NATIONAL UNIVERSITY OF SAN MARCOS

FACULTY OF MATHEMATICAL SCIENCES

SYLLABUS

1. GENERAL INFORMATION

1.1 Course name	:	Capstone Project II
1.2 Code	:	MA402
1.3 Academic Program	:	Scientific Computing
1.4 Credits	:	5
1.5 Prerrequisites	:	• MA401. Capstone Project I. (8^{th} Sem) • ID203. Technical and professional English V. (7^{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

This course constitutes the final phase of the capstone project in computational mathematics, where students complete, validate, and present an applied research project or technological development. It emphasizes the complete implementation of computational solutions, rigorous analysis of results, methodological validation, and professional communication of findings. The project must demonstrate mastery of computational mathematics, innovation capability, and contribution to knowledge or solution of real-world problems, culminating in professional-quality work and a public defense before a specialized jury.

4. GOALS

- Fully implement the designed computational solution, applying advanced computational mathematics techniques.
- Conduct comprehensive 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 topic mastery and technical communication skills.
- Demonstrate autonomous work capability, project management, and professional ethics in applied research development.

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: Advanced Implementation and Optimization (20 hours)	
Competences Expected: ABET-1,ABET-2,ABET-4,ABET-5,ABET-6	
Topics	**Learning Outcomes**
• Complete implementation of algorithms and computational methods • Optimization and performance improvement of solutions • Technical validation and exhaustive testing • Handling of edge cases and complex situations • Iterative refinement based on results	• Conduct complete studies using research methods [Evaluar] • Formally demonstrate properties of solutions [Evaluar] • Implement complex mathematical processes on computer [Usar] • Optimize computational solutions for efficiency [Evaluar]
Readings : [**McConnell2004**], [**Knuth1997**]	

Unit 2: Results Analysis and Validation (20 hours)	
Competences Expected: ABET-1,ABET-2,ABET-4,ABET-5,ABET-6	
Topics	**Learning Outcomes**
• Rigorous statistical analysis of results • Methodological validation and comparison with benchmarks • Sensitivity and robustness analysis of solutions • Evaluation of model limitations and assumptions • Critical interpretation of findings and conclusions	• Analyze social impact of scientific solutions [Evaluar] • Conduct rigorous methodological validations [Evaluar] • Recognize formal structure of complex problems [Evaluar] • Interpret results in applied context [Usar]
Readings : [**Montgomery2017**], [**Box2005**]	

Unit 3: Professional Documentation and Communication (20 hours)	
Competences Expected: ABET-1,ABET-2,ABET-4,ABET-5,ABET-6	
Topics	**Learning Outcomes**
• Preparation of professional technical report • Preparation of scientific articles or technical reports • Design of effective presentations for defense • Communication of results to different audiences • Ethical considerations in results publication	• 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 Final Evaluation (20 hours)	
Competences Expected: ABET-1,ABET-2,ABET-4,ABET-5,ABET-6	
Topics	**Learning Outcomes**
• Preparation for public project defense • Presentation strategies and technical argumentation • Handling jury questions and objections • Critical self-evaluation of own work • Planning of future work and improvements	• 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