INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

3rd YEAR MODELING, INFORMATICS AND COMMUNICATIONS

Introducing

Description

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Optimization and linear programming

Introducing

Description

- Introduction to constrained optimization: definitions and generalities, existence of solutions, convexity and uniqueness
- Optimality conditions: first and second order conditions in unconstrained differentiable optimization, Karush-Kuhn-Tucker (KKT) conditions in constrained differentiable optimization, Lagrangian notion
- Algorithms for unconstrained optimization: gradient algorithm (fixed step, optimal step), Newton's algorithm, linear and nonlinear least squares problems
- Introduction to linear constrained optimization: modeling formalisms, characterization of the search space, geometric interpretation, graphical resolution, link with KKT conditions, simplex algorithm, method of dictionaries, complexity, duality of a PL problem, strong and weak duality theorems, complementary deviations theorems, Farkas lemma, alternatives theorem.

Detailed course handout provided.

Keywords : differentiable optimization, first and second order optimality conditions, gradient algorithms, Newton, least squares problems, linear programming and simplex algorithm.

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):

- The notions of local extremum and convexity
- Characterization of a local extremum by optimality conditions: first and second order conditions in unconstrained differentiable optimization, Karush-Kuhn-Tucker (KKT) conditions in constrained differentiable optimization
- The first algorithms for unconstrained optimization: gradient algorithm (fixed step, optimal step), Newton's algorithm, linear and nonlinear least squares problems
- Optimization under linear constraints (Linear Programming/PL): modeling in PL, characterization of the search space, geometric interpretation, solution principle, simplex algorithm, dictionary methods, complexity, duality.

The student will be able to:
Choose and implement a relevant and numerically efficient optimization method for an unconstrained differentiable optimization problem or for a linear programming problem.

Necessary prerequisites

Differential calculus: know how to calculate a gradient and a hessian. Link with differential.
Linear algebra: know how to diagonalize a matrix, calculate the eigenvalues, notion of semi-definite positivity.

Évaluation

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Practical info

Location(s)

Toulouse

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Operating system

Introducing

Description

The operating system is considered as resources managers: processors management (processes, scheduling) memory management (virtual memory, allocation), access to resources (synchronisation, mutual exclusion) and file system.

Objectives

At the end of this module, the student will have understood and be able to explain the operating system problems with a global overview of its functions and architecture.

Necessary prerequisites

Notions in computer's structure.

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Advanced algorithmics

Introducing

Description

Correction proofs
Asymptotic analysis
Devide and conquer
Greedy algorithms
Dynamic Programming
Branch and Bound
Problems tractability

Objectives

The objective of this course is to introduce the foundations of computational thinking, including complexity theory, proofs of correctness, advanced algorithmic design, and more. Throughout the course, students will learn to analyze the tractability of problems as well as the correctness and complexity of algorithms. They will be taught advanced algorithmic design techniques, such as divide and conquer, greedy algorithms, dynamic programming, and branch and bound.

Necessary prerequisites

Algorithms and Programming (1st and 2nd year)

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Databases 2

Introducing

Description

The aim of this course is to study relational databases. The fundamental concepts of the relational model are studied. The focus is then on relational algebra and the SQL language for manipulating and querying databases.

Objectives

At the end of this module, students should be able to understand and explain the main concepts.
- The relational model
- Data integrity constraints
- Languages for manipulating and querying relational databases, in particular relational algebra and the SQL language.

In practice, students should be able to :

- Implement a designed database while guaranteeing integrity constraints
- write queries in relational algebra, then implement them in SQL for manipulating and querying relational databases

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Markov chains

Introducing

Description

Markov chains and their classification: definition and class properties (irreducibility, recurrence, transience, aperiodicity), convergence to the stationary distribution, reversible Markov chain, absorbing time.

Objectives

Time-homogenous Markov chain over discrete state space, classification of states, stationary measure, reversible Markov chain, convergence to stationary distribution, ergodic theorem.

Markov chains:
The description of a Markovian model to its formalization by a Markov chain
develop a analysis of Markov chains (description of its communication classes, conclusion on the existence of a stationary distribution and on the convergence of the chain distribution)

Necessary prerequisites

Basic notions in discrete probability theory

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Data analysis

Introducing

Description

• Unidimensional descriptive statistics
• Bidimensional descriptive statistics
• Principal component analysis
• Clustering: principle, hierarchical clustering, Kmean and DBSCAN
• Introduction to programming in R and Rmarkdown

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):

• the main definitions for the unidimensional and bi-dimensional descriptive statistics
• the main concepts and the interpretation of graphical results of the principal component analysis
• the main concepts of clustering (hierarchical clustering, kmeans method and DBSCAN) and the interpretation of graphical results

The student will be able to:

• develop a descriptive statistical analysis with the R software
• manipulate the concepts of the principal component analysis, know the main properties and comment the graphical results

Necessary prerequisites

Probability and Statistic course (L2/2MIC)

