SIGNAL_S8_MIN **Spring Semester** **Graduate**	**Signal as a minor S8**	**4 credits** **Lab: 37.5%** **Final exam (3h): 62.5%**
Prerequisite: S5-S7 Signal lectures		

DST_2211	**Statistics and numerical methods**	**Language**
Lecture: 14	**Tutorials: 16**	**Lab work: 16**

This course gathers applied mathematics methods. Two main chapters – estimation and significance tests – are seen from both the aspects of inferential and industrial statistics. The first point of view allows to solve random signals problems, only using time-method, and some telecommunications problems (decoding with maximum likelihood). Other topics, dealing with industrial statistics and Engineer general knowledge, are presented, such as Chi-Squared testing and quality control. Optimization problems coming from statistics are solved with a numerical method. Conversely, statistical methods allow the solution of optimization problems : a topic over stochastic optimization is discussed.

- Random vectors, random processes, statistical samples management
- Likelihood of a statistical model
- Estimation one-point or over a range
- Significance testing: parametric (Neyman-Pearson) and non-parametric (Chi-Squared)
- Finite differences
- Multiple-variable Differential Calculus
- Optimization: gradient method, Newton method, least-squared method
- Stochastic optimization

SIGNAL_S8_MAJ Spring Semester Graduate	Signal as a major S8	6 credits Lab: 41.7% Final exam (3h): 58.3%
Prerequisite: S5-S7 Signal lectures		

DEP_2211	Statistics and numerical methods	Language
Lecture: 14	Tutorials: 16	Lab work: 16
Same as minor.		

DEP_2216	Information theory and multimedia compression	Language
Lecture: 10	Tutorials: 10	Lab work: 16

This course introduces the fundamentals in coding theory, source coding, error correction coding. Multimedia compression is then discussed (image, audio, video). JPEG images compression will be the golden thread since it includes lossless and lossy compression.

- Information theory and digital communications: entropy, mutual information, source coding (Shannon theorem, Huffman algorithm, Markov sources), differential entropy of continuous random variables, Gaussian channel capacity.
- Lossless compression, reversible: statistical algorithms, dictionary-based methods, arithmetic compression
- Lossy compression, non-reversible: scalar and vector quantification, transformations and preparation to compression, restitution quality versus compression rate.
- Channel coding: discrete channel without memory, capacity, Shannon theorem for coding theory, binary linear codes.
- JPEG norms.