NATIONAL UNIVERSITY OF SAN MARCOS

FACULTY OF MATHEMATICAL SCIENCES

SYLLABUS

1. GENERAL INFORMATION

1.1 Course name	:	Capstone Project III
1.2 Code	:	MA403
1.3 Academic Program	:	Scientific Computing
1.4 Credits	:	5
1.5 Prerrequisites	:	MA402. Capstone Project II. (9^{th} 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	:	1 HT; 8 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 Undergraduate Thesis in Computational Mathematics (MA403) course is the culmination of the student's academic training and research process. This course focuses on the consolidation of the final thesis report, ensuring compliance with scientific standards and academic integrity. The student must demonstrate a total integration of mathematical knowledge and computational skills to solve a research problem, finalizing with the formal presentation of the manuscript and technical preparation for the defense before the academic and professional community.

4. GOALS

- Fully implement the designed computational solution, applying advanced computational mathematics techniques.
- Perform exhaustive analysis of results and rigorous methodological validations.
- Professionally document the entire research and development process of the project.
- Evaluate the impact and limitations of the developed solution, proposing future improvements.
- Publicly defend the project before a specialized jury, demonstrating mastery of the subject and technical communication skills.
- Demonstrate capacity for autonomous work, project management, and professional ethics in the development of applied research.

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. (Assessment)

ABET-2) An ability to formulate or design a system, process, procedure, or program for the intended purpose. (Assessment)

ABET-4) An ability to communicate effectively with a range of audiences. (Assessment)

ABET-5) An ability to understand ethical and professional responsibilities and the impact of technical and/or scientific solutions in global, economic, environmental, and societal contexts. (Assessment)

ABET-6) An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty. (Assessment)

6. TOPICS

Unit 1: Technical Consolidation and Final Optimization (20 hours)	
Competences Expected: ABET-1,ABET-2,ABET-4,ABET-5,ABET-6	
Topics	**Learning Outcomes**
• Final review of algorithmic implementation and computational efficiency • Code optimization and scalability of the solution • Formal verification and validation of numerical results • Software repository management and scientific reproducibility	• Conduct complete studies using research methods [Evaluar] • Formally demonstrate properties of solutions [Evaluar] • Implement complex mathematical processes on a computer [Usar] • Optimize computational solutions for efficiency [Evaluar]
Readings : [**McConnell2004**], [**Knuth1997**]	

Unit 2: Methodological Validation and Critical Analysis (20 hours)	
Competences Expected: ABET-1,ABET-2,ABET-4,ABET-5,ABET-6	
Topics	**Learning Outcomes**
• Comparative analysis of results against the state of the art • In-depth discussion on the impact and applications of the model • Final statistical validation and error analysis • Evaluation of the original contribution of the work	• Analyze social impact of scientific solutions [Evaluar] • Conduct rigorous methodological validations [Evaluar] • Recognize formal structure of complex problems [Evaluar] • Interpret results in an applied context [Usar]
Readings : [**Montgomery2017**], [**Box2005**]	

Unit 3: Academic Writing and Thesis Report (20 hours)	
Competences Expected: ABET-1,ABET-2,ABET-4,ABET-5,ABET-6	
Topics	**Learning Outcomes**
• Final structure of the thesis manuscript according to university standards • Scientific writing techniques for mathematics and computing • Citation management, bibliography, and academic integrity • Peer review and editorial correction processes	• Apply ethical principles in scientific communication [Usar] • Effectively communicate complex results [Evaluar] • Learn continuously through feedback [Usar] • Document processes professionally [Evaluar]
Readings : [**Alley1996**], [**Matthews2008**]	

Unit 4: Defense and Professional Projection (20 hours)	
Competences Expected: ABET-1,ABET-2,ABET-4,ABET-5,ABET-6	
Topics	**Learning Outcomes**
• Preparation of the public defense protocol • Technical speaking and argumentation before academic peers • Advanced data visualization for high-impact presentations • Publication plan for results in specialized forums	• Perform effectively in public defense [Evaluar] • Manage complex scientific projects [Evaluar] • Solve advanced mathematical problems [Evaluar] • Respond to criticism constructively [Usar]
Readings : [**Turabian2018**], [**Anholt2006**]	

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