* EVALUATION MISSING ********

10. BASIC BIBLIOGRAPHY

[LE14] Ron Larson and Bruce H. Edwards. *Calculus*. Cengage Learning, 2014.

[Ste15] James Stewart. *Calculus: Early Transcendentals*. Cengage Learning, 2015.