

Syllabus

Signal Processing and Information Theory (6 CFU)

Third Year, B.Sc. in Bioinformatics (Second semester)

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Course material : *Available on the course webpage at <http://acts.eng.uniroma1.it/gsp.php>*

This course introduces the fundamentals of information theory and signal processing. Topics include entropy, coding, and channel capacity, as well as Fourier analysis, sampling, and discrete transforms. Emphasis is placed on methodological tools with applications ranging from communications to genomic signal processing and molecular biology.

Information Theory (3 CFU)

- Introduction: What is information?
- Statistical measures of information
- Entropy
- Conditional entropy
- Discrete memoryless channel capacity
- Binary noise-free channel
- Binary noisy channel
- Binary symmetric channel
- Discrete channel capacity
- Source coding: Shannon–Fano and Huffman coding
- Channel coding: linear codes and block codes

Signal Processing (3 CFU)

- Properties of signals and noise
- Physically realizable signals
- Time average operator
- DC value
- Power and decibels
- Fourier transform and spectra
- Properties of the Fourier transform
- Parseval's theorem and energy spectral density
- Dirac delta function and unit step function
- Rectangular and triangular pulses
- Convolution
- Band-limited signals and noise
- Band-limited waveforms
- Sampling theorem
- Impulse sampling
- Discrete Fourier Transform (DFT)