National University of Engineering (UNI)
School of Artificial Intelligence
Syllabus 2027-I

1. COURSE

AI402. Capstone Project II (Mandatory)

2. GENERAL INFORMATION

2.1 Course	:	AI402. Capstone Project II
2.2 Semester	:	9th Semester.
2.3 Credits	:	4
2.4 Hours	:	1 HT; 5 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	:	CS401. Research Methodology. (4th Sem)

3. PROFESSORS

Meetings after coordination with the professor

4. INTRODUCTION TO THE COURSE

This course aims to enable students to conduct a deep state-of-the-art study on a specific topic chosen for their thesis project. Students will produce a technical report with preliminary comparative experiments and formulate a research proposal, culminating this part alongside with a faculty advisor who specializes in the chosen research area.

5. GOALS

- Conduct a deep state-of-the-art study on a specific topic in computer science.
- Demonstrate mastery of the relevant literature through critical and comparative analysis of existing approaches.
- Design and execute preliminary experiments that reproduce and compare state-of-the-art techniques.
- Write a high-quality technical report with theoretical framework, methodology, and experimental results.
- Formulate a research proposal with research question, hypothesis, objectives, and schedule.
- Select a thesis advisor who specializes in the chosen research area.
- The deliverables for this course are:

  Midterm Progress: Solid bibliography and draft of the theoretical framework in LaTeXformat.

  Final: Technical Report with preliminary comparative experiments and research proposal approved by the advisor.

6. COMPETENCES

AG-C02) Ethics: Applies ethical principles and commits to professional ethics and the standards of professional computing practice. (Assessment)

AG-C04) Communication: Communicates effectively in complex computing activities. (Assessment)

AG-C05) Project Management: Applies management principles in computing to manage projects. (Assessment)

AG-C08) Problem Analysis: Identifies, formulates, and analyzes complex computing problems. (Assessment)

AG-C09) Design and Development of Solutions: Designs, implements, and evaluates solutions for complex computing problems. (Assessment)

7. TOPICS

Unit 1: Deep State-of-the-Art Study on a Specific Topic (10 hours)	
Competences Expected: AG-C08,AG-C09	
Topics	**Learning Outcomes**
• Selection and refinement of the research topic in coordination with the advisor. • Exhaustive multi-source search: IEEE Xplore, ACM Digital Library, Google Scholar, arXiv, and specialized databases. • Identification of seminal works and most-cited papers in the area. • Construction of the citation graph and temporal evolution analysis of the topic. • Identification of sub-areas, variants, and main approaches in the field.	• Build a comprehensive literature map for a specific topic identifying the foundational works. [Evaluar] • Analyze the temporal evolution of a research area identifying trends and gaps. [Evaluar] • Organize the literature into coherent subcategories that reflect the structure of the field. [Evaluar]
Readings : [**ieee**], [**acm**], [**citeseer**]	

Unit 2: Critical and Comparative Analysis of Approaches (10 hours)	
Competences Expected: AG-C08,AG-C09	
Topics	**Learning Outcomes**
• Critical analysis of proposals: methodology, datasets, metrics, and limitations of each approach. • Construction of comparative tables of existing proposals using objective criteria. • Identification of unresolved research gaps in the area. • Formulation of the student's own research question based on the state-of-the-art analysis. • Theoretical framework: structured and coherent synthesis of relevant knowledge in the area.	• Systematically compare multiple approaches using objective and quantifiable criteria. [Evaluar] • Identify unresolved research gaps in a specific area of computer science. [Evaluar] • Formulate an original research question grounded in the state-of-the-art analysis. [Evaluar]
Readings : [**ieee**], [**acm**], [**citeseer**]	

Unit 3: Design and Execution of Preliminary Experiments (12 hours)	
Competences Expected: AG-C05,AG-C08,AG-C09	
Topics	**Learning Outcomes**
• Experimental design: variables, hypotheses, metrics, and benchmarks of the area. • Reproduction of results from relevant state-of-the-art works. • Implementation of baselines for objective comparison of approaches. • Basic statistical analysis: significance tests and confidence intervals. • Experimental data management: datasets, configurations, versions, and results logging.	• Reproduce the results of at least two relevant works from the state of the art of the area. [Usar] • Design and execute a preliminary comparative experiment with defined baselines. [Usar] • Interpret and report experimental results with appropriate statistical rigor. [Evaluar]
Readings : [**ieee**], [**acm**]	

Unit 4: Technical Report Writing (12 hours)	
Competences Expected: AG-C04,AG-C09	
Topics	**Learning Outcomes**
• Structure of the technical report: introduction, theoretical framework, methodology, experiments, results, and conclusions. • Writing the theoretical framework: thematic organization and critical synthesis of the literature. • Documentation of methodology and experimental configuration in LaTeX. • Presentation of results: high-quality tables, charts, and comparative analyses. • Revision cycles: writing, advisor review, and incorporation of feedback.	• Write a complete technical report including theoretical framework and preliminary experiments. [Usar] • Structure and present experimental results with clear and precise visualizations. [Usar] • Apply revision cycles to improve the quality, coherence, and rigor of the document. [Evaluar]
Readings : [**ieee**], [**acm**]	

Unit 5: Research Proposal and Advisor Selection (8 hours)	
Competences Expected: AG-C02,AG-C05,AG-C09	
Topics	**Learning Outcomes**
• Structure of a research proposal: problem, motivation, hypothesis, and objectives. • Definition of thesis project scope: methodology, expected contribution, and schedule. • Feasibility analysis: resources, timeline, risks, and contingencies. • Criteria for selecting a thesis advisor: expertise, availability, and thematic alignment. • Formalization of the researcher-advisor relationship within the academic program.	• Produce a research proposal defining the problem, hypothesis, objectives, and methodology. [Evaluar] • Select an advisor with demonstrated expertise in the chosen research area. [Usar] • Define a viable thesis plan with objectives, scope, schedule, and risk analysis. [Evaluar]
Readings : [**ieee**], [**acm**]	

Unit 6: Presentation and Defense of the State of the Art (8 hours)	
Competences Expected: AG-C02,AG-C04,AG-C05	
Topics	**Learning Outcomes**
• Preparation of the oral presentation of the technical report before the evaluation committee. • Defense techniques for handling questions and challenges from an academic committee. • Design of a technical poster of the state of the art for symposium presentation. • Incorporation of evaluating committee feedback into the final revision of the report. • Planning the transition to CS403: objectives, expected contribution, and next steps.	• Present and orally defend the technical report before an academic committee with rigor. [Evaluar] • Constructively incorporate committee feedback into a revision of the report. [Usar] • Plan the transition to the thesis project (CS403) with clear objectives and next steps. [Usar]
Readings : [**ieee**], [**acm**]	

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