



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

1. COURSE

AI261. Probability and Statistics for AI (Mandatory)

2. GENERAL INFORMATION

- 2.1 Course** : AI261. Probability and Statistics for AI
2.2 Semester : 4th Semester.
2.3 Credits : 4
2.4 Hours : 2 HT; 4 HP;
2.5 Duration of the period : 16 weeks
2.6 Type of course : Mandatory
2.7 Learning modality : Face to face
 - BMA102. Differential Calculus. (1st Sem)
2.8 Prerequisites :
 - BMA101. Linear Algebra. (1st Sem)
 - STA251. Probability Calculation. (3rd Sem)

3. PROFESSORS

Meetings after coordination with the professor

4. INTRODUCTION TO THE COURSE

This course provides the essential probabilistic and statistical foundations for developing Artificial Intelligence systems. It covers key distributions, Bayesian inference, and statistical methods directly applied to machine learning problems, computer vision, and natural language processing.

5. GOALS

- Understand fundamental probability distributions in AI models
- Apply statistical inference methods in model training
- Implement probabilistic solutions using modern libraries (NumPy, SciPy)

6. COMPETENCES

AG-C07) Computing Knowledge: Applies knowledge of mathematics, science, and computing. (Usage)

7. TOPICS

Unit 1: Probabilistic Foundations (15 hours)	
Competences Expected: AG-C07	
Topics	Learning Outcomes
• Probability spaces and random variables • Key distributions: Normal, Poisson, Binomial, Multinomial • Bayes' Theorem and AI applications	• Calculate probabilities in discrete/continuous models [Usar] • Explain the role of distributions in ML algorithms [Familiarizarse]
Readings : [Bishop2006], [Murphy2012]	

Unit 2: Statistics for AI (15 hours)	
Competences Expected: AG-C07	
Topics	Learning Outcomes
• Parameter estimation (MLE, MAP) • Confidence intervals and hypothesis testing • Correlation analysis and linear regression	• Implement MLE/MAP in Python [Usar] • Evaluate statistical significance in model results [Evaluar]
Readings : [DeGroot2014], [Wasserman2004]	

Unit 3: Markov Chains and Stochastic Processes (15 hours)	
Competences Expected: AG-C07	
Topics	Learning Outcomes
• Hidden Markov Models (HMMs) • Markov Chain Monte Carlo (MCMC) • Applications in NLP and computer vision	• Simulate basic stochastic processes [Usar] • Relate theory to neural network architectures [Familiarizarse]
Readings : [Ross2019], [Bishop2006]	

Unit 4: Computational Tools (15 hours)	
Competences Expected: AG-C07	
Topics	Learning Outcomes
• NumPy for probabilistic operations • SciPy for statistical tests • Visualization with Matplotlib/Seaborn	• Program probabilistic simulations [Usar] • Generate statistical visualizations [Evaluar]
Readings : [VanderPlas2016], [McKinney2022]	

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