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Dynamical systems

Introducing

Description

- Definition of an autonomous ODE, definition of a Cauchy Problem, Theorem of Cauchy-Lipschitz
- Definition of a maximal solution and the maximum domain, analysis of the stability
- Qualitative properties: conservative systems, Lyapunov functions, introduction to bifurcations (+ limit cycles)
- Construction of the phase portrait of an ODE in dimension 1 and 2
- Numerical integration of an autonomous ODE (Euler, RK, Crank-Nicholson)
- Analysis of a numerical scheme: stability, consistency and convergence

The above-mentioned concepts will be introduced and applied to 4 dynamical systems used all along this class

Objectives

At the end of this module, the student will have understood and be able to

-Define a Cauchy problem and prove the well-posedness of an autonomous ordinary differential equation
-Obtain qualitative properties of the solution of an autonomous ordinary differential equation (maximal solution, maximum domain, stability)
-Draw the phase portrait of an autonomous ordinary differential equation in dimension 1 and 2
-Solve using numerical integration an autonomous ordinary differential equation
- Apply these notions to analyze a dynamical system used in physics, biology or population dynamics

Necessary prerequisites

Differential and integral calculus, linear algebra

Évaluation

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Practical info

Location(s)

Toulouse

Complements of probabilities

Introducing

Description

Program (detailed contents):
- Sigma-algebra, sigma-algebra generated by one or many random variables.
- Conditional expectation with respect to a sigma-algebra generated by a partition and then with respect to a general sigma-algebra. Main properties of conditional expectation.
- Gaussian random vectors. Main properties, Gaussian miracle for the independence of coordinates, projection theorem for Gaussian random vectors, multidimensional central limit theorem.
- Classical inequalities arising in probability theory: Markov, Chebyshev, Cauchy-Schwarz and Hölder.
- Modes of convergence of random variables: almost sure, in probability, in distribution, in the Lp spaces, and links between them.

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):
- The notion of sigma-algebra generated by one or many random variables.
- The definition and main properties of a conditional expectation.
-The definition and main properties of a Gaussian vector.
-The various modes of convergence in probability theory and the links between them.

The student will be able to:
- Compute a conditional expectation with respect to a given sigma-algebra.
- Prove that a random vector is a Gaussian random vector and give the underlying parameters (expectation and covariance matrix); use the specific properties of Gaussian random vectors.
- Use classical inequalities appearing in probability theory.
- Prove that a given sequence of random variables converges (or not) almost surely, in probability, in distribution or in Lebesgue spaces (Lp spaces).

Necessary prerequisites

Course on Probability and Statistics (2MIC Semester 4).

Évaluation

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Practical info

Location(s)

Toulouse

Ecological Transition, GHG Reduction, Responsibility and Environment (EARTH)

Introducing

Description

The teaching includes a "2 tonnes" workshop, which provides a fun way of understanding the orders of magnitude linked to the objectives of carbon neutrality in 2050. It also includes assignments on the following topics: housing; electricity production; inequalities and responsibilities; mobility; the climate inaction debate; agriculture and food; and aeronautics. Students also work on a complex problem linked to ecological issues, starting their reflections from an everyday object or service.

Objectives

At the end of this module, the student will be able to:

- Be comfortable with the fundamental concepts related to greenhouse gas emissions, and be able to make simple calculations on this subject.
- Know the order of magnitude of important quantities.
- Be able to fetch emission values from the ADEME database and use them appropriately.
- Think about ecological issues in all their complexity and study a specific problem
- Have an understanding of life cycle analysis and how to apply it
- Be able to research scientific literature
- Be able to understand and analyse figures/data
- Draw political conclusions from scientific facts and one's own values
- Debate, discuss and confront points of view.

Necessary prerequisites

Basic knowledge on energy.

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Job Hunting Techniques

Introducing

Description

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Job search

Introducing

Description

Évaluation

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Practical info

Location(s)

Toulouse

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Humanities elective course

Introducing

Description

Évaluation

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Practical info

Location(s)

Toulouse

Physical Education

Introducing

Description

Évaluation

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Practical info

Location(s)

Toulouse

Optimization and linear programming

Introducing

Description

- Introduction to constrained optimization: definitions and generalities, existence of solutions, convexity and uniqueness
- Optimality conditions: first and second order conditions in unconstrained differentiable optimization, Karush-Kuhn-Tucker (KKT) conditions in constrained differentiable optimization, Lagrangian notion
- Algorithms for unconstrained optimization: gradient algorithm (fixed step, optimal step), Newton's algorithm, linear and nonlinear least squares problems
- Introduction to linear constrained optimization: modeling formalisms, characterization of the search space, geometric interpretation, graphical resolution, link with KKT conditions, simplex algorithm, method of dictionaries, complexity, duality of a PL problem, strong and weak duality theorems, complementary deviations theorems, Farkas lemma, alternatives theorem.

Detailed course handout provided.

Keywords : differentiable optimization, first and second order optimality conditions, gradient algorithms, Newton, least squares problems, linear programming and simplex algorithm.

