Content

Course Code	Course Name	Semester	Theory	Practice	Lab	Credit	ECTS
MAT331	Probability	5	3	2	0	5	8

Prerequisites	
Admission Requirements	

Language of Instruction	
Course Type	Compulsory
Course Level	Bachelor Degree
Objective	The aim of this course is to provide students with a solid foundation in probability theory, covering both discrete and continuous models. Students will learn how to model uncertainty mathematically, analyze random phenomena, and apply probability concepts to solve problems in science, engineering, and real life.
Content	• Principles of combinatorial analysis • Axioms of probability • Conditional probability and independence • Discrete random variables and their distributions • Continuous random variables and density functions • Joint, marginal, and conditional distributions • Expectation, variance, and other moments • Law of large numbers and central limit theorem • Selected applications in statistics and data science
References	• Sheldon Ross, A First Course in Probability (latest edition)

Theory Topics

Week	Weekly Contents
1	Permutations and combinations, Sample space and events, Axioms of Probability
2	Conditional probability, Bayes' Formula, Random variables, Discrete random variables
3	Expected Value, Expectation of a Function of a random variable, Variance
4	The Bernoulli and binomial random variables, The Poisson random variable, Other discrete probability distributions
5	Continuous random variables and their expectation and variance
6	The uniform random variable, Normal random variables, Exponential random variables
7	The distribution of a Function of a random variable, Midterm Examination
8	Joint distribution functions, Independent random variables, Sums of independent random variables
9	Conditional Distributions, Joint probability distribution of functions of random variables
10	Properties of expectation, Expectation of sums of random variables, Moments of the number of events that occur
11	Covariance, Variance of sums and Correlations
12	Conditional expectation and prediction, Moment generating Functions
13	Chebyshev's inequality, The weak law of large numbers,
14	The central limit theorem, The strong law of large numbers