NATIONAL UNIVERSITY OF SAN MARCOS

FACULTY OF MATHEMATICAL SCIENCES

SYLLABUS

1. GENERAL INFORMATION

1.1 Course name	:	Calculus II
1.2 Code	:	MA112
1.3 Academic Program	:	Scientific Computing
1.4 Credits	:	4
1.5 Prerrequisites	:	MA111. Calculus I. (2^{nd} 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; 2 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 Integral Calculus: the Indefinite Integral (antiderivative). Integration Techniques. Definite Integral. Integration of hyperbolic and inverse functions. Applications of the Definite Integral (Areas of plane regions, Volumes, Length, Surface Area). Improper Integral. Applications in problems involving living beings.

4. GOALS

- Understand the definite integral as a limit of Riemann sums.
- Master various integration techniques (substitution, parts, partial fractions).
- Apply the Fundamental Theorem of Calculus to solve complex problems.
- Use integrals to calculate areas between curves and volumes of solids of revolution.

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. (Usage)

6. TOPICS

Unit 1: Numerical Differentiation and Integration (25 hours)	
Competences Expected: ABET-1	
Topics	**Learning Outcomes**
• Finite difference approximations (forward, backward, central) • Richardson extrapolation • Newton-Cotes formulas (Trapezoidal rule, Simpson's rule) • Gaussian quadrature • Error analysis for numerical integration	• Compute derivatives of functions using finite difference schemes [Usage] • Apply Richardson extrapolation to improve the accuracy of numerical approximations [Usage] • Implement numerical integration rules (Trapezoidal, Simpson, Gaussian) [Usage] • Compare the accuracy and efficiency of different numerical integration methods [Assessment] • Analyze the error for numerical differentiation and integration formulas [Assessment]
Readings : [**Stewart2016**], [**Thomas2014**]	

Unit 2: Interpolation and Function Approximation (25 hours)	
Competences Expected: ABET-1	
Topics	**Learning Outcomes**
• Polynomial interpolation (Lagrange, Newton forms) • Spline interpolation (cubic splines) • Least squares approximation • Runge's phenomenon and Chebyshev nodes • Error analysis for interpolation	• Construct interpolating polynomials using different methods [Usage] • Implement cubic spline interpolation [Usage] • Apply least squares method for data fitting [Usage] • Explain Runge's phenomenon and strategies to mitigate it [Familiarity] • Analyze the error of an interpolation scheme [Assessment]
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