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):

- The notions of local extremum and convexity
- Characterization of a local extremum by optimality conditions: first and second order conditions in unconstrained differentiable optimization, Karush-Kuhn-Tucker (KKT) conditions in constrained differentiable optimization
- The first algorithms for unconstrained optimization: gradient algorithm (fixed step, optimal step), Newton's algorithm, linear and nonlinear least squares problems
- Optimization under linear constraints (Linear Programming/PL): modeling in PL, characterization of the search space, geometric interpretation, solution principle, simplex algorithm, dictionary methods, complexity, duality.

The student will be able to:
Choose and implement a relevant and numerically efficient optimization method for an unconstrained differentiable optimization problem or for a linear programming problem.

Necessary prerequisites

Differential calculus: know how to calculate a gradient and a hessian. Link with differential.
Linear algebra: know how to diagonalize a matrix, calculate the eigenvalues, notion of semi-definite positivity.

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Operating system

Introducing

Description

The operating system is considered as resources managers: processors management (processes, scheduling) memory management (virtual memory, allocation), access to resources (synchronisation, mutual exclusion) and file system.

Objectives

At the end of this module, the student will have understood and be able to explain the operating system problems with a global overview of its functions and architecture.

Necessary prerequisites

Notions in computer's structure.

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Advanced algorithmics

Introducing

Description

Correction proofs
Asymptotic analysis
Devide and conquer
Greedy algorithms
Dynamic Programming
Branch and Bound
Problems tractability

Objectives

The objective of this course is to introduce the foundations of computational thinking, including complexity theory, proofs of correctness, advanced algorithmic design, and more. Throughout the course, students will learn to analyze the tractability of problems as well as the correctness and complexity of algorithms. They will be taught advanced algorithmic design techniques, such as divide and conquer, greedy algorithms, dynamic programming, and branch and bound.

Necessary prerequisites

Algorithms and Programming (1st and 2nd year)

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Databases 2

Introducing

Description

The aim of this course is to study relational databases. The fundamental concepts of the relational model are studied. The focus is then on relational algebra and the SQL language for manipulating and querying databases.

Objectives

At the end of this module, students should be able to understand and explain the main concepts.
- The relational model
- Data integrity constraints
- Languages for manipulating and querying relational databases, in particular relational algebra and the SQL language.

In practice, students should be able to :

- Implement a designed database while guaranteeing integrity constraints
- write queries in relational algebra, then implement them in SQL for manipulating and querying relational databases

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Markov chains

Introducing

Basic notions in discrete probability theory

Description

Markov chains and their classification: definition and class properties (irreducibility, recurrence, transience, aperiodicity), convergence to the stationary distribution, reversible Markov chain, absorbing time.

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Objectives

Time-homogenous Markov chain over discrete state space, classification of states, stationary measure, reversible Markov chain, convergence to stationary distribution, ergodic theorem.

Markov chains:
The description of a Markovian model to its formalization by a Markov chain
develop a analysis of Markov chains (description of its communication classes, conclusion on the existence of a stationary distribution and on the convergence of the chain distribution)

Location(s)

Toulouse

Necessary prerequisites

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Data analysis

Introducing

Description

• Unidimensional descriptive statistics
• Bidimensional descriptive statistics
• Principal component analysis
• Clustering: principle, hierarchical clustering, Kmean and DBSCAN
• Introduction to programming in R and Rmarkdown

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):

• the main definitions for the unidimensional and bi-dimensional descriptive statistics
• the main concepts and the interpretation of graphical results of the principal component analysis
• the main concepts of clustering (hierarchical clustering, kmeans method and DBSCAN) and the interpretation of graphical results

The student will be able to:

• develop a descriptive statistical analysis with the R software
• manipulate the concepts of the principal component analysis, know the main properties and comment the graphical results

Necessary prerequisites

Probability and Statistic course (L2/2MIC)

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Databases 1 and Web Programming

Introducing

Description

Database 1:

The aim is to introduce the basic concepts of designing relational databases in UML. From the conceptual model designed using UML, the process of derivation and validation of the relational model is studied. The normalization process is investigated.

Web programming

The languages HTML5, CSS, and JavaScript are studied.

Organisation:

Database 1:
10h of courses, followed by 10h of directed labs.

Web programming:
5h of courses, followed by 7,5h of directed labs, followed by 8,25h of practical labs

Students attend lectures accompanied by course materials. The lectures are followed by directed labs, during which students practice the various concepts they have learned in class. The final practical tutorial sessions are devoted to the introduction and study of a project. During practical work, students carry out their project. At the end of the practical work, students will present their project and provide a project report and source codes.

