NATIONAL UNIVERSITY OF SAN MARCOS

FACULTY OF MATHEMATICAL SCIENCES

SYLLABUS

1. GENERAL INFORMATION

1.1 Course name	:	Calculus I
1.2 Code	:	MA111
1.3 Academic Program	:	Scientific Computing
1.4 Credits	:	5
1.5 Prerrequisites	:	MA100. Basic Mathematics. (1^{st} Sem)
1.6 Type of Course	:	Mandatory
1.7 Area of Studies	:	Estudios Generales
1.8 Number of Weeks	:	16
1.9 Hours per week	:	3 HT; 4 HP;
1.10 Cycle	:	I
1.11 Learning modality	:	Face to face
1.12 Academic Period	:	2026-I
1.13 Semester Start Date	:	
1.14 Semester End Date	:	

2. PROFESSORS

Meetings after coordination with the professor

3. INTRODUCTION TO THE COURSE

The course includes knowledge of binary relations and real functions of a real variable. Limits, Continuity, and Derivatives of real functions, applications (maxima and minima), and Differentials applied to the solution of problems involving living beings.

4. GOALS

- Understand the fundamental concepts of limits and continuity.
- Master differentiation techniques for algebraic and transcendental functions.
- Apply derivatives to solve optimization problems and analyze rates of change.
- Develop a rigorous approach to the formal definition of a derivative.

5. COMPETENCES

ABET-1) An ability to identify, formulate, and solve broadly defined technical or scientific problems by applying knowledge of mathematics and science and/or technical topics to areas relevant to the discipline. (Familiarity)

6. TOPICS

Unit 1: Computational Arithmetic and Error Analysis (25 hours)	
Competences Expected: ABET-1	
Topics	**Learning Outcomes**
• Floating-point arithmetic and the IEEE standard • Sources of error: truncation, rounding, and discretization • Error propagation and condition number • Stability of numerical algorithms • Absolute, relative, and forward/backward error	• Define the different types of errors in numerical computation (rounding, truncation, discretization) [Familiarity] • Explain the principles of floating-point representation and arithmetic according to the IEEE standard [Familiarity] • Calculate the absolute and relative error of an approximation [Usage] • Analyze the propagation of errors in a sequence of arithmetic operations [Usage] • Distinguish between the condition of a problem and the stability of an algorithm [Assessment] • Compute the condition number of a simple problem (e.g., matrix-vector multiplication) [Usage]
Readings : [**Stewart2016**], [**Larson2018**]	

Unit 2: Roots Finding and Basic Numerical Optimization (25 hours)	
Competences Expected: ABET-1	
Topics	**Learning Outcomes**
• Bisection method and fixed-point iteration • Newton's method and secant method for root finding • Convergence analysis and order of convergence • Gradient descent for univariate optimization • Rate of convergence and stopping criteria	• Implement root-finding algorithms (bisection, Newton, secant) and analyze their convergence [Usage] • Classify the order of convergence of iterative methods [Assessment] • Apply gradient descent to solve simple univariate optimization problems [Usage] • Design appropriate stopping criteria for iterative methods [Usage]
Readings : [**Stewart2016**], [**Thomas2014**]	

7. WORKPLAN

7.1 Methodology

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

7.2 Theory Sessions

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

7.3 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.

8. EVALUATION SYSTEM

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

9. BASIC BIBLIOGRAPHY