Mathematics	Semester: S5

EU objectives

At the end of this course, students will be able to :

Applied Analysis :

- Efficiently calculate a Fourier series and a Fourier transform
- Understand the different modes of convergence of Fourier series and the Gibbs phenomenon
- Know the convolution product and understand its link with the product of functions,
- Know how to use the Fourier transform to solve classical differential equations.

Probability - Statistics :

- Use the basic concepts of probabilistic modelling and master random variables and classical laws
- Know how to apply the usual probability techniques in various fields
- Explore data sets and simulate data sets using a spreadsheet program
- Apply the most widely used statistical inference techniques: estimation by confidence intervals and hypothesis testing

Numerical Analysis 1 :

- Formulate an interpolation problem and find the appropriate method for solving it.
- Solve a linear system by applying the appropriate method (direct or iterative), ensuring that the chosen algorithm is numerically stable.
- Express and solve a problem involving the approximation of data using the method of least squares.
- From all the methods studied, choose and/or adapt the most appropriate method according to the engineering problem to be solved, and know how to implement it.

Description of the ECUEs
Applied Analysis : - Fourier series - Fourier Transform **Probability-Statistics :** - Random variables, pairs of random variables, independence, correlation - Study of the main discrete and continuous laws - Convergence, limit theorems, approximation of laws - Estimators, confidence intervals, hypothesis testing - Applications: industrial statistical controls, standard compliance tests, quality procedures, etc. - TD: formulating and solving practical problems related to the concepts presented in the course - Practical work: simulation of random experiments, statistical calculations and data exploration using a spreadsheet program **Numerical Analysis 1 :** - Polynomial interpolation - Direct methods for solving linear systems: LU, Cholesky, etc. Application to a least squares problem - Iterative methods for solving linear systems: Jacobi, Gauss-Seidel, Relaxation, Constant-step gradient.
Prerequisites
Applied Analysis : - Complex numbers - Convergence of series of numbers,

- Convergence of sequences and series of functions (different concepts)

- Integrals and generalized integrals

Probability-Statistics :

- Combinatorial analysis on a finite set

- Descriptive statistics (frequencies, median, quartiles, mean, variance, correlation)

Numerical Analysis 1 :

- Basic concepts of linear algebra and analysis

- Polynomials

- Systems of linear equations

- Matrix calculation.

Bibliography

Applied Analysis :

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Numerical Analysis 1 :

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