Objectives

At the end of this module, the student should understand and be able to explain (main concepts):

Database 1:
- The different data models, their advantages and limits
- What is a DBMS (Database management system)
- UML-based data model
- The different concepts of the relational model
- The normalization and its importance
- Data integrity constraints

Web programming
- Understand the concepts and technologies of the Web
- HTML5 language
- CSS language
- JavaScript language

The student should be able to:

Database 1:
- Design a relational database based on UML
- Derive the relational model from UML model and vice versa
- Normalize and validate a relational model

Web programming
- Design a static Web site with HTML5
- Define a CSS file
- Write scripts with JavaScript

Necessary prerequisites

Algorithmic for Web programming

Évaluation

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Practical info

Location(s)

Toulouse

Networks

Introducing

Description

The first part of the course introduces the characteristics of the main network applications.
The second part details the fundamental concepts associated with network design: connectivity, resource sharing, switching, quality of service, and architecture.
The third part describes the architecture of local area networks, using case studies, and Ethernet networks.
Illustrations of these concepts are explored in tutorials and labs.

Objectives

At the end of this module:
The student will understand and be able to explain the main concepts associated with computer networks (personal, local, and wide-area networks) and their interconnection within the Internet (TCP/IP).
They will thus be able to identify: the characteristics of the main distributed applications in networks, the different types of connectivity and addressing schemes within networks, resource sharing solutions and their impact on transfer quality (loss, de-sequencing, delay, throughput), and finally, the concepts of service, protocol, architecture, and quality of service.
More specifically, the services, functionalities, and main mechanisms of the protocols involved in the architecture of Ethernet local area networks and the TCP/IP Internet will be mastered theoretically by the end of the course.

Necessary prerequisites

Notions on operating systems and C programming.

Évaluation

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Practical info

Location(s)

Toulouse

Theory of information and coding

Introducing

Description

- Shannon paradigm, quantity of information, entropy
- Data compression with and without loss of information
- Linear error-correcting codes
- Classical, contemporary and post-quantum cryptography

Objectives

The aim of the course is to introduce the founding principles of information theory with its applications in data compression, corrective codes and cryptography.

At the end of the course, students will be able to:
- apply the principles of information theory to evaluate, quantify and size algorithms for data compression and error detection and correction.
- apply standard cryptographic encryption algorithms for confidential information transfer.

Necessary prerequisites

Basic mathematics in algorithms, information representation, linear algebra, probability and modular arithmetic.

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Ecological Transition, GHG Reduction, Responsibility and Environment (EARTH)

Introducing

Description

The teaching includes a "2 tonnes" workshop, which provides a fun way of understanding the orders of magnitude linked to the objectives of carbon neutrality in 2050. It also includes assignments on the following topics: housing; electricity production; inequalities and responsibilities; mobility; the climate inaction debate; agriculture and food; and aeronautics. Students also work on a complex problem linked to ecological issues, starting their reflections from an everyday object or service.

Objectives

At the end of this module, the student will be able to:

- Be comfortable with the fundamental concepts related to greenhouse gas emissions, and be able to make simple calculations on this subject.
- Know the order of magnitude of important quantities.
- Be able to fetch emission values from the ADEME database and use them appropriately.
- Think about ecological issues in all their complexity and study a specific problem
- Have an understanding of life cycle analysis and how to apply it
- Be able to research scientific literature
- Be able to understand and analyse figures/data
- Draw political conclusions from scientific facts and one's own values
- Debate, discuss and confront points of view.

Necessary prerequisites

Basic knowledge on energy.

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Job Hunting Techniques

Introducing

Description

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Introducing

Description

Évaluation

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Practical info

Location(s)

Toulouse

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Humanities elective course

Introducing

Description

Évaluation

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Practical info

Location(s)

Toulouse

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Physical Education

Introducing

Description

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Signal 2

Introducing

Description

I. Fourier Transform in L1(IR) and L2(IR)

1. Definitions and properties

2. Inversion, derivability and convolution

3. Plancherel Theorem.

4. Shannon¿s Theorem.

II. Fourier trasnform of sequences

1. Definition, properties.

2. Convolution

III. Short thime Fourier transform

1. Definition

2. Windowing and application to sound processing.

IV. Random Signals

1. Definition

2. ARMA process

3. Denoising in an orthogonal basis.

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):

Fourier transform of integrable functions.

Fourier transform of sequences

Short time Fourier trasnform

Sampling Shannon¿s Theorem

Modelisation of random signals.

ARMA process

Signal denoising.

Necessary prerequisites

Undergraduate Analysis: integration, Fourier Series, Gaussian Vectors

Évaluation

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Practical info

Location(s)

Toulouse

Functions approximation

Introducing

Description

Part 1: Data Representation Using Splines (7h30 Lectures, 7h30 Tutorials, 10h Lab Work)
I.1 Interpolation splines (2 Lectures / 2 Tutorials / 1 Lab Session)
I.2 Smoothing splines (2 Lectures / 2 Tutorials / 1 Lab Session)
I.3 B-splines and least squares splines (2 Lectures / 2 Tutorials / 2 Lab Sessions)

Part 2: Data Representation Using Neural Networks (2h30 Lectures, 2h30 Tutorials, 5h Lab Work)
II.1 Adjunction (1 Lecture / 1 Tutorial / 1 Lab Session)
II.2 Neural networks as an approximation method and automatic differentiation (1 Lecture / 1 Tutorial / 2 Lab Sessions)

Objectives

At the end of this module, the student should have understood and be able to explain (main concepts):
1.The approximation of data using splines, either through interpolation or smoothing.
2.The link with geometry generation in CAD and the capabilities for image processing.
3.Automatic differentiation and the structure of a neural network.
4.Object-oriented programming in Python.

