


 Faculty of Applied Sciences

**INGI2348 Information theory and coding**

[30h] 3 credits

This course is taught in the 1st semester

**Teacher(s):** Philippe Delsarte (coord.), Benoît Macq  
**Language:** French  
**Level:** Second cycle

**Aims**

- To explain the notions, methods and results that are used in the analysis and design of information representation, protection and correction systems.
- To present not only general results that determine the possibilities offered by information theory, but also effective compression, security and correction methods.
- To provide some design tools for multimedia (image, sound, data) information coding.

**Main themes**

- Information representation: decorrelation coding and entropic coding.
- Information security: cryptographic coding.
- Information correction: channel coding theory and error-correcting codes.

**Content and teaching methods**

- Basic notions in information theory; mutual information and entropy.
- Discrete source coding by fixed length-codes and variable-length codes.
- Decorrelation coding and coding gain notions.
- Basic notions in cryptology; secret-key and public-key cryptographic coding systems.
- Discrete memoryless channel; capacity notion; noisy channel coding theorem.
- General block coding theory; role of the minimum distance.
- Linear codes: generator matrix and parity-check matrix; syndrome decoding.
- Study of certain classes of linear block codes: cyclic codes and Reed-Solomon codes.
- Introduction to convolution codes.

**Other information (prerequisite, evaluation (assessment methods), course materials recommended readings, ...)**

- Prerequisite:

- (1) FSAB 1101, FSAB 1102, FSAB 1103: Mathematics (linear algebra).
- (2) FSAB 1104: Probability and statistics (basic probability notions).

- References:

- (1) R.G. Gallager, 'Information Theory and Reliable Communication', Wiley, 1968.
- (2) F.J. MacWilliams and N.J.A. Sloane, 'The Theory of Error-Correcting Codes', North-Holland, 1977.

- Assessment

Written examination (no document allowed)

## Miscellaneous

Basic notions in information theory; mutual information and entropy.  
 <br>Discrete source coding by fixed length-codes and variable-length codes.  
 <br>Decorrelation coding and coding gain notions.  
 <br>Basic notions in cryptology; secret-key and public-key cryptographic coding systems.  
 <br>Discrete memoryless channel; capacity notion; noisy channel coding theorem.  
 <br>General block coding theory; role of the minimum distance.  
 <br>Linear codes: generator matrix and parity-check matrix; syndrome decoding.  
 <br>Study of certain classes of linear block codes: cyclic codes and Reed--Solomon codes.  
 <br>Introduction to convolution codes.

## Programmes in which this activity is taught

<b>FSA3DS</b>	Diplôme d'études spécialisées en sciences appliquées
<b>INFO2</b>	Ingénieur civil informaticien

## Other credits in programs

<b>ELEC22</b>	Deuxième année du programme conduisant au grade d'ingénieur civil électricien	(3 credits)
<b>ELEC23</b>	Troisième année du programme conduisant au grade d'ingénieur civil électricien	(3 credits)
<b>ELME23/E</b>	Troisième année du programme conduisant au grade d'ingénieur civil électro-mécanicien (énergie)	(3 credits)
<b>FSA3DA</b>	Diplôme d'études approfondies en sciences appliquées	(3 credits)
<b>FSA3DS/IN</b>	Diplôme d'études spécialisées en sciences appliquées (informatique)	(3 credits)
<b>INFO21</b>	Première année du programme conduisant au grade d'ingénieur civil informaticien	(3 credits)
<b>INFO22</b>	Deuxième année du programme conduisant au grade d'ingénieur civil informaticien	(3 credits)
<b>MAP23</b>	Troisième année du programme conduisant au grade d'ingénieur civil en mathématiques appliquées	(3 credits)