

---

# Signals theory A

## Finalità

The course objective is to provide the student with a basic knowledge of probability theory for engineers. The course covers the basics of the axiomatic theory of probability, up to the treatment of multiple random variables, the law of large numbers and the Central Limit Theorem.

## Programma

Elements of set theory and operations with sets.  
Elements of combinatorial analysis.  
The axiomatic theory of probability. Conditional probability.  
Composite experiments.  
Chain rule, Law of total probability for events, Bayes formula. Independence of events.  
Repeated trials. Experiments in uncountable sample spaces.  
The Dirac delta function to switch from countable to uncountable sample spaces.  
The concept of random variable (RV). Cumulative (CDF) and Density (PDF) functions.  
Discrete and continuous RVs. Transformations of an RV. Expected value.  
Variance. Markov's and Chebychev's inequalities. Moment generating function (MGF) and Characteristic function (CF). Conditional CDF and PDF.  
Elements of Hypothesis testing. Vectors of RVs. Jointly continuous RVs.  
Transformations of vectors of RVs. Correlation and Covariance. The sample mean and the Weak law of Large Numbers. Optimal mean square estimators.  
The regression curve. The central limit Theorem.

## Modalità d'esame

Either two mid-term written examinations during classes or a three-hour written final exam is required.

## Propedeuticità

Analisi A+B

## Testi consigliati

A. Bononi , G. Ferrari “Teoria della probabilità e variabili aleatorie con applicazioni”, Mc-Graw Hill