The student should be able to:
1.Determine and calculate the interpolation spline, the smoothing spline, and the least squares spline for nn points.
2.Construct a B-Spline curve for nn points and a B-Spline surface.
3.Interpolate and filter an image using splines.
4.Design a basic neural network.
5.Develop an automatic differentiation library in Python.

Necessary prerequisites

Multivariable function differentiation, unconstrained optimization (existence, first-order Euler equations, gradient algorithms), linear algebra (matrix systems, scalar product, adjunction). Strong knowledge of Python.

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Object oriented programming

Introducing

Description

The student should be able to :
- design the class diagram of a simple application
- translate it into Java code
- program a simple application in JAVA, using object-oriented programming concepts

Objectives

By the end of this module, the student should have understood and be able to explain (main concepts):
- The different programming paradigms
- The principle and advantage of object-oriented programming
- The principles and fundamental notions of object-oriented design and programming
- The principles of UML class diagrams to represent an application using an object-oriented approach, and the use of the
object-oriented programming language Java to implement the model designed.

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Numerical culture and skills 2

Introducing

Description

The flow of Machine Learning
Data preparation
Machine Learning Terminology
Data types
Data visualization, quality and size
Reliability
Some activation functions
Model performance
Environmental impact

Objectives

At the end of this module, which follows the 2A module, the student will have consolidated his knowledge of the field of AI: accuracy, loss function, overfitting, batch size, visualization techniques... He will also have prepared and passed a PIX certification.

Necessary prerequisites

Basics of Python programming

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Partial Derivative Equations 1

Introducing

Description

Modeling with PDE (linear PDEs in one dimension space)
1. Transport and wave equation
2. Heat equation
3. Schrödinger¿s equation,¿

Exact resolution of PDE in one dimension space
1. Characteristic method (transport, wave)
2. Variable separation (heat, wave, Schrödinger,¿), use of the linearity (superposition principle) and link with Fourier series
3. Fourier transform
4. Dissipative and dispersive phenomenon

Finie Difference Method in one dimension space
3. Consistancy, order, stability, scheme convergence
4. Courant-Friedrichs-Levy condition (CFL)

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):

• Classical linear one dimensional PDE (heat, transport, wave...), their exact resolution and the qualitative behavior of their solutions
• The Finite Difference method in one dimension space to solve PDE

The student will be able to:
• Solve linear PDE in one dimension space (characteristic method, variable splitting, superposition principle, Fourier transform)
• Implement Finite Difference method in one dimension space, coupled with numerical solving method for ODE in order to solve PDE.

Necessary prerequisites

Linear Algebra: matrix manipulation, eigenvalues and eigenelements, solving of linear differential equations.

Ordinary differential equations: modeling, existence of solutions, qualitative study, numerical simulation (convergence, stability, order)

Évaluation

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Practical info

Location(s)

Toulouse

Inferential statistics

Introducing

Description

Syllabus (detailed contents):

• Review of the definitions and properties of the usual distributions (normal, Chi-square, Student's, Fisher's, Gaussian vectors, etc.) and probabilistic tools (law of large numbers, central limit theorem, Slutsky's lemma)
• Estimation in a parametric model: method of moments, maximum likelihood
• Cramer-Rao bound, and efficiency of an estimator
• Confidence interval for the mean and the variance of a Gaussian or a non-Gaussian sample
• Parametric hypothesis testing: concept, tests on the mean and the variance of a Gaussian sample, tests on a proportion, p-value, test for comparing two independent Gaussian samples, Neyman-Pearson's lemma, maximum likelihood ratio tests

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):

• defining a parametric model using usual distributions, such as normal, exponential, Bernoulli, Poisson, etc
• parameter estimation in a parametric model
• confidence interval construction
• hypothesis testing

The student will be able to:
• Model a situation using usual probability distributions, and manipulate them
• Estimate parameters in a parametric model and study the properties of these estimators
• Construct a parametric confidence interval
• Construct a parametric hypothesis testing

Necessary prerequisites

Probability and Statistics (2MIC)

Évaluation

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Practical info

Location(s)

Toulouse

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Project

Introducing

Description

Program (detailed contents):

Elements of Scientific Communication:
1. Introduction to Latex
2. Introduction to Beamer
3. Communication in applied mathematics: document structure (reports, slides), key points: modeling, analysis, simulation, tests

Mathematical modelling project : to be chosen in a list of possible projects.

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):

• Principles of mathematical modeling of an application problem in relation to another discipline or a particular industrial sector
• Self-evaluation of the results obtained in relation to the objectives.

The student will be able to:
• Interact with a specialist or engineer from another discipline
• Organize collaborative work in small groups
• Define the framework and specifications of an original mathematical modeling problem
• Conduct the necessary bibliographic research to solve the problem
• Develop the deterministic and/or stochastic model adapted to its resolution
• Implement its numerical resolution
• Report in writing and orally on the results obtained

Necessary prerequisites

Dynamical systems, advanced probabilities, data analysis.

Évaluation

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Practical info

Location(s)

Toulouse

MCMC methods

Introducing

Description

Program (detailed contents):
- Simulation of random variables and vectors: pseudo-random numbers, simulation by the inversion method of the probability distribution function, by the acceptance-rejection method and by specific simulation methods.
-Classical Monte Carlo methods: implementation, variance reduction by different methods (control variate, importance sampling, antithetic variates method).
- Markov chain Monte Carlo methods: reminders on Markov chains, Markovian law of large numbers, Metropolis-Hastings algorithm.
- Application with the Python software

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):
- The fundamental principles of simulating random variables and vectors.
- The classical methods for variance reduction when approximating numerically integrals by means of the Monte Carlo method.
-The approximation of integrals by means of the Monte Carlo method using Markov chains.

The student will be able to:
- Generate a real random variable by the inversion method.
- Simulate a random vector by the acceptance-rejection method.
- Choose appropriate techniques for variance reduction (control variate, importance sampling, antithetic variates method).
- Use the Metropolis-Hastings algorithm generating a reversible ergodic Markov chain with prescribed stationary distribution.

Necessary prerequisites

Probability and Statistics (2MIC Semester 4).
Probability and Data Analysis (3MIC Semester 5).
Complements of Probability (3MIC MA Semester 5).

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Business Game

Introducing

Description

Simulation of 5 years of company life (decision making in production, finance, marketing) using the SIMGEST business game.

Objectives

The student must have understood and be able to explain the interdependence of the company's functions (production, commercial, financial, human resources) through decision-making and analysis of the company's economic and financial results. He will have to understand how a company operates, construct financial statements, calculate costs, create simple management tools, optimize resources to make the company profitable, present an oral report of activities (in English)

Necessary prerequisites

financial management cours in 3A

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Company Finance

Introducing

Description

Income statement, Cash flow, Balance sheet. Elements on costs. The break-even point. Taking inventory into account in financial statements. Debt financing. Company profitability.

Objectives

The student must have understood and be able to explain the company's financial summary documents as well as the basics of cost calculation in the industrial company.

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Business Communication

Introducing

None

Description

Students will create a fictitious start-up in a market of their choice, conducting market analysis and identifying competitors. They will produce a GoFUND Me video and practice holding meetings and solving business challenges in English. The final presentation will be a "Shark Tank"-style competition, where students pitch their business idea to a panel of investors.

Objectives

This course aims to equip students with essential business communication skills. Students will learn to understand a simple business plan and market research, conduct meetings, and use key business vocabulary. They will develop skills to describe graphs and create high-impact presentations. Students will also practice pitching to investors, introducing a company, and discussing social and environmental responsibility in the workplace.

Necessary prerequisites

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Physical Education

Introducing

Description

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Professional Path Initiative 3rd Year

Introducing

Description

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Societal Openness Modules

Introducing

Description

- Openness to societal issues (Energy transition, Ecological transition, Digital society, Health global, Mobility and infrastructure)

- Themes with interdisciplinary approaches, mixing Sciences & Techniques and Human Sciences and Social or Thematic in SHS complementary to the base proposed by INSA Toulouse.

Each year, the Opening Modules Commission draws up the list of MOs which will be offered in the 2nd semester. Students then choose the MO they wish to experience via a wish phase on a dedicated application. Students are informed of the MO they will follow during the month of January.

- Offered in the 2nd semester of 3A, Monday afternoon from 2 p.m. to 4:45 p.m.
- Open to all specialty pre-orientations (PO)
- Duration: 30 hours student (NB: additional personal work of around 30 hours is expected)

Educational format:
- Active pedagogies
- Face-to-face, hybrid or fully remote
- ECIU+ Challenge Based Learning possibility

Objectives

The Societal Openness Modules are courses open to the 5 societal issues addressed by INSA Toulouse, allowing complex situations to be understood and covering themes not covered in INSA courses.

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Concepts and hardware for data transmission

Introducing

Description

- Description and programming in Arm and x86 assembly languages.
- Description and use of a standardized C compilation chain via scripts, as well as the use of associated debugging tools.
- Description and analysis of the main aspects of the software's lower layers (function calls, data storage, associated security aspects) at C and assembly language level.
- Description and optimization of the use of hardware resources, particularly memory.
- Description and analysis of hardware vulnerabilities.
- Study of DFT, setup DFT parameters (window, number of points) according to a given application, (MATLAB)
- Study of spectrum aliasing phenomena, then design of an anti-aliasing filter,
- programming on STM32 controller for the laser shooting game in ASM and C.

Objectives

The module is divided into two parts, one dealing with assembler language and associated hardware architectures, the other based on numerous practical sessions, combining signal, electronics and embedded programming in assembler and C on STM32 controller.
At the end of the module assembly language and hardware architectures, students will be able to program in assembly language, identify and correct software problems (resource under-utilization, bugs) in C and assembly language, and identify potential hardware vulnerabilities.
The aim of the second part composed of 11 practical sessions is to study a telecommunication-type transmission system (optical link) at all levels, from signal aspects to on-board programming in ASM and C, including a small-scale electronic implementation on a test plate. The supporting application is a multi-player laser shooting game with use of DFT to identify players

Necessary prerequisites

- Knowledge of computer architecture and internal functional description (processor, memory, caches).
- C language.
- electronics and signal basics strongly recommended

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Graphs

Introducing

Description

Outline :
- General definitions of graphs
- Some classic graph problems (traversal, connectedness, shortest path, spanning tree, flow) and various associated solving methods.

Practical Labs in Graphs :
- In this lab, the concepts and algorithms of graph theory will be used to solve a standard problem requiring the development of known algorithms. Secondly, we will be asked to design a new algorithm to solve a more innovative problem.
The programming language is Java.

Objectives

At the end of this module, the student should have understood and be able to explain (main concepts):
- how to use the formalism of graphs for modeling various classical problems in computer science
- The principles of several graph-based problem-solving algorithms.

The student should be able to :
- develop a classical graph algorithm to solve a known problem, but with large datasets,
- develop and compare different implementations of a known algorithm, in order to understand the notions of algorithm complexity,
- propose adaptations of classic algorithms to solve a new problem,
- conduct relevant test campaigns to evaluate the performance of different algorithms.

Necessary prerequisites

- Programming (Ada, C, Python, Java, ...)
- Advanced Algorithms and Complexity (3rd year MIC)
- Algorithms and Data Structures (2nd year MIC and 1st year)

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Object oriented programming

Introducing

Description

The student should be able to :
- design the class diagram of a simple application
- translate it into Java code
- program a simple application in JAVA, using object-oriented programming concepts

Objectives

By the end of this module, the student should have understood and be able to explain (main concepts):
- The different programming paradigms
- The principle and advantage of object-oriented programming
- The principles and fundamental notions of object-oriented design and programming
- The principles of UML class diagrams to represent an application using an object-oriented approach, and the use of the
object-oriented programming language Java to implement the model designed.

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Numerical culture and skills 2

Introducing

Description

The flow of Machine Learning
Data preparation
Machine Learning Terminology
Data types
Data visualization, quality and size
Reliability
Some activation functions
Model performance
Environmental impact

Objectives

At the end of this module, which follows the 2A module, the student will have consolidated his knowledge of the field of AI: accuracy, loss function, overfitting, batch size, visualization techniques... He will also have prepared and passed a PIX certification.

Necessary prerequisites

Basics of Python programming

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

System and Network Programming

ECTS

Hourly volume
59h

Introducing

Description

The unit is divided into three parts:

Part 1: "System Programming and Multithreading" (12.5 hours of lectures, 6.25 hours of tutorials, 11 hours of practical work)
The course teaches the concepts and techniques related to the use and manipulation of mechanisms on an operating system instance:
multi-programming (process, thread),
local communication (IPC),
process synchronization (signaling, semaphores, condition variables),
scheduling.
An introduction to parallel processing is also provided.
The entire course is illustrated by practical exercises in multi-threaded programming using synchronization and scheduling functions.
Part 2: "Internet Applications and Socket Programming" (6.25 hours of lectures, 5.5 hours of practical work)
The first part of the course details the main distributed applications on the Internet: http, ftp, sftp, SMTP – POP3/IMAP4, Telnet, SSH + pooling/clustering techniques, P2P model, multimedia applications.
The second part presents the socket programming interface (socket API), the basic technology for coding a distributed application (in particular) on the Internet.
Two practical sessions are dedicated to the implementation (in C language) of concepts associated with distributed programming via UDP and TCP sockets (via the programming of a configurable traffic generator/receiver).
Part 3: "Integration Engineering Department" (13.75 hours of practical work + 3.75 hours of tutorials)
A design office (DE) concludes the UF. Its objective is to design and develop a Transport-level protocol (TCP-level) in C language optimized for the transport of distributed video streams in real time. The optimization consists of developing a partially reliable loss recovery mechanism, taking advantage of the loss tolerance of video applications to minimize the transit time of application packets. The service offered is accessible through an API whose service primitive specifications are provided, and which students are required to develop. Managing asynchronism in communication between the application and the Transport service is also addressed, in conjunction with the system programming and multithreading course.

The objectives are assessed based on an integration project report and an assessment of student engagement during the practical sessions. Written exams and/or multiple-choice questions may supplement the validation of theoretical skills.

Objectives

At the end of this module, the student should have understood and be able to explain (main concepts):
concurrent programming with threads
possible interactions with operating systems (main system calls)
the main distributed applications on the Internet: HTTP, FTP, SFTP, SMTP – POP3/IMAP4, Telnet, SSH + pooling/clustering techniques, P2P model, multimedia

applications
fundamental concepts associated with programming distributed applications on the Internet via the socket API
the use of finite state machines (FSM) for protocol specification

The student should be able to:
- use and program an operating system on single- and multi-processor (threaded) machines
- use the socket API to develop (in C language) a distributed client/server application on the Internet
- specify in FSM form and program in C language a transport-level protocol optimized for the transfer of real-time video
- manage asynchronism in communication between the application and the Transport service
- to develop and implement experimental scenarios (here aimed at proving the benefits of the optimized protocol compared to a traditional TCP-type protocol).

Location(s)

Toulouse

Necessary prerequisites

Introduction to Operating Systems (3rd year MIC)
Introduction to Computer Networks (3rd year MIC)
C Language (3rd year MIC)
Assembly Concepts (3rd year MIC)

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Telecommunications systems

ECTS

Hourly volume
68h

Introducing

Description

Random signals: random process, stationarity, correlation, ergodicity, covariance, spectral density.

Digital filters: fast Fourier transform, discrete signals and systems, structure and properties of recursive and non-recursive filters, design methods.

Telecommunications systems: data rates, eye diagrams, transmission lines, baseband coding, analog and digital modulation, constellation diagrams, frames, multiplexing, channel access (FDMA, TDMA, CDMA), spread spectrum. There will also be an introduction to mobile networks, space communications and securing wireless communications. The tutorials will go into greater depth on the concepts seen in class, and will focus on well-known applications of telecommunications systems (e.g. USB, Bluetooth, FM radio, etc.). Lab classes will address the design of analog and digital modulations using Software Defined Radio (SDR) tools and an implementation on Universal Software Radio Peripherals (USRP) to develop a wireless telecommunication system. An introduction to the topic of communications security will also be illustrated.

Objectives

At the end of this module, the student should have understood and be able to explain (main concepts):
o Definitions related to random signals
o Basics of spectral analysis
o Structures and design modes of digital filters
o Operating principles of telecommunication systems

The student will be able to design a simple digital filter and the architecture of a telecommunication system: choice of the modulation, choice of the media accès type, etc.

Necessary prerequisites

Signal Process Course

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Business Game

Introducing

Description

Simulation of 5 years of company life (decision making in production, finance, marketing) using the SIMGEST business game.

Objectives

The student must have understood and be able to explain the interdependence of the company's functions (production, commercial, financial, human resources) through decision-making and analysis of the company's economic and financial results. He will have to understand how a company operates, construct financial statements, calculate costs, create simple management tools, optimize resources to make the company profitable, present an oral report of activities (in English)

Necessary prerequisites

financial management cours in 3A

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Company Finance

Introducing

Description

Income statement, Cash flow, Balance sheet. Elements on costs. The break-even point. Taking inventory into account in financial statements. Debt financing. Company profitability.

Objectives

The student must have understood and be able to explain the company's financial summary documents as well as the basics of cost calculation in the industrial company.

Évaluation

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Location(s)

Toulouse

Practical info

Business Communication

Introducing

Description

Students will create a fictitious start-up in a market of their choice, conducting market analysis and identifying competitors. They will produce a GoFUND Me video and practice holding meetings and solving business challenges in English. The final presentation will be a "Shark Tank"-style competition, where students pitch their business idea to a panel of investors.

Objectives

This course aims to equip students with essential business communication skills. Students will learn to understand a simple business plan and market research, conduct meetings, and use key business vocabulary. They will develop skills to describe graphs and create high-impact presentations. Students will also practice pitching to investors, introducing a company, and discussing social and environmental responsibility in the workplace.

Necessary prerequisites

None

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Physical Education

Introducing

Description

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

Introducing

Description

Évaluation

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Practical info

Location(s)

Toulouse

Societal Openness Modules

Introducing

Description

- Openness to societal issues (Energy transition, Ecological transition, Digital society, Health global, Mobility and infrastructure)

- Themes with interdisciplinary approaches, mixing Sciences & Techniques and Human Sciences and Social or Thematic in SHS complementary to the base proposed by INSA Toulouse.

Each year, the Opening Modules Commission draws up the list of MOs which will be offered in the 2nd semester. Students then choose the MO they wish to experience via a wish phase on a dedicated application. Students are informed of the MO they will follow during the month of January.

- Offered in the 2nd semester of 3A, Monday afternoon from 2 p.m. to 4:45 p.m.
- Open to all specialty pre-orientations (PO)
- Duration: 30 hours student (NB: additional personal work of around 30 hours is expected)

Educational format:
- Active pedagogies
- Face-to-face, hybrid or fully remote
- ECIU+ Challenge Based Learning possibility

Objectives

The Societal Openness Modules are courses open to the 5 societal issues addressed by INSA Toulouse, allowing complex situations to be understood and covering themes not covered in INSA courses.

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse