SCIENCE, TECHNOLOGY, HEALTH

ENGINEER FROM INSA TOULOUSE YEARS 1, 2, AND 3

Engineering sciences

Targeted level of education
BAC+3

Duration
année

Component
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

Introducing

Objectives

Admissions

Access conditions

Target audience

Necessary prerequisites

Recommended prerequisites

Practical info

Location(s)

Toulouse

Program

FIRST YEAR INSA TOULOUSE
1st YEAR

1st YEAR INSA

MATHEMATICS AND ALGORITHMICS FIELD_21 ECTS

Algorithmics

Mathematical rigor and reasoning

Calculation technics

Analysis

Algebra

PHYSICAL, CHEMICAL AND INDUSTRIAL SCIENCES FIELD_26 ECTS

Chemistry

Electrical phenomena

Classical mechanics

Thermodynamics

Industrial sciences

Geometrical optics

Acquire new theoretical concepts

Solve a problem

Conduct analyze and report experiments

Thinking Together the New Socio-Ecological Challenges and our Responsibility

HUMANITIES FIELD_13 ECTS

Find, understand and reuse information

Be implicated in one’s work

Communicate in an intercultural context

Master written communication techniques

Master oral communication techniques

Search, analyze and present information

Business management

Maintain one’s physical condition

1sr YEAR NORGINSA

1st YEAR NORGINSA

MATHEMATICS AND ALGORITHMICS FIELD_21 ECTS

Algorithmics 1

Algorithmics 2

Mathematics 0

Mathematics I	6 crédits	

Analysis

Algebra

PHYSICAL, CHEMICAL AND INDUSTRIAL SCIENCES_FIELD

Optics

Chemistry	4 crédits	63h

Classical mechanics

Industrial sciences

Electrical phenomena

Thermodynamics

Thinking Together the New Socio-Ecological Challenges and our Responsibility

HUMANITIES FIELD_13 ECTS

French as a foreign language semester 1	3 crédits	55h

French as a foreign language and documentary project

Corporate Social Responsibility (CSR)

Professional Path Initiative

Physical activities and sports

Learning to learn

1st YEAR FAS

1st YEAR FAS

MATHEMATICS AND ALGORITHMICS FIELD_19 ECTS

Algorithmics

Argumentation, rigor and reasoning

Calculation techniques

Analysis

Algebra

PHYSICS_CHEMISTRY_INDUSTRIAL TECHNOLOGY_CONCEPTION FIELD_26 ECTS

Appropriate

Formalizing

Calculating

Interpreting

Achieving

HUMANITIES FIELDS_15 ECTS

Identify, understand, analyze and interpret information

Get to know yourself and engage in a task, taking into account the objectives and the situation, and respecting the instructions given

Written communication: structure and expression

Understanding, communicating and interacting orally

Master written French language

SECOND YEAR INSA TOULOUSE

2nd YEAR CHEMICAL, BIOCHEMICAL AND ENVIRONMENTAL ENGENEERING

SEMESTER 3_2nd YEAR ICBE

MATHEMATICS AND TRANSFER BASES FIELD_10 ECTS

Mathematics

Transfer bases

BASICS OF CHEMICAL, PHYSICOCHEMICAL AND BIOCHEMICAL SYSTEMS FIELD_13 ECTS

Organic chemistry

Thermodynamics of physical-chemical systems

Structural Biochemistry

HUMANITIES – 3rd SEMESTER_7 ECTS

Expression

Contemporary economy and ecological transition

Foreign Language 1

Internship defense

Professional path initiative

Physical Activities and Sports

SEMESTER 4_2nd YEAR ICBE

SCIENCES FOR ENGINEERS FIELD_11 ECTS

Analytical Methods 1

Chemical reaction engineering

Process control

Industrial facilities

Careers

TOOLS AND METHODS FOR

ENGINEERS FIELD_11 ECTS

Numerical calculation and statistics

Digital culture and skills 1

Energy Mix and Transition

Microbiology

Elective scientific course

HUMANITIES FIELD – 4th SEMESTER_8 ECTS

Foreign language 2

Professional Path Initiative 2nd Year

Physical Activities and Sports

2nd YEAR CONSTRUCTION ENGINEERING

SEMESTER 3_ 2nd YEAR IC

MATHEMATICS AND MECHANICS 1 FIELD_12 ECTS

Mathematics

Mechanics

DESIGN AND CONSTRUCTION I FIELD_11 ECTS

Design – CAD

Strength of Materials 1

HUMANITIES FIELD – 3rd SEMESTER_7 ECTS

Expression

Contemporary economy and ecological transition

Foreign Language 1

Internship defense

Professional path initiative

Physical Activities and Sports

SEMESTER 4_2nd YEAR IC

MATHEMATICS AND MECHANICS II FIELD_9 ECTS

Ordinary Differential Equations and Series

Energy Mix and Transition

Digital culture and skills 1

Dynamics

DESIGN ET CONSTRUCTION II

FIELD_13 ECTS

Elective scientific course

Strength of Materials II

Materials science

Building Environment and Materials

Design and Materials Project

HUMANITIES FIELD – 4th SEMESTER_8 ECTS

Foreign language 1

Foreign language 2

Professional Path Initiative 2nd Year

Physical Activities and Sports

2nd YEAR MATERIALS DEVICES AND SYSTEMS ENGINEERING

SEMESTER 3_2nd YEAR IMACS

PHYSICS, MATHEMATICS AND SCIENTIFIC CULTURE 1 FIELD_12 ECTS

Analysis 1

Algebra

Electromagnetism

Materials

AUTOMATION, ELECTRONICS AND COMPUTING 1 FIELD_11 ECTS

Analog electronics

Signal

Feedback systems

HUMANITIES FIELD – 3rd SEMESTER_7 ECTS

Expression

Contemporary economy and ecological transition

Foreign Language 1

Internship defense

Professional path initiative

Physical Activities and Sports

SEMESTER 4_ 2nd YEAR IMACS

PHYSICS, MATHEMATICS AND SCIENTIFIC CULTURE 2 FIELD_13 ECTS

Nanophysics

Analysis 2

Probabilities and statistics

Energy Mix and Transition

Elective scientific course

AUTOMATION, ELECTRONICS AND COMPUTING 2 FIELD_9 ECTS

Logics

Hardware architecture

Digital electronics

Operating systems

Computing 56h

Digital culture and skills 1

HUMANITIES FIELD – 4th SEMESTER_8 ECTS

Foreign language 1

Foreign language 2

Professional Path Initiative 2nd Year

Physical Activities and Sports

2nd YEAR MODELING, INFORMATICS AND COMMUNICATIONS

SEMESTER 3_2nd YEAR MIC

MATHEMATICS 1 FIELD_10 ECTS

Analysis 1

Linear algebra

COMPUTING 1 FIELD_13 ECTS

Unix

Discrete automatics

Continuous automatics

HUMANITIES FIELD – 3rd SEMESTER_7 ECTS

Expression

Contemporary economy and ecological transition

Foreign Language 1

Internship defense

Professional path initiative

Physical Activities and Sports

SEMESTER 4_2nd YEAR MIC

MATHEMATICS 2 FIELD_11 ECTS

Analysis 2

Probability-Statistics

Signal 1

Energy Mix and Transition

Design – CAD

Strength of Materials 1

COMPUTING 2 FIELD _11 ECTS

Algorithm and programming 2

Hardware architecture

Language (C)

Digital culture and skills 1

Elective scientific course

MATHEMATICS AND MECHANICS 1 FIELD_12 ECTS

Mathematical tools 1

Mechanics

HUMANITIES FIELD – 3rd SEMESTER_7 ECTS

Expression

Contemporary economy and ecological transition

Foreign Language 1

Internship defense

Professional path initiative

Physical Activities and Sports

HUMANITIES FIELD – 4th SEMESTER_8 ECTS

Foreign language 1

Foreign language 2

Professional Path Initiative 2nd Year

Physical Activities and Sports

2nd YEAR FAS CONSTRUCTION

SEMESTER 3_2nd YEAR FAS CONSTRUCTION

DESIGN AND CONSTRUCTION 1 FIELD _11 ECTS

SEMESTER 4_2nd YEAR FAS CONSTRUCTION

MATHEMATICS AND MECHANICS 2 FIELD_11 ECTS

Mathematical tools 2

Dynamics

Energy Mix and Transition

Digital culture and skills 1

DESIGN AND CONSTRUCTION 2 FIELD_11 ECTS

Strength of Materials II

Materials science

Building Environment and Materials

Design and Materials Project

Thermodynamics

HUMANITIES FIELD – 4th SEMESTER_8 ECTS

Foreign language 1

Foreign language 2

Professional Path Initiative 2nd Year

Physical Activities and Sports

2nd YEAR FAS NUMERICAL

SEMESTER 3_2nd YEAR FAS NUMERICAL

MATHEMATICS, PHYSICS AND AUTOMATION FIELD_13 ECTS

Analysis 1

Algebra

Continuous automatics

Discrete automatics

Electrostatics (Elective course)

COMPUTER SCIENCE AND ELECTRONICS FIELD_10 ECTS

Algorithmics and Programming 1

Unix

Combinatorial logic

Electronic systems for communication

HUMANITIES FIELD – 3rd SEMESTER_7 ECTS

Expression

Contemporary economy and ecological transition

Foreign Language 1

Internship defense

Professional path initiative

Physical Activities and Sports

SEMESTER 4_2nd YEAR FAS

NUMERICAL

MATHEMATICS AND ENERGY FIELD_9 ECTS

Signal 1

Energy Mix and Transition

Analysis 2

Probability and statistics 1 26h

COMPUTER SCIENCE AND ELECTIVE COURSE FIELD_13 ECTS

Algorithm and programming 2

Hardware architecture

Language (C)

Digital culture and skills 1

Mathematics tools (elective course)

Physics 2 (elective course)

HUMANITIES FIELD – 4th SEMESTER_8 ECTS

Foreign language 1

Foreign language 2

Professional Path Initiative 2nd Year

Physical Activities and Sports

THIRD YEAR INSA TOULOUSE

3rd YEAR CHEMICAL, BIOCHEMICAL AND ENVIRONMENTAL ENGENEERING

SEMESTER 5_3rd YEAR ICBE

3rd YEAR ICBE GB SPECIALITY SEMESTER 5

CHEMICAL ENGINEERING FIELD_12 ECTS

Fluid mechanics

Heat Transfer

Hydraulic engineering 39h

LIFE SCIENCES 1 FIELD_11 ECTS

Microbiology

Molecular biology

Processes

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

HUMANITIES FIELD_5 th SEMESTER_7 ECTS

Job Hunting Techniques

Job search

Humanities elective course

Physical Education

3rd YEAR ICBE GPE SPECIALITY
SEMESTER 5

BASICS OF CHEMICAL ENGINEERING 1 FIELD_10 ECTS

Fluid mechanics

Physical chemistry

Dispersed systems

BASICS OF CHEMICAL ENGINEERING 2 FIELD_10 ECTS

Heat Transfer

Hydraulic engineering 39h

Processes

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

HUMANITIES FIELD_5th SEMESTER_7 ECTS

Job Hunting Techniques

Job search

Humanities elective course

Physical Education

SEMESTER 6_3rd YEAR ICBE

3rd YEAR ICBE GB SPECIALITY
SEMESTER 6

CHEMISTRY AND BIOPHYSICS FIELD_10 ECTS

Numerical culture and skills 2

Biophysics

Organic chemistry

Structural chemistry

LIFE SCIENCES 2 FIELD_10 ECTS

Bioseparation

Enzymology

Bacterial genetics

HUMANTIES FIELD_6th SEMESTER_10 ECTS

Business Game

Company Finance

Business Communication

Physical Education

Professional Path Initiative 3rd

Year

Societal Openness Modules

3rd YEAR ICBE GPE SPECIALITY
SEMESTER 6

CHEMISTRY AND PROCESSES FIELD_10 ECTS

Analytical methods II

Mass transfer

Chemical reaction engineering 2

ENERGY, ENVIRONMENT FIELD_10 ECTS

Thermodynamics and energy

Water, Environment and Risks

Careers in Chemical Engineering (1)

Numerical culture and skills 2

HUMANTIES FIELD_6th SEMESTER_10 ECTS

Business Game

Company Finance

Business Communication

Physical Education

Professional Path Initiative 3rd Year

Societal Openness Modules

3rd YEAR CONSTRUCTION ENGINEERING

SEMESTER 5_ 3rd YEAR IC

3rd YEAR IC _GC SPECIALITY
SEMESTER 5

FUNDAMENTALS OF CIVIL ENGINEERING FIELD_13 ECTS

Partial Differential Equations and Numerical Analysis

Solid mechanics

Fluid mechanics

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

APPLIED SCIENCES FOR CIVIL ENGINEERING – 1_10ECTS

Cementitious materials

Ecodesign and Civil Engineering

Architecture double track

HUMANITIES FIELD_5th SEMESTER_7

ECTS

Job Hunting Techniques

Job search

Humanities elective course

Physical Education

3rd YEAR IC _GM SPECIALITY
SEMESTER 5

FUNDAMENTALS OF MECHANICAL ENGINEERING FIELD_14 ECTS

Partial Differential Equations and Numerical Analysis

Solid mechanics

Fluid mechanics

Dynamic Systems

APPLIED SCIENCES FOR MECHANICAL ENGINEERING – 1 FIELD_9 ECTS

Mechanical design

Mechanical manufacturing

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

HUMANITIES FIELD_5th SEMESTER_7

ECTS

Job Hunting Techniques

Job search

Humanities elective course

Physical Education

SEMESTER 6_ 3rd YEAR IC

3rd YEAR IC _GC SPECIALITY
SEMESTER 6

FUNDAMENTALS FOR CIVIL ENGINEERING FIELD_11 ECTS

Fluid mechanics

Heat transfers

Analysis of Static Structures 56h

Numerical culture and skills 2

Deepening in Structures

Deepening in Climatics – Aerolitics – Fluid Mechanics

APPLIED SCIENCES FOR CIVIL ENGINEERING FIELD_9 ECTS

Geotechnic 1

Reinforced concrete

Prestressed Concrete

HUMANTIES FIELD_6th SEMESTER_10 ECTS

Business Game

Company Finance

Business Communication

Physical Education

Professional Path Initiative 3rd Year

Societal Openness Modules

3rd YEAR IC _GM SPECIALITY SEMESTER 6

FUNDAMENTALS FOR MECHANICAL ENGINEERING FIELD_9 ECTS

Heat transfers

Systems Control

Logical systems

Introduction to Systems Engineering

Numerical culture and skills 2

APPLIED SCIENCES FOR MECHANICAL ENGINEERING FIELD_11 ECTS

Machine elements

Digital Control and Computer-Aided Manufacturing

Metrology

Heat Treatment and Welding

HUMANTIES FIELD_6th SEMESTER_10 ECTS

Business Game

Company Finance

Business Communication

Physical Education

Professional Path Initiative 3rd Year

Societal Openness Modules

3rd YEAR MATERIALS DEVICES AND SYSTEMS ENGINEERING

SEMESTER 5_3rd YEAR IMACS

3rd YEAR IMACS_AE SPECIALITY SEMESTER 5

FUNDAMENTALS OF AUTOMATION AND ELECTRONICS 1 FIELD_12 ECTS

In-depth study of electronic circuits

Semiconductors

Modeling and Analysis of Continuous Linear Systems

Digital filtering

PHYSICAL MEASUREMENTS, COMPUTING AND SCIENTIFIC CULTURE 1_11 ECTS

Numerical analysis

Programming in C

Experimental physics and stochastic modelling

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

HUMANITIES FIELD_5th SEMESTER_7 ECTS

Job Hunting Techniques

Job search

Humanities elective course

Physical Education

3rd YEAR IMACS_GP SPECIALITY SEMESTER 5

CLASSICAL AND MODERN PHYSICS, ELECTRONICS, MATERIALS 1_12 ECTS

In-depth study of electronic circuits

Semiconductors

Waves and propagation

Hamiltonian mechanics

PHYSICAL MEASUREMENTS, COMPUTING AND SCIENTIFIC CULTURE 1_11 ECTS

Numerical analysis

Programming in C

Experimental physics and stochastic modelling

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

HUMANITIES FIELD_5th SEMESTER_7 ECTS

Job Hunting Techniques

Job search

Humanities elective course

Physical Education

SEMESTER 6_3rd YEAR IMACS

3rd YEAR IMACS_AE SPECIALITY SEMESTER 6

PHYSICAL MEASUREMENTS, COMPUTING AND SCIENTIFIC CULTURE 2 FIELD_9 ECTS

Introduction to networks

C language and networks

Databases

Assembly language

Hardware architecture 55h

Numerical culture and skills 2

FUNDAMENTALS OF AUTOMATION AND ELECTRONICS 2 FIELD_11 ECTS

Electronics project

Telecommunication systems

Random signals

Control of continuous linear systems

Modeling and control of discrete-event systems

HUMANTIES FIELD_6th SEMESTER_10 ECTS

Business Game

Company Finance

Business Communication

Physical Education

Professional Path Initiative 3rd Year

Societal Openness Modules

3rd YEAR IMACS_GP SPECIALITY SEMESTER 6

CLASSIC AND MODERN PHYSICS, ELECTRONICS, MATERIALS 2 FIELD_12 ECTS

Thermodynamics

Point defects and diffusion

Quantum physics

Statistical physics

Cohesion

Dislocations and deformations

Anisotropy

PHYSICAL MEASUREMENTS, COMPUTING AND SCIENTIFIC CULTURE 2 FIELD_8 ECTS

Structure of solids

Applied material physics

Scientific project

Numerical culture and skills 2

HUMANTIES FIELD_6th SEMESTER_10 ECTS

Business Game

Company Finance

Business Communication

Physical Education

Professional Path Initiative 3rd Year

Societal Openness Modules

3rd YEAR MODELING, INFORMATICS AND COMMUNICATIONS

SEMESTER 5_3rd YEAR MIC

3rd YEAR MIC_MA SPECIALITY SEMESTER 5

COMMON CORE FIELD_14 ECTS

Optimization and linear programming

Operating system

Advanced algorithmics

Databases 2

Markov chains

Data analysis

MATHEMATICS FIELD_9 ECTS

Dynamical systems

Complements of probabilities

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

HUMANITIES FIELD_5th SEMESTER_7 ECTS

Job Hunting Techniques

Job search

Humanities elective course

Physical Education

3rd YEAR MIC_IR SPECIALITY SEMESTER 5

COMMON CORE FIELD_14 ECTS

Optimization and linear programming

Operating system

Advanced algorithmics

Databases 2

Markov chains

Data analysis

COMPUTER SCIENCE FIELD_9 ECTS

Databases 1 and Web Programming

Networks

Theory of information and coding

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

HUMANITIES FIELD_5th SEMESTER_7 ECTS

Job Hunting Techniques

Job search

Humanities elective course

Physical Education

SEMESTER 6_3rd YEAR MIC

3rd YEAR MIC_ MA SPECIALITY SEMESTER 6

MATHEMATICS AND NUMERICAL TOOLS FIELD_8 ECTS

Signal 2

Functions approximation

Object oriented programming

Numerical culture and skills 2

APPLIED MATHEMATICS FIELD_12 ECTS

Partial Derivative Equations 1

Inferential statistics

Project

MCMC methods

HUMANTIES FIELD_6th SEMESTER_10 ECTS

Business Game

Company Finance

Business Communication

Physical Education

Professional Path Initiative 3rd Year

Societal Openness Modules

3rd YEAR MIC_IR SPECIALITY SEMESTER 6

COMPUTING, DIGITAL AND HARDWARE TOOLS FIELD_10 ECTS

Concepts and hardware for data transmission

Graphs

Object oriented programming

Numerical culture and skills 2

COMPUTER SCIENCE AND NETWORKS FIELD_10 ECTS

System and Network Programming	59h
Telecommunications systems	68h

HUMANTIES FIELD_6th SEMESTER_10 ECTS

Business Game

Company Finance

Business Communication

Physical Education

Professional Path Initiative 3rd Year

Societal Openness Modules

Algorithmics

Introducing

Description

Semester 1 :
Definition of functions; control structures (FOR, WHILE, IF); variables; record type.
Basic algorithms (min, max, average, etc. applied to a collection of data)
Rules of typing and proper formation of a program.

Semester 2 :
Enumerated types; 1D, 2D arrays (matrices); exploiting structured data (nested arrays and records) ;
Basic algorithms (above) applied to structured data

Objectives

The objective, at the end of the two semesters of algorithmics, is to have understood :
- the notion of algorithm and typing ;
- nested data structures ;

and to be able to :
- design algorithms for simple problems (e.g. finding a min in a collection of structured data);
- write them as reusable subroutines (functions) in Ada ;
- test their validity using unit tests

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

Mathematical rigor and reasoning

Toulouse

Introducing

Description

Argumentation, rigor and reasoning (AR): Reasoning, proof writing, set manipulation

Objectives

Acquisition of the basics of reasoning mathematics.

Necessary prerequisites

High school knowledge in mathematics

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)

Calculation technics

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

Analysis

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Algebra

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

Chemistry

Introducing

Description

Electronic structure of atoms - atomic Orbitals - periodic table of the elements - Periodicity of the properties - Covalent bonds - Molecular orbitals - pH of aqueous solutions - Solubility, precipitation - Oxidation, reduction.
Laboratory work: Set of six experiments, introducing the implementation of basic laboratory equipment - Titration by acid-basic and oxidation-reduction reactions - Titration by precipitation reactions - Spectrophometric and potentiometric titrations (pH-metric, silver electrode) - Equilibrium of affinity per exchange of ions.

Objectives

1. Memorize the definitions and the chemistry-related vocabulary.
2. Determine the atom structure
3. Describe the structure of the periodic table of the elements.
4. Propose a structure for a molecule (Lewis and spatial) from its raw formula.
5. Describe the link within molecules.
6. Describe the structure of metallic and ionic solids.
7. Describe interactions between molecules.
8. Describe the liquid water structure and explain the main reactivities in solution (equation balance sheet reflecting a reaction of dissolution, precipitation, acid-basic or oxidation- reduction).
9. Analyse a problem to identify the ingredients likely to be present in solution. Deduce one or several equations showing the conservation of elements, the electro neutrality and the constant of balance.
10. Solve a problem about chemistry solutions coming up with as equation as there is unknowns in this problem in order to calculate the unknowns¿ concentration.
11. Describe the principle and be able to implement the basic experimental technics for the analysis
12. Carry out a lab experiment and analyse the result.

Necessary prerequisites

Basic knowledge in physical science (atoms structure, radiation) and in chemistry as describe in the program of the final year high school science.

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

Electrical phenomena

Introducing

Description

Electrokintecis 1
*Fundamentals of electrokinetics (current, voltage, resistors)
*Study of electrical circuits
*Current/voltage calculations using various theorems

Electrokinetics 2
*Linear components in transient state (resistors, capacitors, coils)
*Transient state and mathematical tools, first and second-order circuits
*Sinusoidal state and complex notation

Electrostatics
*Scalar fields, vector fields
*Differential operators of field theory
* Invariances and Symmetries
*Electric charges and their interactions
*The electric field
*The electrostatic potential
*The local equations of the electric field and the electrostatic potential
* Calculation methods and application examples
*Conductors
* Capacitors and electrical energy

Objectives

This course is divided into three modules (Electrokinetics 1, Electrokinetics 2, Electrostatics). It begins with an introduction to the basic concepts of electrokinetics (current, electric potential, voltage, etc.), the study of voltage/current generators and resistors, and their characteristics in a steady-state regime. This is followed by the study of electrical circuits using various general laws and theorems. Topics covered include Kirchhoff's laws, superposition theorems, Norton's theorem, Thévenin's theorem, Millman's theorem, and simplification through equivalent circuits. The course then delves into the operation of two other elements, namely capacitors and coils, in circuits, both in transient and sinusoidal states. Mathematical formalism using complex notation to describe the latter will also be employed. Students will grasp these concepts through interactive lectures, and they will see practical applications and engage in exercises during tutorials. The setting up of electrical circuits and the visualization and measurement of signals/parametersand other phenomena will be put into practice during labs. An introduction to instrumentation using LabVIEW will also be offered during these sessions.

Finally, the electrostatics part aims to discover how the natural sciences formalize electrical effects related to electric charges present in matter. This formalism also allows for the study of spatial representation (coordinate systems) and field theory (differential operators). Phenomena depending on time (moving charges) are not covered. The various chapters of the course and associated tutorial sessions enable students to progress towards calculating the electric field and electrostatic potential generated by any charge system and describe the electrification of conductive materials. This introduction leads to capacitors and methods for storing electrical energy associated with them. A practical session illustrates the main effects of electrostatics (electric forces, point effects, electrostatic influence).

The aim of the course is to discover the way natural sciences formalize the electrical effects, linked to the electrical charges present in matter.

This formalism also makes it possible to work on the representation of space (coordinate systems) and field theory (differential operators). Time-dependent phenomena (moving charges are not covered). The different chapters of the course and the associated tutorial sessions allow students to progress towards the methods of calculating the electric field and the electrostatic potential generated by any system of charges, then towards the description of the electrification of conductive materials and thus to introduce capacitors and the associated methods of storage of electrical energy. A practical session illustrates the main effects of electrostatics (electrical forces, tip effects, electrostatic influence, etc.).

Necessary prerequisites

Mathematical tools of 1A : Vectors, derivatives and integrals

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

Classical mechanics

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

Thermodynamics

Introducing

Description

Fundamental concepts (concept of systems, evolution of a system, mathematical tools in thermodynamics, ideal gas model). Work and heat. The first law of thermodynamics and the internal energy function. The enthalpy function and the steady-state systems. Thermodynamic functions changes during reactions. Physical equilibria for a pure substance (phases diagram, real fluids). Thermodynamic machines (enthalpy and entropy diagram, power plants, refrigeration units and heat pumps).

Objectives

At the end of this module, the student should have understood and be able to explain:
- the inductive approach specific to thermodynamics which consists in generalizing, by defining them as laws, the conditions for conservation of energy and evolution of systems;
- the meaning, relevance and fields of application of the main thermodynamic functions (internal energy, enthalpy, entropy and free enthalpy).

The student should be able to:
- identify the studied system and to carry out on this system, in a current and systematic way, the mass balance, the energy balance and the entropy balance;
- use and interpret the enthalpy diagram and the entropic diagram of real fluids;
- apply thermodynamics to the understanding and description of equilibria between phases for a pure substance;
- explain the operation of thermodynamic machines (power plant, refrigeration unit, heat pump), based on the two laws of thermodynamics and on the equilibria between phases.

Necessary prerequisites

Function of several variables and partial derivatives concepts. Integrals of usual functions. Mastery of units. General knowledge of physics and mechanics from high school.

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Industrial sciences

Introducing

This is an introductory class to industrial design and manufacturing. Students are supposed to have a good knowledge of High School Maths and Physics.

Description

- Industrial product lifecycle
- 3D computer modeling
- 2D and 3D drawing
- introduction to mechanical design

--> Time : 27,5 h.

Objectives

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

Basic knowledge of mechanical design and manufacturing.

The student will be able to:

1) Module CSM (Mechanical Design):

_ Identify parts of a mechanical system using a mechanical drawing
_ Model simple parts and simple assemblies using CAD software
_ Design a simple mechanical product, describe it using appropriate mechanical engineering wording

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Geometrical optics

Introducing

Description

- Generalities on the properties and the propagation of light. Reflection and refraction of light. Basic laws of geometrical optics. Fermat's principle.

- Image formation by optical systems. Stigmatism and paraxial approximation.

- Study of the basic components of optical systems (thin lenses and spherical mirrors).

- Application: study of some optical instruments (microscopes, telescopes, camera lenses, ...). Construction, working principle, and some figures of merit (linear and angular magnification, optical power).

The geometrical optics course is based on a triple approach: calculations, geometrical constructions and experiments (through simple observation experiments realized during the tutorial sessions and more complex experiments during the lab sessions.)

Objectives

The goal of this optics course is the study of optical phenomena and optical instruments through a geometric description of light propagation.

The course also aims at developing the students scientific reasoning skills.

Necessary prerequisites

Elementary notions of geometry and trigonometry.

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

Acquire new theoretical concepts

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

Solve a problem

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

Conduct analyze and report experiments

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

Thinking Together the New Socio-Ecological Challenges and our Responsibility

Introducing

Description

The student understands the orders of magnitude of the impacts of human activities in the 20th and 21st centuries: carbon impact, atmospheric CO2 concentration, species extinction, biodiversity, environment, etc.

The student is able to identify the contribution of engineering to these impacts

The student is able to consider solutions, not just technical ones (avoiding techno-solutionism)

The student is able to develop a systemic vision of human impacts on the planet (climate fresco, systemic and complexity analysis)
The student is able to analyze and critically examine the use of numbers and figures relating to socio-ecological issues, and their various interpretations.

The student is made aware of the concept of environmental justice (climate fresco, ethics).

The student is able to question certain engineering activities and their uses.

Objectives

Thinking Together New Socio-Ecological Challenges and Our Responsibility:
Understanding the limits of the Anthropocene and its consequences for our present: socio-ecological issues

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

Find, understand and reuse information

Introducing

Description

Objectives

Know how to locate, understand, evaluate and use relevant information

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

Be implicated in one's work

Introducing

Description

Transversal competence assessed through 5 subjects of the Humanities Domain:
LV1, LV2 (or FLE), Documentary project, APS, PPI

Objectives

Engage in a task taking into account the objectives and the situation, in accordance with the instructions given

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

Communicate in an intercultural context

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

Master written communication techniques

Introducing

Description

-course on the general principles of professional communication and its key points
-article review methodology
-work in Td on the report

Objectives

Master the principles of written communication in a professional context:
-restitute and reformulate information in a clear and concise manner
- structure information into logical groups and build a coherent logical plan
- formatting a professional report

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

Master oral communication techniques

Introducing

Description

-course on the main principles of oral communication
-Professional oral methodology
-oral in pairs with Powerpoint support

Objectives

-Understand and master the specific principles of professional oral
-Know how to present a professional oral presentation with effective Powerpoint support

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

Search, analyze and present information

Introducing

Description

Research methodology : how to approach a literature search as well as the different steps of the search.
Presentation of all the tools and all the resources available at the library.
How to search on the Internet.
The quality and the reliability of information.
Introduction to copyright and plagiarism.
Reminder of the presentation rules of bibliographies.

Objectives

The training in literature search is a part of the Humanities domain of the first years.
The « documentary project » is the practical exercice and the support of this training : the freshmen are divided in groups of 5 to 6 members in order to work on a project given by a professor, who then become their tutor. The students have to produce a written summary of their research along with a bibliography, and they have to make an oral presentation in front of a jury.

Initiating the freshmen to research and information treatment on a professional level.
Increasing the students autonomy and as well as their level of knowledge of scientific and technical information.
Giving the students a new set of skills for them to be able to elaborate an efficient research strategy.
Improving the students knowledge about all the documentary tools at their disposal.
Introducing the students to the rules of bibliography writing and on how to use other people's research work.

Necessary prerequisites

The freshmen also have to train themselves through a independant learning path on Moodle, before the literature search 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 management

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

Maintain one’s physical condition

Introducing

Description

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

Algorithmics 1

Introducing

Description

Semester 1 :
Definition of functions; control structures (FOR, WHILE, IF); variables; record type.
Basic algorithms (min, max, average, etc. applied to a collection of data)
Rules of typing and proper formation of a program.

Semester 2 :
Enumerated types; 1D, 2D arrays (matrices); exploiting structured data (nested arrays and records) ;
Basic algorithms (above) applied to structured data

Objectives

The objective, at the end of the two semesters of algorithmics, is to have understood :
- the notion of algorithm and typing ;
- nested data structures ;

and to be able to :
- design algorithms for simple problems (e.g. finding a min in a collection of structured data);
- write them as reusable subroutines (functions) in Ada ;
- test their validity using unit tests

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

Algorithmics 2

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

Mathematics 0

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

Mathematics I

ECTS
6 crédits

Hourly volume

Introducing

Description

Calculus : complex numbers, polynomials, rational fractions, differential equations.

Study of functions : limits, continuité, derivability, study of functions, inverse functions

Objectives

Acquisition of standard basic mathematical notions

Necessary prerequisites

Basic notions in calculus and study of functions.

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

Analysis

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

Algebra

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

Optics

Introducing

Description

Course Chapter Breakdown:

The course is divided into several key chapters to provide you with a comprehensive understanding of geometrical optics:

1- Introduction to Geometrical Optics

˚Definition and importance of geometrical optics.
˚Historical background and recent developments in the field.

2- Fundamental Laws of Geometrical Optics

˚Law of reflection.
˚Law of refraction (Snell's Law).
˚Fermat's Principle and its applications.

3- Propagation of Light in Homogeneous and Inhomogeneous Media

˚Study of the rectilinear propagation of light.
˚Analysis of homogeneous and inhomogeneous media.
˚Effects of variations in the refractive index.

4- Reflection and Refraction at Interfaces

˚Behavior of light rays at interfaces between different media.
˚Total internal reflection and its applications.
˚Study of prisms and lenses.

5- Simple Optical Systems

˚Plane and spherical mirrors.
˚Thin and thick lenses.
˚Image formation by simple optical systems.

6-Complex Optical Systems

˚Combination of lenses and mirrors.
˚Analysis of optical aberrations.
˚Design and optimization of complex optical systems.

7-Practical Applications of Geometrical Optics

˚Common optical instruments (microscopes, telescopes, cameras).
˚Applications in photonics and telecommunications.
˚Case studies and practical projects.

This course aims to provide you with a deep understanding of the fundamental concepts of geometrical optics and to develop your analytical and practical skills to solve complex problems in this field.

Objectives

Course Objectives:

By the end of this course, you will be able to:

1-Understand the fundamental principles of geometrical optics, including the laws of reflection and refraction.
2-Analyze the behavior of light rays through different media and interfaces.
3-Use mathematical tools to model and solve problems in geometrical optics.
4-Apply geometrical optics concepts to the design and analysis of simple and complex optical systems.
5-Interpret experimental and theoretical results to evaluate the performance of optical systems.

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

Chemistry

ECTS
4 crédits

Hourly volume
63h

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

Classical mechanics

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

Industrial sciences

Introducing

This is an introductory class to industrial design and manufacturing. Students are supposed to have a good knowledge of High School Maths and Physics.

Description

- Industrial product lifecycle
- 3D computer modeling
- 2D and 3D drawing
- introduction to mechanical design

--> Time : 27,5 h.

Objectives

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

Basic knowledge of mechanical design and manufacturing.

The student will be able to:

1) Module CSM (Mechanical Design):

_ Identify parts of a mechanical system using a mechanical drawing
_ Model simple parts and simple assemblies using CAD software
_ Design a simple mechanical product, describe it using appropriate mechanical engineering wording

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

Electrical phenomena

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

Thermodynamics

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

Thinking Together the New Socio-Ecological Challenges and our Responsibility

Introducing

Description

The student is able to perceive changes in the way we inhabit the planet (history, anthropology)

The student is able to identify the nine thresholds of overshoot

The student understands the orders of magnitude of the impacts of human activities in the 20th and 21st centuries: carbon impact, atmospheric CO2 concentration, species extinction, biodiversity, environment, etc.

The student is able to identify the contribution of engineering to these impacts

The student is able to consider solutions, not just technical ones (avoiding techno-solutionism)

The student is able to develop a systemic vision of human impacts on the planet (climate fresco, systemic and complexity analysis)
The student is able to analyze and critically examine the use of numbers and figures relating to socio-ecological issues, and their various interpretations.

The student is made aware of the concept of environmental justice (climate fresco, ethics).

The student is able to question certain engineering activities and their uses.

Objectives

Thinking Together New Socio-Ecological Challenges and Our Responsibility:
Understanding the limits of the Anthropocene and its consequences for our present: socio-ecological issues
Develop critical thinking and demonstrate reflexivity

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

French as a foreign language semester 1

ECTS
3 crédits

Hourly volume
55h

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

French as a foreign language and documentary project

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

Corporate Social Responsibility (CSR)

Introducing

Description

Responsible business, CSR (Corporate Social Responsibility), responsible legal structure, stakeholders and responsible governance, responsible value creation and sharing.

Objectives

This course introduces the fundamental concepts, approaches, and tools of responsible business management. The objective is to raise students' awareness of sustainable business practices. It highlights the integration of social, environmental, and economic issues into the operations of businesses.

By the end of this course, students will be able to :
- Design business transformation strategies
- Understand the main challenges of responsible business
- Identify and assess decisions related to corporate responsibility
- Establish action priorities in terms of responsibility

Cross-disciplinary skills :
- Grasp the complexity of real-world situations
- Take a step back from managerial information and adopt a critical mindset
- Work independently and as part of a team

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

Professional Path Initiative

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Physical activities and sports

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

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Learning to learn

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

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Algorithmics

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

Argumentation, rigor and reasoning

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

Calculation 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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Analysis

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

Algebra

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

Appropriate

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

Formalizing

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

Calculating

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

Interpreting

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Achieving

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

Identify, understand, analyze and interpret information

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

Get to know yourself and engage in a task, taking into account the objectives and the situation, and respecting the instructions given

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

Written communication: structure and expression

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

Understanding, communicating and interacting orally

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

Master written French language

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

Mathematics

Introducing

Description

In the Analysis-Algebra course:
- Laplace transform and application to the resolution of first and second order linear ODEs.
- bilinear algebra: bilinear forms, symmetric bilinear forms, associated quadratic form, scalar product, orthogonality, Gram-Schmidt orthogonalization procedure, orthogonal of a vector subspace, orthogonal projection, norm associated with a scalar product, convergence, continuity, Weierstrass theorem.
- functions of several variables: continuity, partial derivatives, differentiability, local extremum points, multiple integrals.

In the Probabilities section:
- probability space and conditional probabilities, independence of events
- discrete and continuous random variables (law of probability, expectation, variance, etc.)
- couples of random variables
- limit theorems (law of large numbers, central limit theorem)

Objectives

Introduce the Laplace transform and its use to solve certain ordinary differential equations.
Introduce some notions of bilinear algebra, in particular the scalar product and orthogonality.
Introduce concepts of analysis in several variables.
Introduce the basic concepts of probability.

Necessary prerequisites

1st year linear algebra.
1st year analysis: functions of a single variable (continuity, derivative, integrals, local extremum points).
Newton binomial, geometric series, exponential series.

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

Transfer bases

Introducing

Description

Transport phenomena: Continuum media, concept of shear stress. Statics of fluids. Kinematics of fluids.
Principles of conservation of mass, momentum and energy. Writing local equations and the global balances of mass, momentum and energy. Rheological laws (examples of Newtonian fluid and some non-Newtonian fluids).
Boundary conditions.
Exact solutions of some model problems. Analogies of transfers (Newton, Fourier, Fick).

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):
- The basics of continuum mechanics
- The concept of balance and the different scales of application
The student will be able to:
- Define a system and its contours, and calculate inlet, outlet and transformation fluxes
- Write local and macroscopic balances of mass, energy and momentum
- Solve analytically simple problems of Newtonian fluid mechanics

Necessary prerequisites

UF "Thermodynamics - Basics and Applications" from the first year of INSA or equivalent.
First-year mathematics (differential and integral calculus, notions of geometry, trigonometry and algebra).

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

Organic chemistry

Introducing

Description

Part I: Spatial and electronic structures.
- Hybridization of atomic orbitals and geometry of organic molecules.
- Nomenclature.
- Constitutional and conformational isomerism.
- Stereochemistry (enantiomerism, diastereosisomerism).
- Electronic effects: polarity, polarizability, inductive and mesomeric effects.
- Structure-reactivity relationship: the main classes of reagents: acids, bases, nucleophiles, electrophiles, reaction intermediates: carbocations, carbanions, free radicals.

Part Two: Reactivity of compounds. The main reaction mechanisms.

- Radical substitutions on alkanes (SR).
- Electrophilic additions to alkenes (AE).
- Electrophilic substitutions on arenes (SE).
- Nucleophilic substitutions in aliphatic series (SN1 and SN2).
- Elimination reactions (E1 and E2).

Basic practical work:
- Doubling of a racemic mixture.
- Chemical synthesis.
Acquire and implement the main experimental techniques (distillation, extraction, reflux set-up, recrystallisation, TLC and silica gel column chromatography).
- Raise students' awareness of safety during chemical manipulations.

UV visible spectrophotometry: principles, theory, Beer Lambert's Law.
IR and NMR spectroscopy: principles, equipment, interpretation of spectra.

Objectives

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

- the spatial and electronic structures of molecules in order to understand the main reaction mechanisms and their stereochemical consequences.

- the basic reaction mechanisms of chemical reactions in the living world and industrial organic chemistry.

The student should be able to:

- Identify the main chemical functions and name chemical compounds.
- Represent chemical compounds (Newman, Fischer, Cram).
- Distinguish between the different types of isomerism: conformational and configurational isomerism (enantiomerism, diastereoisomerism).
- Analyse electronic effects (inductive effects and mesomeric effects) in a molecule.
- Describe the different classes of reagents and reaction intermediates.
- Describe the main reaction mechanisms encountered in chemistry: Radical substitutions on alkanes (SR), Electrophilic additions on alkenes (AE), Electrophilic substitutions on arenes (SE), Nucleophilic substitutions in aliphatic series (SN1 and SN2), Elimination reactions (E1 and E2).
- Carry out organic syntheses using the basic experimental techniques of organic chemistry.
- Use the various techniques for characterising organic compounds (UV, IR, NMR)

- Interpret UV, IR and NMR spectra

Necessary prerequisites

I1ANETCH Atomistic
I1ANETCH Solution chemistry

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

Thermodynamics of physical-chemical systems

Introducing

Description

Systems, quantities and properties of states
Energy description of systems
Macroscopic properties of pure components
Description of physicochemical systems
Reaction quantities
Chemical potential and fugacity
Real solutions
Characterization of phase equilibria
Chemical equilibrium

Objectives

At the end of this module, the student will have acquired systematic practice in the implementation of material and energy balances with chemical reactions, and analyzes in closed and open energy systems. He will understand the behavior of real fluids, the generalized formulation of these behaviors using equations of state, their behavior in saturation zones, the main associated thermodynamic diagrams and their application to various systems.

He will have acquired the basics of thermochemistry including reaction quantities as well as the influence of temperature on these quantities (Kirschhoff), the heat of reaction, and will apply this knowledge to reactive systems under various conditions both theoretically through supervised work and practically in TP.

He will also have acquired the bases for the description of physicochemical systems and solutions (ideal/non-ideal) allowing the characterization and calculations of equilibrium between phases in the solutions. These bases are necessary for understanding and sizing unit operations in chemical and biochemical systems.

He will understand and apply the concepts associated with chemical equilibria: limitation of reaction progress, stability, instability and spontaneity of chemical reactions, chemical equilibrium constant, displacement of the equilibrium (Lechatelier's law).

He will apply this knowledge to homogeneous equilibria in the gas phase and in the condensed phase as well as to heterogeneous chemical equilibria.

Necessary prerequisites

UF « Thermodynamique Bases et applications » (code I1ANTH11) de la première année de l'INSA ou équivalent.

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

Structural Biochemistry

Introducing

Description

Detailed description of the structure of the molecules listed below and their major role in the cellular functioning of living beings:
- Monosaccharides, oligosaccharides, and polysaccharides
- Fatty acids and lipids
- Nucleotides and nucleic acids (DNA and RNA)
- Amino acids and proteins

Description and implementation of several analytical methods to elucidate the structure of certain compounds.
Introduction to the study and use of these biomolecules for biotechnologies in the context of ecological transition, sustainable development, and the bioeconomy.

Objectives

By the end of this module, students should have understood and been able to describe the overall structure of the four major classes of biomolecules that make up living systems (carbohydrates, lipids, nucleic acids, and proteins), as well as their function in cells. Students will also be aware of the great diversity that exists in the living world and its importance. They will also be able to cite certain techniques for analyzing these molecules and should be familiar with some simple examples of their relevance to biotechnology.

Necessary prerequisites

I1ANBC11 Chemistry
I2BECH11 Organic chemistry

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

Expression

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

Contemporary economy and ecological transition

Introducing

Description

The main areas studied are as follows:

- The market
- Economic actors
- Income and distribution
- Economic growth
- Unemployment
- Financing the economy
- Currency and inflation
- Economic policies
- New economic models

Objectives

The objective of this course is to provide basic concepts allowing students to better understand their current and future environment and to identify the main issues.

Students will be able to carry on a conversation and debate using arguments based on knowledge of fundamental economic mechanisms and some theories of economic thought.

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

Foreign Language 1

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Internship defense

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

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

Physical Activities and Sports

Introducing

Description

The APS (Physical and Sports Activities) offering is structured around several categories:

Team sports: football, basketball, volleyball

Individual sports: tennis, badminton, climbing, judo, strength training, gymnastics

Artistic and expressive activities: circuit training, dance

Outdoor activities: outdoor physical and nature-based activities (OPNA), golf

Adapted sports: adapted strength training, learn-to-swim, learn-to-ride, Pilates, sophrology

At the beginning of the academic year, students use a dedicated platform ("choix APS") to rank the available APS options in order of preference. Each student is then assigned an activity based on their choices and availability.

All APS sessions are supervised by certified PE teachers, either permanent staff (CAPEPS, AGREGATION holders) or external instructors.

Objectives

At the end of this module, the student should have understood and be able to explain the following key concepts:

Deepened self-awareness.

Ability to interact effectively with others.

The student should be able to:

Analyze a problem collaboratively (identify the issue, define possible approaches through interactive discussion).

Facilitate group expression and decision-making, allowing everyone to share their opinion.

Adjust and regulate their behavior in response to others.

Identify their own strengths and weaknesses, as well as those of others.

Apply these insights in the context of physical and sports practice.

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

Analytical Methods 1

Introducing

Description

This module is divided into three parts in order to understand and manage theoretical and experimental concepts relating to analytical methods.

Electrochemistry (Conductimetry, probes, ion-selective electrodes).

Liquid and gas Chromatographies: theory, instrumentation and quantification methods.

Sensors (biomass, microscopy, temperature, flow, pressure, viscosity, etc.).

Objectives

At the end of this module, the student will have understood and be able to explain the principles of analytical techniques implemented currently in laboratories and the associated mechanisms using his/her knowledge in quantum physics and chemistry (chemical reactions, physical and chemical properties ¿)

The student will be able to:

AA1 Choose the most relevant technique regarding the problem by explaining the relating theoretical concepts.

AA2 Carry out these analytical techniques.

AA3 Define and interface sensors with their electronic signal processing unit and identify needs for filtering, amplification and other signal processing requirements

AA4 Analyse and discuss the results in a critical way.

Necessary prerequisites

Thermodynamic 1Y (I1ANETTH) and 2Y (I2BETH11) / Chemistry of solutions 1Y (I1ANETCH) / Organic Chemistry 2Y (I2BECH11) / biostructural chemistry 2Y / Electrokinetics 1Y

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Chemical reaction engineering

Introducing

Description

Mass balance in reactional homogeneous systems. Continuous and batch systems. Transient and steady states. Progress reaction parameters and global balances. Reaction rate, law for reaction rates and temperature influence. Identification of reaction rate laws. Pseudo-first order approximation. Ideal reactors (batch, continuous stirred and plug flow). Mass balances application in ideal reactors. Isothermal reactors design.

Objectives

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

- kinetics of a chemical, or biochemical reaction
- Rate-limiting step, catalysis, inhibition
- Reaction rates, kinetic order and constant, activation energy
- Reaction progress parameters
- Mass balances applied to reactors
- Continuous and batch stirred reactors
- Plug flow reactors

The student will be able to:

- define a system, its boundaries, for a defined purpose; calculate all the molar fluxes (inlet, outlet, transformation, variation);
- choose the best ideal reactor for a homogeneous isothermal chemical reaction in liquid phase and calculate it (reactor design)
- write mass balances by using reaction progress parameters
- establish a kinetic law from reaction mechanisms in the case of simple chemical and enzymatic reactions. Understand how physiological aspects can impact the kinetics of microbiological reactions.
- propose experimental and numerical methods for determining the kinetic law for a homogeneous reaction from experimental data.
- determine a kinetic constant for a given temperature (Arrhenius law)
- treat a general homogeneous isothermal problem of chemical reaction engineering

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

Process control

Introducing

Description

- Overall total or partial mass balance, enthalpy balance in transient and steady state
- Concept of system, input and output variables, disturbance
- Some mathematical aspects: linearization of a function with several variables, Laplace Transformation
- Transfer function
- Block diagram
¿ 1st order, 2nd order and pure delay linear systems
- Open loop and closed loop
- Derivative Proportional Integral Regulation
- Concept of stability of a system
- Setting the parameters of a regulator
- Applications: chemical and biological reactors

Objectives

Acquire the main concepts of process control and apply them to simple cases of process engineering and biochemical engineering.

Necessary prerequisites

I2BEBT10 Global mass and energy balances on geometric domains
I2BEMT11 Laplace transform, Taylor expansion, Decomposition into simple elements

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

Industrial facilities

Introducing

Description

-Introduction of general concepts associated with a process, including classification and schematization and the notion of unit operation.
- Presentation of the methodology for carrying out (macroscopic) mass balances on a process in stationary mode including the notion of variance
- Application of these concepts on case studies of increasing complexity
- Mass balances on different unit operations (separator, mixer, divider, etc.) and on processes combining these unit operations, reactors, etc. –
-Mass balances on installations with or without recycling

Objectives

The mass balance is an essential tool for quantifying the performance of industrial installations and optimizing them according to criteria of yield, production, productivity, etc. It is also an essential tool for the environmental assessment of processes and bioprocesses. This course therefore aims to train students in the functional analysis approach of processes by introducing the basic concepts associated with the study of processes, including their schematization and the writing of the corresponding macroscopic mass balances. It presents a methodology for solving these balances through the concept of the degree of freedom of a system (variance). These approaches are illustrated through case studies ranging from a unit operation to a complex process operating in steady state.
At the end of the course, the student will be able to:
- Understand the basic concepts associated with processes (continuous process, discontinuous process, reactions, separations, recycling) –
-Understand and analyze a process from the diagram and literal descriptive elements in order to identify the mass flows (flow rates and compositions)
- Calculate the variance of a system and a process
- Write and solve the mass balances associated with an industrial installation operating in steady state
- Present these results by checking their consistency (physical meaning, units..)

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

Careers

Introducing

Description

The number of hours devoted to "discovering careers" is approximately 50 hours. It encompasses all the activities listed below and scheduled in the timetable.

Project to discover engineering professions and functions
This project is carried out in groups of 5 or 6, and aims to expose students to the realities of the industrial world as early as possible. To this end, they are asked to carry out a study designed to identify the jobs available to them - R&D engineer, quality engineer, production engineer, technical sales engineer, etc. - and the sectors in which they will be able to work - environment, pharmaceuticals, chemicals, agri-food, etc. Ideally, all these projects should cover the full range of opportunities offered by the 2 Biochemical Engineering and Process Engineering specializations.

Please note that these projects are not bibliographic projects designed to explain how a particular product is made! The aim is to place each industrial branch - which can, if necessary, be described in scientific and technological terms - in its organizational, economic, environmental and/or societal context, and above all to identify the specific features, in terms of the job, of the engineers working in it. Students are guided in their work by a teacher, but it is essential that during these projects students get out of INSA, meet professionals, visit factories, firms, design offices...

Objectives

The "discovering careers" section complements the "PPI" scheme, which helps students to reflect on and discuss their educational and career plans, and to take a more coherent career path. The objectives of "discovering careers" are listed below (in no particular order):
1°) to help students project themselves into what will be their daily professional life when they leave INSA, and to enable them to make their choice of specialization in year 3 in a well-thought-out manner. The aim is to give them as complete a picture as possible of the career opportunities available at the end of the 2 specializations to which the pre-orientation leads;
2°) to encourage students to open up to the world outside INSA, with particular emphasis on contacts with industry;
3°) to enable students to understand the usefulness of the courses they are taking by placing them in a professional context;
4°) to give students who have a particular project the opportunity to implement it (civic or community project, etc.)

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 calculation and statistics

Introducing

Description

Numerical calculation:
- concept of loop, tracing of functions
- calculation of an integral by a numerical method (trapezoid, midpoint) writing of a generic solver.
- resolution of nonlinear equation systems: Newton's method.
- resolution of differential equations: explicit and implicit Euler method
- resolution of a system of differential equations: use of an EDO solver

Statistics
- one- and two-dimensional descriptive statistics
- principal component analysis
- the point estimate and by confidence intervals of the mean and variance in the Gaussian and non-Gaussian case
- tests on the mean, homogeneity and normality
- the principles of linear models and generalized linear models.

Objectives

Give students basic programming training
Learn numerical methods to solve the different classes of equations typical of their future field of specialty (Chemical and Biological Engineering)

Necessary prerequisites

Elementary notion of mathematical analysis: Matrix, vectors, scalar product
Basic notions of programming: loop, test, assignment, writing functions

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Digital culture and skills 1

Introducing

Description

Introductory course to AI: history, algorithms, issues.
"No code" discovery of neural networks on Vittascience; notebook for building a small character recognition network.
Presentation of PIX and study of a certain number of themes independently with the objective of passing the PIX certification at the end of the 3rd year.

Objectives

At the end of this module, the student will have discovered the first dimensions of the field of AI: history, examples of what AI allows, distinction between supervised and unsupervised learning, rapid scope of techniques and algorithms, ethical aspects, risks and controversies. In a second part, the student will have advanced his PIX course according to the defined program.

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

Energy Mix and Transition

Introducing

Description

The main concepts covered during the course are: conversion, transport, storage and usage efficiencies / power flux density / material resource intensity / load factor / stock and flow concepts / production and demand profiles / networking / energy mix / energy transition scenarios for 2050.
The course covers the following technologies: wind generation, electrolytic storage (H2), photovoltaics, electrochemical batteries, hydroelectricity / WWTP, fossil-nuclear-biomass power stations, biogas production.

Objectives

To understand the stakes involved in supplying energy to our production system.
To be able to answer the following questions:
- How do we obtain our energy today (knowing the different means of conversion and storage, and the different mixes) ?
- What are the orders of magnitude for our individual and national energy consumption on a day-to-day basis ?
- Where are the dependencies, weaknesses and limits of our energy supply ?
- How can we build an energy mix that meets our demand profile up to 2050 and the challenge of decarbonization ?

Necessary prerequisites

Be familiar with the concepts of electrical power and energy, as well as the general concepts of efficiency and density.
Have acquired the knowledge and skills of the first year at INSA, especially in electrokinetics, mechanics and thermodynamics.

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

Microbiology

Introducing

Description

Microbiology :
- Cell biology of microorganisms: General aspects of the microbial world, Prokaryotes: structure and function, Eukaryotes: structure and function, Nutrition and growth, Viruses.
- Classification: Principles of classification, Identification methods, Overview of the microbial world.
- Industrial applications: Industrial microbiology, Water treatment and microorganisms, Negative implications of microorganisms.

Objectives

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

Structure of prokaryotes and eukaryotes. Reproduction. Nutrition. Notion of metabolism. Growth and counting. Classification, identification and industrial applications of microorganisms.

The student should be able to:
Describe microbial diversity and its role in natural cycles. Present the structures and functions of cellular components. Grow and count microorganisms. Master the investigative methods used to classify and characterise organisms. Describe the products of industrial microbiology and water treatment techniques.

Necessary prerequisites

I2BEBS10 Structural biochemistry of carbohydrates, lipids and proteins.

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

Elective scientific course

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

Foreign language 2

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 2nd 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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Physical Activities and Sports

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

Mathematics

Introducing

Description

Part: Mathematical Concepts (Lectures = 17.5h / Tutorials = 17.5h)
1.Generalized integrals and series (2 Lectures / 2 Tutorials)
2.Norms 1, 2, and infinity in finite and infinite dimensions (1.5 Lectures / 1 Tutorial)
3..Scalar product, Cauchy-Schwarz inequality, and Pythagoras (1.5 Lectures / 1 Tutorial)
4.Vector orthogonality, decomposition on orthogonal bases (1 Lecture / 2 Tutorials)
5.Special matrices: symmetric, projection, and isometries (1.5 Lectures / 2 Tutorials)
6.Continuity and differentiability of multivariable functions (2 Lectures / 3 Tutorials)
7.Multiple integration (3 Lectures / 3 Tutorials)
8.Hessian matrix and optimization (1.5 Lectures / 0 Tutorials)

Part: Numerical Analysis (Lectures = 7.5h / Tutorials = 7.5h / Lab Work = 17.5h)
0.Introduction to Python and numerical analysis (1 Lab Session)
1.Numerical integration (Rectangle, trapezoid, and Simpson methods) (1 Lecture / 1 Tutorial / 1 Lab Session)
2.Norms and conditioning (Induced norms and the impact of conditioning) (1 Lecture / 1 Tutorial / 1 Lab Session)
3.Direct resolution of linear systems (Gaussian elimination and LU decomposition) (1 Lecture / 1 Tutorial / 1 Lab Session)
4.Solving nonlinear equations (Bisection, Newton's method, and fixed-point iteration) (1 Lecture / 1 Tutorial / 1 Lab Session)
5.Polynomial interpolation (Vandermonde matrices and the Runge phenomenon) (1 Lecture / 1 Tutorial / 1 Lab Session)
6.Least squares method (Normal equations) (1 Lecture / 1 Tutorial / 1 Lab Session)

Part: Probability and Statistics (Lectures = 13.75h / Tutorials = 13.75h / Lab Work = 2.5h)
1.Events, probabilities, conditioning, independence
2.Random variables, probability distributions, discrete variables
3.Continuous random variables, random vectors
4.Statistical inference: point estimation, confidence intervals, and hypothesis testing

Objectives

This Teaching Unit (UE) aims to master the essential concepts and foundational knowledge in mathematics for engineers in Civil Engineering or Mechanical Engineering. The UE is divided into three components with complementary objectives:
1.Mathematical Concepts: Master essential mathematical tools for Civil or Mechanical Engineering.
2.Numerical Analysis: Implement efficient algorithms using Python and analyze their convergence.
3.Probability and Statistics: Understand and apply probabilistic and statistical modeling.

Necessary prerequisites

First-year Mathematics course. Note that the different sections are not independent, and tools introduced in one part may be used in others.

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

Mechanics

Introducing

Description

Analyze structure equilibrium and apply Newton's second law to a system of rigid bodies:
- Model usual mechanical actions as wrenches using screw theory (kinematic joints and external forces)
- Model friction using Coulomb's Law of Friction
- Model the tilting of a plane joint using a mobile point of application for the normal force
- Identify a statically determinate/indeterminate system (number of static unknowns)
- Determine a solving strategy for the second law (systems of interest, external forces, free body diagram, equations to use, solid bodies subjected to only two external forces)
- Calculate the mechanical actions that need to be determined (joints or actuators)
- Validate the stability of a structure (sliding, tilting on a plane, loss of contact)

Determine the absolute or relative velocity and acceleration of a point on a rigid body:
- Interpret the kinematic parameterization of a mechanism
- Describe the velocity vector field that characterizes a body's motion as a twist using screw theory
- Apply velocity addition, velocity field analysis and time derivatives of vectors in rotating frames
- Determine the condition for rolling without slipping at the contact between two bodies
- Solve a 2D kinematics problem graphically (instantaneous axis of rotation, velocity field)

Objectives

Solid mechanics
At the end of this course, you will be able to:
- determine the mechanical loads exerted on rigid bodies (preliminary step to sizing),
- verify the stability conditions of a mechanism (friction, tilting, loss of contact),
- analyze velocities and accelerations in a mechanism (particularly in power transmissions).

Necessary prerequisites

- Reading a kinematic diagram
- Solving systems of algebraic equations
- Trigonometry and projections
- Vectors, scalar and vector products
- Derivatives of composite functions

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

Design – CAD

Introducing

Description

3 ECTS: Mechanical Design

Design and understand the architecture of mechanisms.

3 ECTS: Civil Engineering BIM

Model and transition from 2D to 3D.
Apply concepts of construction techniques.

Objectives

The student must be able to:

Define a simple rotational guide.
Specify the assembly of components.
Represent schematically (modeling).
Provide a graphical representation of a mechanism's architecture.
Create 2D and 3D graphical representations.
Model elements of civil engineering projects.
Query a digital model to extract production data.
Understand the mechanical functioning of civil engineering projects.

Necessary prerequisites

Introductory courses on industrial techniques in the first year: I1ANTI11 and I1ANSY21.

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

Strength of Materials 1

Introducing

Description

Modeling with beam-like structures ;
Internal forces (cohesion forces), Relation between continuum stresses and internal forces, Equilibrium equations (in terms of internal forces) ;
Computing strains, stresses and displacements for the elementary loading cases : axial, bending and torsion.

Objectives

Strength of materials: Introduction to beam theory
- Drawing internal forces diagrams for an isostatic, straight, planar beams.
- Calculate the beam strains and stresses for a few simple loads in the case of a simple section and a slender beam.
- Final objective is to learn how to analyse and design beam-like structural members or machine elements subjected to tension, compression, torsion, and bending.

Necessary prerequisites

Equilibrium equations in terms of forces and moments.
Differential and integral calculus.

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

Expression

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

Contemporary economy and ecological transition

Introducing

Description

The main areas studied are as follows:

- The market
- Economic actors
- Income and distribution
- Economic growth
- Unemployment
- Financing the economy
- Currency and inflation
- Economic policies
- New economic models

Objectives

The objective of this course is to provide basic concepts allowing students to better understand their current and future environment and to identify the main issues.

Students will be able to carry on a conversation and debate using arguments based on knowledge of fundamental economic mechanisms and some theories of economic thought.

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

Foreign Language 1

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

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Internship defense

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

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

Physical Activities and Sports

Introducing

Description

The APS (Physical and Sports Activities) offering is structured around several categories:

Team sports: football, basketball, volleyball

Individual sports: tennis, badminton, climbing, judo, strength training, gymnastics

Artistic and expressive activities: circuit training, dance

Outdoor activities: outdoor physical and nature-based activities (OPNA), golf

Adapted sports: adapted strength training, learn-to-swim, learn-to-ride, Pilates, sophrology

At the beginning of the academic year, students use a dedicated platform ("choix APS") to rank the available APS options in order of preference. Each student is then assigned an activity based on their choices and availability.

All APS sessions are supervised by certified PE teachers, either permanent staff (CAPEPS, AGREGATION holders) or external instructors.

Objectives

At the end of this module, the student should have understood and be able to explain the following key concepts:

Deepened self-awareness.

Ability to interact effectively with others.

The student should be able to:

Analyze a problem collaboratively (identify the issue, define possible approaches through interactive discussion).

Facilitate group expression and decision-making, allowing everyone to share their opinion.

Adjust and regulate their behavior in response to others.

Identify their own strengths and weaknesses, as well as those of others.

Apply these insights in the context of physical and sports practice.

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

Ordinary Differential Equations and Series

Introducing

Description

1.Review and Additions on First- and Second-Order Scalar ODEs: Linear cases, Equations of Mechanics, Riccati Equations.
2.Qualitative Aspects of ODEs: Maximal and global solutions, Existence and Uniqueness Theorems, Equations with separable variables, Phase portraits.
3.Numerical Aspects of ODEs: Euler schemes, Trapezoidal method, Runge-Kutta schemes, Error estimation.
4.Function Series: Review of function sequences and numerical series, Modes of convergence and summation properties, Power series applications to ODEs.
5.Linear Differential Systems: First-order systems with constant coefficients, Matrix exponential, Practical resolution, Phase portraits in the plane, Stability of equilibria.
6.Laplace Transform: Integral definition, Computational properties, Applications to ODEs.

Objectives

This module introduces the mathematical framework of Ordinary Differential Equations (ODEs) and provides methods for qualitative and quantitative analysis. Students are expected to identify the type of an ODE and apply appropriate techniques to solve or characterize its solutions.

Necessary prerequisites

Mathematics courses from the first year and UE I2ICMT31.

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

Energy Mix and Transition

Introducing

Description

The main concepts covered during the course are: conversion, transport, storage and usage efficiencies / power flux density / material resource intensity / load factor / stock and flow concepts / production and demand profiles / networking / energy mix / energy transition scenarios for 2050.
The course covers the following technologies: wind generation, electrolytic storage (H2), photovoltaics, electrochemical batteries, hydroelectricity / WWTP, fossil-nuclear-biomass power stations, biogas production.

Objectives

To understand the stakes involved in supplying energy to our production system.
To be able to answer the following questions:
- How do we obtain our energy today (knowing the different means of conversion and storage, and the different mixes) ?
- What are the orders of magnitude for our individual and national energy consumption on a day-to-day basis ?
- Where are the dependencies, weaknesses and limits of our energy supply ?
- How can we build an energy mix that meets our demand profile up to 2050 and the challenge of decarbonization ?

Necessary prerequisites

Be familiar with the concepts of electrical power and energy, as well as the general concepts of efficiency and density.
Have acquired the knowledge and skills of the first year at INSA, especially in electrokinetics, mechanics and thermodynamics.

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

Digital culture and skills 1

Introducing

Description

Introductory course to AI: history, algorithms, issues.
"No code" discovery of neural networks on Vittascience; notebook for building a small character recognition network.
Presentation of PIX and study of a certain number of themes independently with the objective of passing the PIX certification at the end of the 3rd year.

Objectives

At the end of this module, the student will have discovered the first dimensions of the field of AI: history, examples of what AI allows, distinction between supervised and unsupervised learning, rapid scope of techniques and algorithms, ethical aspects, risks and controversies. In a second part, the student will have advanced his PIX course according to the defined program.

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

Dynamics

Introducing

Description

- Analyze the spatial mass distribution of a rigid body (inertia matrix, center of mass).

Newton's first law of motion for a system of rigid bodies:
- Determine the linear and angular momentum and their time derivatives using screw theory
- Determine a solving strategy to apply the first law (systems of interest, equations to be used)
- Determine mechanical actions or differential equations of motion by applying the first law

Work-energy theorem for a system of rigid bodies:
- Calculate the kinetic energy of a body in motion (rotation, translation, helical motion)
- Determine the power of external forces and contact forces
- Derive an equation of motion or determine a force using the work-energy theorem (WET)

Objectives

Rigid body dynamics
At the end of this course, you will be able to:
- Determine the motion of a mechanism over time given the forces acting on it,
- Determine the mechanical actions in the joints or actuators required to produce the desired motion.
Newton's first law of motion and the work-energy theorem (WET) will be used

Necessary prerequisites

Solid mechanics I course:
- Force and moment calculation
- Common forces modeling
- Calculation of velocity and acceleration
- Screw theory: modeling forces as wrenches and velocity fields as twists
- Solving a statics problem

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

Elective scientific course

Introducing

Description

Students take one of the following courses, of their choice:
- spatial data acquisition,
- mechanics for health,
- Python for engineers,
- networks and electrical machines.

Objectives

Elective courses are scientific courses related to the content of the pre-orientation, i.e. courses that can be used by future engineers in the Civil Engineering and Mechanical Engineering sectors. These courses are not prerequisites for the rest of the curriculum.

Necessary prerequisites

See detailed descriptions of each 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

Strength of Materials II

Introducing

Description

Beam theory:
• Transition from the real system to the beam type model: average line and geometric properties of sections, connections, loading, linear elastic material;
• Static reminders – Balance – Linking actions – Isostaticity and hyperstaticity;
• Internal forces: normal force, bending, shear force, torsion;
• Stress/strain/displacement fields and potential energy of elastic deformation associated with the different internal forces;
• Methods for solving hyperstatic structures (by application of the superposition principle and Castigliano's theorem).

Objectives

The student will be able to assess:
The mechanical behavior of isostatic and hyperstatic "beam" type structures under static loading:
- Model a "beam" type structure (geometric characteristics, support and loading),
- Calculate the support actions and internal forces,
- Calculate the stress, deformation and displacement fields associated with each type of internal force,
- Calculate the potential energy of elastic deformation,
- Apply resolution methods for hyperstatic structure of degree 1.

Necessary prerequisites

Mechanics
Materials science
Mathematical tools

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

Materials science

Introducing

Description

Detailed programme for common materials:

6 CMs of 1.25h each
Crystallography of metals and ceramics - Amorphous structures
Thermodynamics of binary metal alloys: Gibbs free energy - Entropy - Enthalpy Binary iron-carbon metal alloy: Phase equilibrium diagram - Eutectoid transformation
Mechanical behaviour of construction materials at room temperature: Elasticity - Plasticity - Ductility - Fragility
Mechanical properties of materials in use and mechanical tests at room temperature
Physical properties of construction materials and associated non-destructive testing
Chemical properties of construction materials and corrosion phenomena

Tutorial topics: 4 tutorials of 1.25 hours each
1/ Crystallography: Pattern - Atomic density - Miller indices
2/ Phase diagram: Iron-carbon diagram - Determination of the microstructure of a steel at room temperature
3/ Mechanical properties: Tensile strength curve and skimming - Strain energy
4/ Chemical properties: Corrosion

Practical work session: 2 TPs of 3 hours each
TP1 Mechanical tests: tensile test - Hardness test - Impact test
TP2 Chemical tests

Objectives

Make the link between the mechanical, physical and chemical properties of construction materials (metals, ceramics and polymers) and the characteristics of these materials on an atomic (crystallographic) and microstructural (binary phase diagram) scale.

Necessary prerequisites

For the common core of materials: Notion of Crystallography and Thermodynamics from 1A

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

Building Environment and Materials

Introducing

Description

Materials for Civil Engineering: 18.75 hours

11.25 hours: Lectures on the portfolio of construction materials used in Civil Engineering.
2.5 hours: Tutorials on Life Cycle Assessment (LCA) approaches and quantitative methods.
5 hours: Laboratory sessions on materials and digital tools.

Project Design Component: 52 hours

7.5 hours: Lectures on design principles (Architecture and Structure).
8.75 hours: Tutorials on architectural analysis, load paths, and structural design linked to construction techniques.
2 hours: Construction site visit.
33.75 hours: Small-group project work, focusing on project selection and approach, architectural and structural design, justification of choices, numerical modeling, quantification, technical design details, defining and calculating load transfers, and assessing the environmental impact of construction materials.

Objectives

The student must be able to:

Understand and develop materials used in Civil Engineering.
Develop an interdisciplinary understanding of sustainable urban development.
Navigate the complexity of civil engineering design projects and apply multicriteria, multi-stakeholder, and multi-scale spatial and temporal decision-making frameworks.
Explore the concepts of eco-design.
Manage the design of architectural programs.
Define, select, and specify construction materials.
Justify and assess the environmental impact of prescribed solutions.
Design the load-bearing structure of buildings (limited to vertical loads).
Calculate and predict load transfers (restricted to gravitational and operational loads).

This course is designed to:

Facilitate the development of skills in civil engineering project methods.
Promote the use of digital tools.
Enhance practices in design projects.
Introduce architectural design principles.
Provide guidance on the selection of construction techniques and materials.
Develop quantitative and multicriteria approaches.

The module aims to:

Present the dual Architect-Engineer curriculum.
Foster analytical thinking and design methodologies for building projects integrated within an urban fabric.
Serve as a practical application of concepts from Strength of Materials 2 (covered in semester 4), specifically focusing on the understanding of beams, loads, and the concrete application of static principles.

Necessary prerequisites

"Civil Engineering Design with BIM: Utilizing a 3D

modeling tool, focusing on the technical approach to parametric families and objects, and emphasizing collaborative workflows.
Strength of Materials 1 (SOM 1): Ability to apply the Fundamental Principle of Statics.

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

Design and Materials Project

Introducing

Description

Detailed programme for common materials:

6 CMs of 1.25h each
Crystallography of metals and ceramics - Amorphous structures
Thermodynamics of binary metal alloys: Gibbs free energy - Entropy - Enthalpy Binary iron-carbon metal alloy: Phase equilibrium diagram - Eutectoid transformation
Mechanical behaviour of construction materials at room temperature: Elasticity - Plasticity - Ductility - Fragility
Mechanical properties of materials in use and mechanical tests at room temperature
Physical properties of construction materials and associated non-destructive testing
Chemical properties of construction materials and corrosion phenomena

Tutorial topics: 4 tutorials of 1.25 hours each
1/ Crystallography: Pattern - Atomic density - Miller indices
2/ Phase diagram: Iron-carbon diagram - Determination of the microstructure of a steel at room temperature
3/ Mechanical properties: Tensile strength curve and skimming - Strain energy
4/ Chemical properties: Corrosion

Practical work session: 2 TPs of 3 hours each
TP1 Mechanical tests: tensile test - Hardness test - Impact test
TP2 Chemical tests

If the student chooses to approach the objectives with 'Mechanical Engineering' oriented materials

- 35.5 hours for a mechanical design project, through the study of a project in a small group, the students approach functional analysis, modelling (schematisation), the search for solutions, pre-dimensioning and the production of a 'digital mock-up' using CAD software. Students supplement the knowledge they need to develop the project with various documents at their disposal: resource documents on the 'moodle' platform, books, internet.
- 8 hours of practical work on bearing assembly,
- Using the elements made available to them (bearings, gear housing shafts, keys, elastic rings, locknuts, etc.), the students must analyse, design and produce bearing assemblies that comply with current regulations.
- 6 hours on the study and operation of different heat engines. Using visual aids, students discover the different cycles of internal combustion engines, the distribution and supply systems, and the principles of turbojet and turboprop engines. They identify the different functional elements of an engine from an overall drawing.

Materials for Mechanical Engineering - Lesson (7.5h)
- Phase transformations under equilibrium conditions: isothermal (eutectoid and eutectic) and non-isothermal transformations
- Diffusion: Fick's laws (unidirectional)
- Germination-growth mechanisms of a new phase (from a liquid or a solid phase)
- Mechanical properties of metal alloys: fatigue strength and behaviour in the presence of cracks

TD topics (5h)
1: Use of Fick's laws in steel carburising
2: Analysis of the microstructural evolution of steels
3: Work hardening - Introduction to residual stresses
4: Conventional fatigue limit and fatigue diagram (Haig)

Practical work (6h)
TP1 Mechanical test: Effect of cold rolling on tensile properties - Alloy Al20217

TP2 Microstructure: Microstructures of steels and white cast irons

If the student chooses to approach the objectives with 'Civil Engineering' oriented materials
Civil engineering materials: 18.75 h
- 11.25 h Portfolio lecture on construction materials used in civil engineering
- 2.5 h of tutorials on LCA and quantitative approaches
- 5 h of practical work on materials and numerics
Project design part: 52 h
- 7.5 h Lectures on project principles (architecture and structure)
- 8.75 h Tutorials: architectural analysis, load analysis and structural design in relation to construction techniques
- 2 h site visit
- 33.75 h project work in small groups based on project choices and approach, architectural and structural design, justification of choices, digital modelling, quantification, technical design details, definition and calculations of load transfers and environmental impact study of construction materials.

Objectives

- Make the link between the mechanical, physical and chemical properties of construction materials (metals, ceramics and polymers) and the characteristics of these materials on an atomic (crystallographic) and microstructural (binary phase diagram) scale.
- Make a reasoned selection of metallic materials for mechanical construction by making the link between the mechanical characteristics and the nature of the metallic alloy: chemical composition, microstructure, nature of the phases, heat treatment possibilities, etc;
- Implement a design procedure based on specifications and acquire a technological culture.
The student may choose to approach this general objective with either a 'Mechanical Engineering' or a 'Civil Engineering' teaching aid.

If the student chooses to approach the objectives with 'Mechanical Engineering' oriented teaching aids, he/she must :

- Propose one or more solutions in the form of a kinematic diagram, based on a set of specifications.
- Calculate the powers involved and choose a motor.
- Design and size a simple gearbox.
- Design and size a radial contact ball bearing assembly.
- Calculate the isostatism of an assembly of fixed parts and a moving mechanism.
- Produce a digital model of the mechanism using CAD software.
- Give an oral and written presentation of the project.
- Participate and get involved in a work group.
- Identify the links to be implemented using real components for the bearings.
- Be familiar with 4-stroke and 2-stroke cycles.
- Be familiar with distribution and supply systems.
- Be familiar with the principles of turbojet and turboprop engines.
- Be able to identify the functional elements of an engine from a drawing.
- Be familiar with the secondary functions (cooling, lubrication, electrical generation, etc.).
- Be familiar with the terminology of the component parts.

If the student chooses to approach the objectives using 'Civil Engineering' oriented materials, he or she will be able to :
- Develop an interdisciplinary culture around sustainable urban development,
- To immerse themselves in the complexity of civil engineering design projects and in multi-criteria, multi-actor and multi-scale spatial and temporal decision-making.
- Discover the concepts of eco-design
- Design architectural programmes
- Define, select and specify construction materials

- Justify and assess the environmental impact of the solutions prescribed
- Design the load-bearing structure of buildings (vertical loads only)
- Calculating and predicting load transfer (gravity and operational loads only)

This course is designed to be closely linked to the development of skills in civil engineering project methods, the use of digital tools, the development of design project practices, the discovery of architectural design, the choice of construction techniques and materials and the use and development of multi-criteria and quantitative approaches.

The module provides an introduction to the dual Architect/Engineer curriculum, and develops analytical skills and design methods for building projects within an urban fabric. The project also provides an opportunity to practise the concepts of Resistance of Materials 2 seen in S4, with an understanding of beams, loads and the practical application of the principles of statics.

Necessary prerequisites

For the common core of materials: Notion of Crystallography and Thermodynamics from 1A

If the student chooses to approach the objectives with 'Mechanical Engineering' oriented materials
- I2ICTI31 teaching in semester 3 (kinematic diagram, isostatism applied to the assembly of fixed parts, design of an assembly of radial contact ball bearings, knowledge of the rules of industrial drawing, knowing how to use the basic functions of CREO.
- Teaching I2ICME31 in semester 3 (knowing how to use the Fundamental Principle of Statics).

If the student chooses to approach the objectives with 'Civil Engineering' oriented materials
- I2ICTI31 teaching in semester 3 GC BIM design with tools linked to the use of a 3D modeller, technical approach to parametric families and objects, collaborative approach.
- I2ICME31 teaching in semester 3 (knowing how to use the Fundamental Principle of Statics).

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

Foreign language 1

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

Foreign language 2

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 2nd 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

Physical Activities and Sports

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

Analysis 1

Introducing

Description

• The notion of differentiability of a function of multiple variables, partial derivatives
• The concept of norms, convergence of sequences in vectorial spaces, basic topological concepts: open and closed sets,
• Integrals of functions unbounded or on unbounded domains, with several variables

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):
• The notion of differentiability of a function of multiple variables, partial derivatives
• The concept of norms, convergence of sequences in vectorial spaces, basic topological concepts: open and closed sets,
• Integrals of functions unbounded or on unbounded domains, with several variables

The student will be able to:
• Carry out computations of integrals on bounded intervals, of unbounded functions.
• Study the differentiability of a function of multiple (real) variables, carry out an asymptotic expansion
• Manipulate norms of vectors and matrices, study the convergence of a sequence limits in vectors spaces.

Necessary prerequisites

Basic Calculus, Basic Linear algebra

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

Algebra

Introducing

Description

Euclidean spaces.
Orthogonal matrices.
Reduction of quadratic shapes.

Objectives

Reduce symmetric endomorphisms.
Manipulate scalar products and understand the notion of orthogonality in euclidean spaces.
Express quadratic forms as sums of squares.

Necessary prerequisites

1st year Mathematics 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

Electromagnetism

Introducing

Description

Course Structure

The course is divided into six main chapters:

1- Magnetostatics:

˚Study of static magnetic fields and magnetic forces.
˚Application of Biot-Savart and Ampère's laws.
˚Analysis of magnetic circuits and magnetic materials.

2- Induction Phenomena:

˚Introduction to Faraday's law and Lenz's law.
˚Study of induced currents and electromotive forces.
˚Practical applications of induction phenomena in transformers and generators.

3- Maxwell's Equations in Vacuum:

˚Derivation and understanding of Maxwell's equations.
˚Relationship between electric and magnetic fields in vacuum.
˚Introduction to electric and magnetic potentials.

4- Electromagnetic Wave Propagation:

˚Study of the propagation of electromagnetic waves in different media.

5-Electromagnetic Energy and the Poynting Vector:

˚Calculation of energy stored in electric and magnetic fields.
˚Introduction to the Poynting vector and its role in the propagation of electromagnetic energy.

6-Study of the Special Case of Monochromatic Progressive Plane Waves:

˚Analysis of progressive plane waves and their properties.
˚Study of monochromatic waves and their polarization.

This course aims to provide a deep understanding of the fundamental concepts of electromagnetism and to develop your analytical and practical skills to solve complex problems in this field.

Objectives

Course Objectives:

1- Master the basic theoretical tools and concepts of electromagnetism, such as Maxwell's equations, induction phenomena, and quasi-stationary regimes. These foundational concepts will lay the groundwork for understanding the propagation of electromagnetic waves, which will be further developed in the following year.
2- Identify relevant variables in problems related to magnetostatics and time-varying electromagnetism.
3- Simplify real-world problems to calculate useful physical quantities.
4- Geometrize any electromagnetism problem in 3D, whether it is in a static or time-varying regime.
5- Extract the full set of physical properties of an electromagnetic wave from Maxwell's equations.

This course aims to provide you with a deep understanding of the fundamental concepts of electromagnetism and to develop your analytical and practical skills to solve complex problems in this field.

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

Materials

Introducing

Description

- Introduction
- Atomic Structure
- Structures and ordering in condensed matter
- Phase diagrams
- Mechanical properties of crystalline materials
- Ceramics / Polymers
- Electronic properties of materials and their applications (electronic, thermal and optical properties).

Objectives

At the end of this module, the student will be able to:
Describe the main macroscopic properties of materials (mechanical, electronic, thermal, magnetic, dielectric and optical) and identify their origins in terms of structural arrangement and electronic structure.

Necessary prerequisites

No necessary knowledge.

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

Analog electronics

Introducing

Description

This course is divided into 8 chapters :
Chapter 1: Electronics – a whole world to discover.
Chapter 2: First-year review.
Chapter 3: Diodes, Zener diodes, and LEDs.
Chapter 4: The bipolar transistor in switching applications.
Chapter 5: How to receive a light signal: the photodiode.
Chapter 6: Mathematical tools for the electronics engineer.
Chapter 7: How to filter a signal? Passive filters.
Chapter 8: How to amplify a signal? The linear operational amplifier.

Objectives

This analog electronics course is intended for 2nd-year IMACS students. Its objective is to provide a foundation of knowledge and skills for students who are just beginning in this subject.

Necessary prerequisites

The required concepts are as follows :
- General laws of electrokinetics : Kirchhoff's voltage law, Kirchhoff's current law, Ohm's law, constitutive relation (current/voltage) for capacitors and inductors.
- Thévenin's and Norton's theorems.
- Superposition theorem.

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

Introducing

Description

Teaching is organized into 12 class sessions, 12 practical sessions and 3 practical sessions. The course is organized as follows:

1. Introduction; notions of signal, signal processing, system response, filtering

2. Chapter 2 is dedicated to defining the properties of linear time-invariant (LTI) systems, and the concepts of excitation and response. A prerequisite for calculating the response of a system is to find the type of excitation that facilitates this task. We will highlight two types of excitation families: complex exponential and impulse. These will enable us to define two complementary ways of modeling a system: in the time domain by the impulse response, and in the frequency domain by the transfer function.

3. Chapter 3 is devoted to the Laplace transform. This tool, which transforms a mathematical function in time into a new function expressed in the complex frequency domain, provides a highly efficient means of calculating the transient response of LTI systems, whatever the input excitation applied.

4. Chapter 4 deals with frequency analysis and filtering. Filters are LTI systems like any others. Their specific purpose is to eliminate unwanted frequency components from a signal. To design a filter, its transfer function must be analyzed. This chapter introduces a graphical tool for filter analysis: the Bode diagram, as well as the vocabulary associated with filter characterization.

5. Chapter 5 introduces the decomposition of a periodic signal into a series of (co)sinusoidal terms, known as the Fourier series. This forms the basis of frequency signal analysis. After a description of the different forms taken by the series, the main properties of Fourier series are presented. Several examples of signal decomposition in Fourier series are given. A line spectrum representation of the signal is also introduced, providing a powerful graphical analysis tool.

6. Fourier series are a formidable tool for signal analysis, but are limited to periodic signals. The Fourier transform is an extension for a class of non-periodic signals. Chapter 6 is dedicated to presenting the Fourier transform and its application. The chapter also shows that the Fourier transform is a special case of the Laplace transform.

7. Chapter 7 returns to the calculation of the time response of systems. This was covered in Chapter 3, where the signal was transformed into the frequency domain using the Laplace transform. In this chapter, we show how this calculation can be performed directly in the time domain. This requires the use of the convolution product.

8. In the final chapter, we return to the concepts of signal power and energy. We present calculation methods in the time and frequency domains. We introduce another fundamental tool for studying the similarity of signals: correlation. It also has another major interest: knowledge of it enables us to determine the power spectral density of a signal, giving the signal's power distribution in the frequency domain.

Practical sessions are also dedicated to getting to grips with digital signal processing tools (Matlab, Octave).

Objectives

The aim of this course is to introduce the main mathematical concepts, methods and tools for continuous-time signal processing (Laplace, Fourier, convolution, correlation, spectrum, frequency analysis, etc.).

Necessary prerequisites

Mathematics for enginners (trigonometry, complex numbers, integration)

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

Feedback systems

Introducing

Description

Outline :
Chapter 1 Introduction to Automation
What is automation
On the notion of system and input/output/disturbance
Determining the I/O of a system
BO vs BF and Setpoint vs Command
Introductory example
The systems considered and the I/O model (linear diff. equation of order n).
Chapter 2 Mathematical tools
Some definitions
time response, step, ramp, Dirac, causality, Analysis, Control, linearity, Invariance
The Laplace transform, a short and useful version
Def., table, derivation=<EDO role of ICs, final value theorem
The notion of transfer function
Chapter 3 Modeling
Why model...How to model
Qq reminders (elec, mech, basic fluid) => Passage to Laplace
Block diagram - Definition and conventio
Simplification and transformation
Linearization
Chapter 4 Time Response
Reminder of simple EDO resolution
Solving by Laplace (simple element decomposition)
1st-order systems
Second-order systems
On the notion of performance: response time, overshoot and accuracy
Other systems (unstable and pole dominance)
On the notion of performance: response time, overshoot and accuracy
Chapter 5 Harmonic response
Why and how
A complex example and introduction to the various plots
The pure integrator and the pure derivator
The first order
Second order
Method for plotting asymptotes for a qcq order
From BO to BF: black's chart

Objectives

Frequency approach to continuous linear control

Necessary prerequisites

Ordinary differential equation
Complex variable

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)

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Toulouse

Expression

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

Contemporary economy and ecological transition

Introducing

Description

The main areas studied are as follows:

- The market
- Economic actors
- Income and distribution
- Economic growth
- Unemployment
- Financing the economy
- Currency and inflation
- Economic policies
- New economic models

Objectives

The objective of this course is to provide basic concepts allowing students to better understand their current and future environment and to identify the main issues.

Students will be able to carry on a conversation and debate using arguments based on knowledge of fundamental economic mechanisms and some theories of economic thought.

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

Foreign Language 1

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

Internship defense

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

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

Physical Activities and Sports

Introducing

Description

The APS (Physical and Sports Activities) offering is structured around several categories:

Team sports: football, basketball, volleyball

Individual sports: tennis, badminton, climbing, judo, strength training, gymnastics

Artistic and expressive activities: circuit training, dance

Outdoor activities: outdoor physical and nature-based activities (OPNA), golf

Adapted sports: adapted strength training, learn-to-swim, learn-to-ride, Pilates, sophrology

At the beginning of the academic year, students use a dedicated platform ("choix APS") to rank the available APS options in order of preference. Each student is then assigned an activity based on their choices and availability.

All APS sessions are supervised by certified PE teachers, either permanent staff (CAPEPS, AGREGATION holders) or external instructors.

Objectives

At the end of this module, the student should have understood and be able to explain the following key concepts:

Deepened self-awareness.

Ability to interact effectively with others.

The student should be able to:

Analyze a problem collaboratively (identify the issue, define possible approaches through interactive discussion).

Facilitate group expression and decision-making, allowing everyone to share their opinion.

Adjust and regulate their behavior in response to others.

Identify their own strengths and weaknesses, as well as those of others.

Apply these insights in the context of physical and sports practice.

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

Nanophysics

Introducing

Description

Wave phenomena, interferences and diffraction. Particle phenomena. The dual nature of waves and particles, application to electron microscopy. Quantum physics
laws. Quantum effects and applications. Scanning tunnelling microscope, quantum wells and quantum dots, application to radioactivity, harmonic oscillator, vibrations of molecules and Infrared spectroscopy, kinetic momentum and its application to molecular rotation spectroscopy, spin and its applications in NMR and MRI. Atomic and molecular orbitals. X-rays . Lasers. Crystalline solids, concept of energy bands, application
in semiconductor electronic devices.

Objectives

At the end of this module, the student will have understood and be able to explain :
The fundamentals of wave propagation and quantum physics that are necessary for the understanding of modern electronic devices and analytical techniques
The principle of analytical techniques commonly used in laboratories and the underlying molecular mechanisms of quantum physics

The student will be able to:
Formulate in his own words some nano-scale mechanisms and give concrete examples of micro and nano-devices together with well-known analytical methods using these mechanisms
Master elementary phenomena of nano-scale physics
Select the best method for a specific characterisation on the basis of the acquired concepts.
Carry out some nano-scale characterisation methods
Link mathematical formalism of quantum physics to real applications
Grasp the necessary approximations that are required in quantum physics
Bring together these different concepts to assimilate them, extract them from their context in order to apply them to real situations.

Necessary prerequisites

L1 level in Mechanics, Electrostatics, Optics and Mathematics.

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

Analysis 2

Introducing

Description

Numerical series, power series.

Objectives

At the end of this module, the student will have understood and be able to:
- determine the different kinds of convergence of numerical series.
- study the convergence of power series.

Necessary prerequisites

Analysis lectures of first 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

Probabilities and statistics

Introducing

Description

- Random variables (discrete or continuous) and their characteristics
- Multidimensional random variables, conditional distributions and independence
- Limit theorems (LLN and CLT) and approximation of laws
- Statistical estimation, both punctual and using confidence intervals
- Statistical test for mean.

Objectives

At the end of this module, the student should have understood and be able to explain (main concepts):
- what a random variable (discrete or continuous) and its characteristics are
- how to apply limit theorems such as the Law of Large Numbers (LLN) or the Central Limit Theorem
(CLT)
- the notion of statistical estimation
- the notion of statistical test.

The student will be able to:

- to determine the law of a random variable, to compute its expectation, variance, cumulative distributive, etc
- to study the independence of random variables
- to approximate distributions by using underlying limit theorems
- to estimate using confidence intervals some unknown parameters (expectation, variance, proportion) associated to a large population
- perform a statistical test for a mean.

Necessary prerequisites

Analysis I and Analysis II

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

Energy Mix and Transition

Introducing

Description

The main concepts covered during the course are: conversion, transport, storage and usage efficiencies / power flux density / material resource intensity / load factor / stock and flow concepts / production and demand profiles / networking / energy mix / energy transition scenarios for 2050.
The course covers the following technologies: wind generation, electrolytic storage (H2), photovoltaics, electrochemical batteries, hydroelectricity / WWTP, fossil-nuclear-biomass power stations, biogas production.

Objectives

To understand the stakes involved in supplying energy to our production system.
To be able to answer the following questions:
- How do we obtain our energy today (knowing the different means of conversion and storage, and the different mixes) ?
- What are the orders of magnitude for our individual and national energy consumption on a day-to-day basis ?
- Where are the dependencies, weaknesses and limits of our energy supply ?
- How can we build an energy mix that meets our demand profile up to 2050 and the challenge of decarbonization ?

Necessary prerequisites

Be familiar with the concepts of electrical power and energy, as well as the general concepts of efficiency and density.
Have acquired the knowledge and skills of the first year at INSA, especially in electrokinetics, mechanics and thermodynamics.

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

Elective scientific course

Introducing

Description

Students take one of the following courses, of their choice:
- spatial data acquisition,
- mechanics for health,
- Python for engineers,
- networks and electrical machines.

Objectives

Elective courses are scientific courses related to the content of the pre-orientation, i.e. courses that can be used by future engineers in the Civil Engineering and Mechanical Engineering sectors. These courses are not prerequisites for the rest of the curriculum.

Necessary prerequisites

See detailed descriptions of each 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

Logics

Introducing

Description

This course deals with logic. After introducing Boolean algebra and logical functions, various minimisation methods are discussed. The general structure of a sequential system and elementary sequential systems are also studied (counters, flip-flops, etc.). A method for designing synchronous sequential systems using flip-flops is studied.

Objectives

By the end of this module, students should have understood and be able to explain (key concepts):

- The concepts of combinational and sequential systems,
- The concepts of synchronous and asynchronous systems (circuits),
- The methods for designing and implementing these systems.

Students should be able to:
- Represent and minimise logic functions,
- Design a combinational or sequential logic system.

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

Hardware architecture

Introducing

Description

- Functional description of the fundamental components of a conventional processor-based computer and their interactions.
- Description and contextualization of computer architecture models.
- Functional description of the processor, its memory and caches, and associated technologies.
- Hardware-level functional description of paging and memory virtualization.

Objectives

At the end of this module, students will be able to describe how a computer works, based on its internal structural elements, and define the actions required at hardware level to perform a given task.

Necessary prerequisites

Basic notions of algorithmics and logic.

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

Digital electronics

Introducing

Description

Numerical representation of information (base 2, binary coding, signed numbers, hexadecimal)
Basic digital components: diodes, Zener, LED, trigger, level adaptation circuits
Combinational logic: TTL logic gates, Fan-In, Fan-Out
Synchronous counters, reset circuits
Oscillators (ICM7555), LED blinking
Sampling and analog-to-digital conversion
Prototyping and component selection (BOM, datasheets)

Objectives

Learning Objectives
Acquire fundamentals of digital electronics.
Understand data representation and analog-to-digital conversion.
Design and size logical circuits and digital interfaces.
Explore the operation of digital integrated circuits.
Learning Outcomes
Represent and manipulate digital signals.
Design digital circuit architectures.
Interpret component datasheets.
Analyze and size circuits based on specifications.

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 systems

Introducing

Description

The command interpreter (the shell), variables, iterative structures, control structures,
Programming using the command language (essentially bash),
Handling the file system and, in particular, access rights,
User management (uid, gid, home directory, etc),
I/O and pipe redirection mechanisms.
Some general information on documentation, archiving, compression and a few network commands.

Objectives

At the end of this module, the student will be able to use the command interface of the Unix operating system independently.

Necessary prerequisites

No required

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

Computing

ECTS

Hourly volume
56h

Introducing

Description

Programme (detailed contents):
1- breakdown in sub programs
2- constraint and non constraint arrays
3- recursive algorithms: principle, examples
4- pointers and linked lists

Objectives

At the end of this module, the student will have understood and will be able to explain (main concepts):
- functional breakdown: procedure choice, setting of procedures
- differences between several data structures: arrays, records, pointers and linked lists
- recursive algorithms
- array exploring, sorting and merging

The student will be able to:
- analyze an advanced problem
- breakdown it into subprograms
- choose adapted data structures
- specify (recursive) algorithms
- implement algorithms in ADA language
- specify and realize test cases.

Necessary prerequisites

L1 algorithm lecture.

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

Digital culture and skills 1

Introducing

Description

Introductory course to AI: history, algorithms, issues.
"No code" discovery of neural networks on Vittascience; notebook for building a small character recognition network.
Presentation of PIX and study of a certain number of themes independently with the objective of passing the PIX certification at the end of the 3rd year.

Objectives

At the end of this module, the student will have discovered the first dimensions of the field of AI: history, examples of what AI allows, distinction between supervised and unsupervised learning, rapid scope of techniques and algorithms, ethical aspects, risks and controversies. In a second part, the student will have advanced his PIX course according to the defined program.

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

Foreign language 1

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

Foreign language 2

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 2nd 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

Physical Activities and Sports

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Analysis 1

Introducing

Description

Series
1. Introduction, Finite and Infinite Series
2. Sums of non negative numbers
3. Rearrangement of series: absolute convergence, semi-convergence
Illustrations: decimal representation of natural numbers, of real numbers, notion of numerical errors

Topology of Normed Vector Spaces
1. Norms, Comparison of Norms
2. Sequences in Normed Spaces and Convergence
3. Topology: open and closed sets, closure, density
4. Limits, continuity of functions, compactness
5. Linear Applications between Normed Vector Spaces
Illustrations: Iterative Methods to solve linear systems, matrix condition number

Several Variable Differential Calculus

1. Derivatives in several variable calculus
2. Partial and directional derivatives
3. Taylor expansion
4. The inverse function theorem, the implicit function theorem
Illustration: Newton method to solve a system of nonlinear equations.

Objectives

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

• The notion of numerical series and convergence of series
• The notion of differentiability of a function of multiple variables, partial derivatives
• The concept of norms, convergence of sequences in vectorial spaces, basic topological concepts: open and closed sets, compactness

The student will be able to:

Use the main mathematical results to
• Study the convergence of numerical series with majoration and comparison methods
• Study the differentiability of a function of multiple (real) variables, carry out an asymptotic expansion
• Manipulate norms of vectors and matrices, study the convergence of a sequence or function limits in vectors spaces.

Necessary prerequisites

Basic Calculus, Basic Linear algebra

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

Linear algebra

Introducing

Description

Resolution of linear systems
1. Gauss elimination. Manipulation of rows and columns. Matrix interpretation
2. Existence criterion: rank, kernel, strictly dominant diagonals
3. LU factorization

Prehilbertian and Euclidian spaces
1. Scalar product: examples, properties
2. Orthogonality: orthogonal basis, projections
3. Mean Square solution of linear systems, QR factorization

Reduction of endomorphisms
1. Eigen-elements: eigenvalues, eigenfunctions, characteristic polynom
2. Diagonalisation, trigonalisation, Cayley-Hamilton
3. Applications: linear differential systems and recurrences, spectrum computation

Endomorphisms of Euclidian spaces
1. Isometries, Orthogonal Matrices
2. Adjoint, Self-adjoint endomorphisms, diagonalization
3. Singular Value Decomposition (data visualization)

Hermitian spaces
1. Hermitian product, Orthogonality
2. Endomorphisms of Hermitian spaces: adjoint, reduction.

Objectives

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

- Knowing main factorization results on matrices: LU, QR, SVD
- Main results on diagonalization and trigonalization
- Orthogonality
- Adjoint of a matrix, self-adjoint matrices and spectral theorem, Isometries

The student will be able to:

- Solve linear system with Gauss elimination and give a matrix interpretation
- Compute orthogonal basis or orthogonal projection on a subspace
- Provide a matricial interpretation of the main classes of Euclidian endomorphisms
- Diagonalize or trigonalize matrices
- Solve numerically a linear system in a mean square sense. Apply numerical SVD.

Necessary prerequisites

Basic linear algebra: vector spaces, subspaces, linear application, matrix, Kernel and Image of a linear application

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

Unix

Introducing

Description

The command interpreter (the shell), variables, iterative structures, control structures,
Programming using the command language (essentially bash),
Handling the file system and, in particular, access rights,
User management (uid, gid, home directory, etc),
I/O and pipe redirection mechanisms.
Some general information on documentation, archiving, compression and a few network commands.

Objectives

At the end of this module, the student will be able to use the command interface of the Unix operating system independently.

Necessary prerequisites

No required

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

Discrete automatics

Introducing

Description

The second part covers discrete event systems control. It includes the general structure of a sequential system and the study of elementary sequential functions (flip-flops, counters). It also addresses the synthesis and analysis of a sequential logic system. The Huffman method is introduced, as well as simplified sequencer synthesis. The realization will be done using flip-flops for synchronous systems. Additional information is provided on Huffman synthesis for asynchronous sequential logic systems (issues of hazards and races). The formalism of Petri nets is introduced for specifying problems related to parallelism, synchronization, and critical resource management, as well as the statecharts formalism.

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):
• Sequential logic: synthesis and analysis
The student should be capable of:
• Conducting minimal synthesis and analysis of a sequential system based on flip-flops, including that of a sequencer (synchronous systems).
• Analyzing and synthesizing complex asynchronous sequential logic systems, identifying and resolving issues related to static hazards and races.
• Modeling a system with parallelism, synchronization, and shared resources using the formalism of Petri nets or statecharts, and analyzing properties (safe, live, and sound) of a network through the marking graph.

Necessary prerequisites

Combinatory logic

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

Continuous automatics

Introducing

Description

This course deals with the modeling, analysis and control of continuous linear systems. It presents the classical methods of frequency automata. They are based on the transfer function representation, obtained from the Laplace transform. The stability property and their temporal and frequency responses, in the form of Bode and Nyquist diagrams, are studied. We analyze the performance of a servo system, in terms of accuracy, transient regime and stability margins. Finally, the synthesis of correctors is approached by studying the effects of elementary corrections, before combining them to set PI, PID and phase lead controller.

Objectives

At the end of this module, the student should have understood and be able to explain the main concepts of the automatic control of continuous linear systems:
- model a continuous linear system in the form of transfer functions and block diagrams
- calculate the time and frequency responses of a continuous linear system, and analyze its stability
- analyze the main properties of a servo system (stability, transient regime, accuracy and stability margins)
- synthesize, using the classical frequency method, some controller (elementary corrections, PI, PID, phase lead)

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

Expression

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

Contemporary economy and ecological transition

Introducing

Description

The main areas studied are as follows:

- The market
- Economic actors
- Income and distribution
- Economic growth
- Unemployment
- Financing the economy
- Currency and inflation
- Economic policies
- New economic models

Objectives

The objective of this course is to provide basic concepts allowing students to better understand their current and future environment and to identify the main issues.

Students will be able to carry on a conversation and debate using arguments based on knowledge of fundamental economic mechanisms and some theories of economic thought.

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

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Foreign Language 1

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

Internship defense

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Professional path initiative

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

Physical Activities and Sports

Introducing

Description

The APS (Physical and Sports Activities) offering is structured around several categories:

Team sports: football, basketball, volleyball

Individual sports: tennis, badminton, climbing, judo, strength training, gymnastics

Artistic and expressive activities: circuit training, dance

Outdoor activities: outdoor physical and nature-based activities (OPNA), golf

Adapted sports: adapted strength training, learn-to-swim, learn-to-ride, Pilates, sophrology

At the beginning of the academic year, students use a dedicated platform ("choix APS") to rank the available APS options in order of preference. Each student is then assigned an activity based on their choices and availability.

All APS sessions are supervised by certified PE teachers, either permanent staff (CAPEPS, AGREGATION holders) or external instructors.

Objectives

At the end of this module, the student should have understood and be able to explain the following key concepts:

Deepened self-awareness.

Ability to interact effectively with others.

The student should be able to:

Analyze a problem collaboratively (identify the issue, define possible approaches through interactive discussion).

Facilitate group expression and decision-making, allowing everyone to share their opinion.

Adjust and regulate their behavior in response to others.

Identify their own strengths and weaknesses, as well as those of others.

Apply these insights in the context of physical and sports practice.

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

Analysis 2

Introducing

Description

Program (detailed contents):

Sequence of functions
1. Pointwise convergence, uniform convergence
2. Properties of the limit function
3. Approximation: interpolation, density
Applications: interpolation, numerical integration
Series of functions
1. Pointwise, uniform, normal convergence
2. Properties of series of functions
3. Power series
Banach Spaces
1. Cauchy sequences, properties
2. Contraction Mapping theorem
3. Series in Banach spaces
Ordinary Differential Equations: Linear case
1. Examples, affine ODEs
2. Linear ODEs with constant coefficients. Phase portraits. Stability
3. Gronwall Lemma
Introduction to Optimization
1. Convexity: definition, examples
2. Symmetric, positive definite matrices
3. Minimization (compactness arguments). Optimality conditions of order 1 and 2.
Integration
1. Integrals of functions on infinite interval or unbounded functions
2. Integrals with parameters: convergence, continuity, differentiability
3. Integrals of several variables: Fubini theorem, Change of variable.

Objectives

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

• Notion of pointwise and uniform convergence
• Notion of completeness and applications
• Integrals of functions unbounded or on unbounded domains, with parameters, with several variables

The student will be able to:
• Study pointwise or uniform convergence of a sequence of functions
• Study functions defined as integrals or series of functions with parameters
• Solve linear ordinary differential equations
• Carry out computations of integrals on bounded intervals, of unbounded functions.
• Find extrema of C^1 or C^2 functions.

Necessary prerequisites

Linear Algebra, Analysis 1

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

Probability-Statistics

Introducing

Description

- Probability spaces
- Conditional probability and independence
- Random variables (discrete or continuous) and their characteristics
- Multidimensional random variables, conditional distributions and independence
- Limit theorems (LLN and CLT) and approximation of laws
- Statistical estimation, both punctual and using confidence intervals

Objectives

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

- what a probability space is
- the notion of conditional probability and independence between events
- what a random variable (discrete or continuous) and its characteristics are
- how to apply limit theorems such as the Law of Large Numbers (LLN) or the Central Limit Theorem (CLT)
- the notion of statistical estimation

The student will be able to:

- to compute probabilities using Bayes formula
- to determine the law of a random variable, to compute its expectation, variance, cumulative distributive and characteristic functions, etc
- to study the independence of random variables
- to approximate distributions by using underlying limit theorems
- to estimate using confidence intervals some unknown parameters (expectation, variance, proportion) associated to a large population

Necessary prerequisites

Basic set theory, summations and series, derivation, integration (both simple and multiple), improper integrals, equivalents and limit computations.

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Signal 1

Introducing

Description

Program (detailed contents):
- Hilbert Spaces : scalar products, projection onto a vector subspace, approximation of a vector in a basis.
- Fourier series : definition, properties, Parseval's theorem and Dirichlet's theorem. Gibbs phenomenon.

Objectives

At the end of this course, the student will have understood and be able to explain (main concepts):
- Fourier coefficients, partial sums and Fourier series of piece-wise continuous functions.
- Various notions of convergence of Fourier Series.

The student will be able to:
- Compute the Fourier coefficients of a function.
- Compute some series and solve equations using Fourier coefficients.

Necessary prerequisites

Integrals, complex numbers, series.

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

Energy Mix and Transition

Introducing

Description

The main concepts covered during the course are: conversion, transport, storage and usage efficiencies / power flux density / material resource intensity / load factor / stock and flow concepts / production and demand profiles / networking / energy mix / energy transition scenarios for 2050.
The course covers the following technologies: wind generation, electrolytic storage (H2), photovoltaics, electrochemical batteries, hydroelectricity / WWTP, fossil-nuclear-biomass power stations, biogas production.

Objectives

To understand the stakes involved in supplying energy to our production system.
To be able to answer the following questions:
- How do we obtain our energy today (knowing the different means of conversion and storage, and the different mixes) ?
- What are the orders of magnitude for our individual and national energy consumption on a day-to-day basis ?
- Where are the dependencies, weaknesses and limits of our energy supply ?
- How can we build an energy mix that meets our demand profile up to 2050 and the challenge of decarbonization ?

Necessary prerequisites

Be familiar with the concepts of electrical power and energy, as well as the general concepts of efficiency and density.
Have acquired the knowledge and skills of the first year at INSA, especially in electrokinetics, mechanics and thermodynamics.

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

Algorithm and programming 2

Introducing

Description

Abstract types and implementation.
Linear data structures: stacks, queues, linked lists.
Tree-like data structures: binary trees, binary heaps, n-ary trees.
Hash tables.

Objectives

Learn to implement and use classic linear and tree data structures.

Necessary prerequisites

Algorithms and Programming I (previous semester).

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

Hardware architecture

Introducing

Description

- Functional description of the processor, its memory and caches, and associated technologies.
- Hardware-level functional description of paging and memory virtualization.

Objectives

At the end of this module, students will be able to describe how a computer works, based on its internal structural elements, and define the actions required at hardware level to perform a given task.

Necessary prerequisites

Basic notions of algorithmics and logic.

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

Language (C)

Introducing

Description

The conventional aspects (variables, types, control structures, iterative structures) are presented as well as the more specific points of the language (bit-by-bit operators, generalised use of pointers, parameter passing, input/output, etc.).

Objectives

At the end of this module, the student should have understood and be able to explain the programming of a particularly widespread computer language (C), including in particular the hardware-related aspects.

Necessary prerequisites

Notions of assembler and programming in an advanced language are welcome, as well as a minimum knowledge of computer architecture.

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

Digital culture and skills 1

Introducing

Description

Introductory course to AI: history, algorithms, issues.
"No code" discovery of neural networks on Vittascience; notebook for building a small character recognition network.
Presentation of PIX and study of a certain number of themes independently with the objective of passing the PIX certification at the end of the 3rd year.

Objectives

At the end of this module, the student will have discovered the first dimensions of the field of AI: history, examples of what AI allows, distinction between supervised and unsupervised learning, rapid scope of techniques and algorithms, ethical aspects, risks and controversies. In a second part, the student will have advanced his PIX course according to the defined program.

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

Elective scientific course

Introducing

Description

Students take one of the following courses, of their choice:
- spatial data acquisition,
- mechanics for health,
- Python for engineers,
- networks and electrical machines.

Objectives

Elective courses are scientific courses related to the content of the pre-orientation, i.e. courses that can be used by future engineers in the Civil Engineering and Mechanical Engineering sectors. These courses are not prerequisites for the rest of the curriculum.

Necessary prerequisites

See detailed descriptions of each 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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Foreign language 1

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

Foreign language 2

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 2nd 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

Physical Activities and Sports

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

Design – CAD

Introducing

Description

3 ECTS: Mechanical Design

Design and understand the architecture of mechanisms.

3 ECTS: Civil Engineering BIM

Model and transition from 2D to 3D.
Apply concepts of construction techniques.

Objectives

The student must be able to:

Define a simple rotational guide.
Specify the assembly of components.
Represent schematically (modeling).
Provide a graphical representation of a mechanism's architecture.
Create 2D and 3D graphical representations.
Model elements of civil engineering projects.
Query a digital model to extract production data.
Understand the mechanical functioning of civil engineering projects.

Necessary prerequisites

Introductory courses on industrial techniques in the first year: I1ANTI11 and I1ANSY21.

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

Strength of Materials 1

Introducing

Description

Modeling with beam-like structures ;
Internal forces (cohesion forces), Relation between continuum stresses and internal forces, Equilibrium equations (in terms of internal forces) ;
Computing strains, stresses and displacements for the elementary loading cases : axial, bending and torsion.

Objectives

Strength of materials: Introduction to beam theory
- Drawing internal forces diagrams for an isostatic, straight, planar beams.
- Calculate the beam strains and stresses for a few simple loads in the case of a simple section and a slender beam.
- Final objective is to learn how to analyse and design beam-like structural members or machine elements subjected to tension, compression, torsion, and bending.

Necessary prerequisites

Equilibrium equations in terms of forces and moments.
Differential and integral calculus.

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

Mathematical tools 1

Introducing

Description

Part: Mathematical Concepts
- Generalized integrals and series
- Continuity and differentiability of multivariable functions
- Hessian matrix and optimization

Part: Numerical Analysis
- Introduction to Python and numerical analysis (1 Lab Session)
- Direct resolution of linear systems (Gaussian elimination and LU decomposition)
- Solving nonlinear equations (Bisection, Newton's method, and fixed-point iteration)

Part: Probability and Statistics
- Events, probabilities, conditioning, independence
- Random variables, probability distributions, discrete variables
- Continuous random variables, random vectors
- Statistical inference: point estimation, confidence intervals, and hypothesis testing

Objectives

This Teaching Unit (UE) aims to master the essential concepts and foundational knowledge in mathematics for engineers in Civil Engineering or Mechanical Engineering. The UE is divided into three components with complementary objectives:
1. Mathematical Concepts: Master essential mathematical tools for Civil or Mechanical Engineering.
2. Numerical Analysis: Implement efficient algorithms using Python and analyze their convergence.
3. Probability and Statistics: Understand and apply probabilistic and statistical modeling.

Necessary prerequisites

1st year linear algebra and analysis, programming in Python language

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

Mechanics

Introducing

Description

Analyze structure equilibrium and apply Newton's second law to a system of rigid bodies:
- Model usual mechanical actions as wrenches using screw theory (kinematic joints and external forces)
- Model friction using Coulomb's Law of Friction
- Model the tilting of a plane joint using a mobile point of application for the normal force
- Identify a statically determinate/indeterminate system (number of static unknowns)
- Determine a solving strategy for the second law (systems of interest, external forces, free body diagram, equations to use, solid bodies subjected to only two external forces)
- Calculate the mechanical actions that need to be determined (joints or actuators)
- Validate the stability of a structure (sliding, tilting on a plane, loss of contact)

Determine the absolute or relative velocity and acceleration of a point on a rigid body:
- Interpret the kinematic parameterization of a mechanism
- Describe the velocity vector field that characterizes a body's motion as a twist using screw theory
- Apply velocity addition, velocity field analysis and time derivatives of vectors in rotating frames
- Determine the condition for rolling without slipping at the contact between two bodies
- Solve a 2D kinematics problem graphically (instantaneous axis of rotation, velocity field)

Objectives

Solid mechanics
At the end of this course, you will be able to:
- determine the mechanical loads exerted on rigid bodies (preliminary step to sizing),
- verify the stability conditions of a mechanism (friction, tilting, loss of contact),
- analyze velocities and accelerations in a mechanism (particularly in power transmissions).

Necessary prerequisites

- Reading a kinematic diagram
- Solving systems of algebraic equations
- Trigonometry and projections
- Vectors, scalar and vector products
- Derivatives of composite functions

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

Expression

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

Contemporary economy and ecological transition

Introducing

Description

The main areas studied are as follows:

- The market
- Economic actors
- Income and distribution
- Economic growth
- Unemployment
- Financing the economy
- Currency and inflation
- Economic policies
- New economic models

Objectives

The objective of this course is to provide basic concepts allowing students to better understand their current and future environment and to identify the main issues.

Students will be able to carry on a conversation and debate using arguments based on knowledge of fundamental economic mechanisms and some theories of economic thought.

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

Foreign Language 1

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

Internship defense

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

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

Physical Activities and Sports

Introducing

Description

The APS (Physical and Sports Activities) offering is structured around several categories:

Team sports: football, basketball, volleyball

Individual sports: tennis, badminton, climbing, judo, strength training, gymnastics

Artistic and expressive activities: circuit training, dance

Outdoor activities: outdoor physical and nature-based activities (OPNA), golf

Adapted sports: adapted strength training, learn-to-swim, learn-to-ride, Pilates, sophrology

At the beginning of the academic year, students use a dedicated platform ("choix APS") to rank the available APS options in order of preference. Each student is then assigned an activity based on their choices and availability.

All APS sessions are supervised by certified PE teachers, either permanent staff (CAPEPS, AGREGATION holders) or external instructors.

Objectives

At the end of this module, the student should have understood and be able to explain the following key concepts:

Deepened self-awareness.

Ability to interact effectively with others.

The student should be able to:

Analyze a problem collaboratively (identify the issue, define possible approaches through interactive discussion).

Facilitate group expression and decision-making, allowing everyone to share their opinion.

Adjust and regulate their behavior in response to others.

Identify their own strengths and weaknesses, as well as those of others.

Apply these insights in the context of physical and sports practice.

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

Mathematical tools 2

Introducing

Description

Linear Algebra

Eigen-elements: eigenvalues, eigenvectors, characteristic polynomial

Diagonalization

Applications

Euclidean Spaces

Scalar product: examples, properties

Orthogonality: Pythagoras theorem, orthogonal bases, orthogonal projection

Bilinear Algebra

Bilinearity

Symmetric positive definite matrices: definition, properties, characterization

Ordinary Differential Equations (ODEs) – Linear

Examples, general framework of affine ODEs

Special case of linear ODEs with constant coefficients

Multivariable Functions

Notion of differential for multivariable functions

First- and second-order optimality conditions

Multiple integrals

Numerical Analysis

Numerical resolution of ODEs

Interpolation

Numerical integration

Least squares method

Objectives

At the end of this module, the student should have understood and be able to explain the following key concepts:

Knowledge of the main results in matrix reduction

Understanding the concept of scalar product and orthogonality

Basic notions of bilinear algebra

The concept of the differential of a multivariable function and partial derivatives

Solving linear differential equations with or without a forcing term

Calculations of integrals of functions of several variables

Finding extrema of a function

The least squares method

Numerical interpolation

Numerical integration

Numerical resolution of differential equations

List of competencies:
Code Competency
1_1 Master mathematical concepts and computational tools relevant to engineering
1_2 Develop rigorous scientific reasoning and the capacity for abstraction
2_1 Master the fundamental tools of the mathematical engineer
(Competency matrix of CTI, 2019)

Necessary prerequisites

Linear algebra and first-year analysis, programming in 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

Dynamics

Introducing

Description

- Analyze the spatial mass distribution of a rigid body (inertia matrix, center of mass).

Newton's first law of motion for a system of rigid bodies:
- Determine the linear and angular momentum and their time derivatives using screw theory
- Determine a solving strategy to apply the first law (systems of interest, equations to be used)
- Determine mechanical actions or differential equations of motion by applying the first law

Work-energy theorem for a system of rigid bodies:
- Calculate the kinetic energy of a body in motion (rotation, translation, helical motion)
- Determine the power of external forces and contact forces
- Derive an equation of motion or determine a force using the work-energy theorem (WET)

Objectives

Rigid body dynamics
At the end of this course, you will be able to:
- Determine the motion of a mechanism over time given the forces acting on it,
- Determine the mechanical actions in the joints or actuators required to produce the desired motion.
Newton's first law of motion and the work-energy theorem (WET) will be used

Necessary prerequisites

Solid mechanics I course:
- Force and moment calculation
- Common forces modeling
- Calculation of velocity and acceleration
- Screw theory: modeling forces as wrenches and velocity fields as twists
- Solving a statics problem

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

Energy Mix and Transition

Introducing

Description

The main concepts covered during the course are: conversion, transport, storage and usage efficiencies / power flux density / material resource intensity / load factor / stock and flow concepts / production and demand profiles / networking / energy mix / energy transition scenarios for 2050.
The course covers the following technologies: wind generation, electrolytic storage (H2), photovoltaics, electrochemical batteries, hydroelectricity / WWTP, fossil-nuclear-biomass power stations, biogas production.

Objectives

To understand the stakes involved in supplying energy to our production system.
To be able to answer the following questions:
- How do we obtain our energy today (knowing the different means of conversion and storage, and the different mixes) ?
- What are the orders of magnitude for our individual and national energy consumption on a day-to-day basis ?
- Where are the dependencies, weaknesses and limits of our energy supply ?
- How can we build an energy mix that meets our demand profile up to 2050 and the challenge of decarbonization ?

Necessary prerequisites

Be familiar with the concepts of electrical power and energy, as well as the general concepts of efficiency and density.
Have acquired the knowledge and skills of the first year at INSA, especially in electrokinetics, mechanics and thermodynamics.

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

Digital culture and skills 1

Introducing

Description

Introductory course to AI: history, algorithms, issues.
"No code" discovery of neural networks on Vittascience; notebook for building a small character recognition network.
Presentation of PIX and study of a certain number of themes independently with the objective of passing the PIX certification at the end of the 3rd year.

Objectives

At the end of this module, the student will have discovered the first dimensions of the field of AI: history, examples of what AI allows, distinction between supervised and unsupervised learning, rapid scope of techniques and algorithms, ethical aspects, risks and controversies. In a second part, the student will have advanced his PIX course according to the defined program.

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

Strength of Materials II

Introducing

Description

Beam theory:
• Transition from the real system to the beam type model: average line and geometric properties of sections, connections, loading, linear elastic material;
• Static reminders – Balance – Linking actions – Isostaticity and hyperstaticity;
• Internal forces: normal force, bending, shear force, torsion;
• Stress/strain/displacement fields and potential energy of elastic deformation associated with the different internal forces;
• Methods for solving hyperstatic structures (by application of the superposition principle and Castigliano's theorem).

Objectives

The student will be able to assess:
The mechanical behavior of isostatic and hyperstatic “beam” type structures under static loading:
- Model a “beam” type structure (geometric characteristics, support and loading),
- Calculate the support actions and internal forces,
- Calculate the stress, deformation and displacement fields associated with each type of internal force,
- Calculate the potential energy of elastic deformation,
- Apply resolution methods for hyperstatic structure of degree 1.

Necessary prerequisites

Mechanics
Materials science
Mathematical tools

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

Materials science

Introducing

Description

Detailed programme for common materials:

6 CMs of 1.25h each
Crystallography of metals and ceramics - Amorphous structures
Thermodynamics of binary metal alloys: Gibbs free energy - Entropy - Enthalpy Binary iron-carbon metal alloy: Phase equilibrium diagram - Eutectoid transformation
Mechanical behaviour of construction materials at room temperature: Elasticity - Plasticity - Ductility - Fragility
Mechanical properties of materials in use and mechanical tests at room temperature
Physical properties of construction materials and associated non-destructive testing
Chemical properties of construction materials and corrosion phenomena

Tutorial topics: 4 tutorials of 1.25 hours each
1/ Crystallography: Pattern - Atomic density - Miller indices
2/ Phase diagram: Iron-carbon diagram - Determination of the microstructure of a steel at room temperature
3/ Mechanical properties: Tensile strength curve and skimming - Strain energy
4/ Chemical properties: Corrosion

Practical work session: 2 TPs of 3 hours each
TP1 Mechanical tests: tensile test - Hardness test - Impact test
TP2 Chemical tests

Objectives

Make the link between the mechanical, physical and chemical properties of construction materials (metals, ceramics and polymers) and the characteristics of these materials on an atomic (crystallographic) and microstructural (binary phase diagram) scale.

Necessary prerequisites

For the common core of materials: Notion of Crystallography and Thermodynamics from 1A

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

Building Environment and Materials

Introducing

Description

Materials for Civil Engineering: 18.75 hours

11.25 hours: Lectures on the portfolio of construction materials used in Civil Engineering.
2.5 hours: Tutorials on Life Cycle Assessment (LCA) approaches and quantitative methods.
5 hours: Laboratory sessions on materials and digital tools.

Project Design Component: 52 hours

7.5 hours: Lectures on design principles (Architecture and Structure).
8.75 hours: Tutorials on architectural analysis, load paths, and structural design linked to construction techniques.
2 hours: Construction site visit.
33.75 hours: Small-group project work, focusing on project selection and approach, architectural and structural design, justification of choices, numerical modeling, quantification, technical design details, defining and calculating load transfers, and assessing the environmental impact of construction materials.

Objectives

The student must be able to:

Understand and develop materials used in Civil Engineering.
Develop an interdisciplinary understanding of sustainable urban development.
Navigate the complexity of civil engineering design projects and apply multicriteria, multi-stakeholder, and multi-scale spatial and temporal decision-making frameworks.
Explore the concepts of eco-design.
Manage the design of architectural programs.
Define, select, and specify construction materials.
Justify and assess the environmental impact of prescribed solutions.
Design the load-bearing structure of buildings (limited to vertical loads).
Calculate and predict load transfers (restricted to gravitational and operational loads).

This course is designed to:

Facilitate the development of skills in civil engineering project methods.
Promote the use of digital tools.
Enhance practices in design projects.
Introduce architectural design principles.
Provide guidance on the selection of construction techniques and materials.
Develop quantitative and multicriteria approaches.

The module aims to:

Present the dual Architect-Engineer curriculum.
Foster analytical thinking and design methodologies for building projects integrated within an urban fabric.
Serve as a practical application of concepts from Strength of Materials 2 (covered in semester 4), specifically focusing on the understanding of beams, loads, and the concrete application of static principles.

Necessary prerequisites

"Civil Engineering Design with BIM: Utilizing a 3D modeling tool, focusing on the technical approach to parametric families and objects, and emphasizing collaborative workflows.
Strength of Materials 1 (SOM 1): Ability to apply the Fundamental Principle of Statics.

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

Design and Materials Project

Introducing

Description

Detailed programme for common materials:

6 CMs of 1.25h each
Crystallography of metals and ceramics - Amorphous structures
Thermodynamics of binary metal alloys: Gibbs free energy - Entropy - Enthalpy Binary iron-carbon metal alloy: Phase equilibrium diagram - Eutectoid transformation
Mechanical behaviour of construction materials at room temperature: Elasticity - Plasticity - Ductility - Fragility
Mechanical properties of materials in use and mechanical tests at room temperature
Physical properties of construction materials and associated non-destructive testing
Chemical properties of construction materials and corrosion phenomena

Tutorial topics: 4 tutorials of 1.25 hours each
1/ Crystallography: Pattern - Atomic density - Miller indices
2/ Phase diagram: Iron-carbon diagram - Determination of the microstructure of a steel at room temperature
3/ Mechanical properties: Tensile strength curve and skimming - Strain energy
4/ Chemical properties: Corrosion

Practical work session: 2 TPs of 3 hours each
TP1 Mechanical tests: tensile test - Hardness test - Impact test
TP2 Chemical tests

If the student chooses to approach the objectives with 'Mechanical Engineering' oriented materials
- 35.5 hours for a mechanical design project, through the study of a project in a small group, the students approach functional analysis, modelling (schematisation), the search for solutions, pre-dimensioning and the production of a 'digital mock-up' using CAD software. Students supplement the knowledge they need to develop the project with various documents at their disposal: resource documents on the 'moodle' platform, books, internet.
- 8 hours of practical work on bearing assembly,
- Using the elements made available to them (bearings, gear housing shafts, keys, elastic rings, locknuts, etc.), the students must analyse, design and produce bearing assemblies that comply with current regulations.
- 6 hours on the study and operation of different heat engines. Using visual aids, students discover the different cycles of internal combustion engines, the distribution and supply systems, and the principles of turbojet and turboprop engines. They identify the different functional elements of an engine from an overall drawing.

Materials for Mechanical Engineering - Lesson (7.5h)
- Phase transformations under equilibrium conditions: isothermal (eutectoid and eutectic) and non-isothermal transformations
- Diffusion: Fick's laws (unidirectional)
- Germination-growth mechanisms of a new phase (from a liquid or a solid phase)
- Mechanical properties of metal alloys: fatigue strength and behaviour in the presence of cracks

TD topics (5h)
1: Use of Fick's laws in steel carburising
2: Analysis of the microstructural evolution of steels
3: Work hardening - Introduction to residual stresses
4: Conventional fatigue limit and fatigue diagram (Haig)

Practical work (6h)

TP1 Mechanical test: Effect of cold rolling on tensile properties - Alloy Al20217
TP2 Microstructure: Microstructures of steels and white cast irons

If the student chooses to approach the objectives with 'Civil Engineering' oriented materials
Civil engineering materials: 18.75 h
- 11.25 h Portfolio lecture on construction materials used in civil engineering
- 2.5 h of tutorials on LCA and quantitative approaches
- 5 h of practical work on materials and numerics
Project design part: 52 h
- 7.5 h Lectures on project principles (architecture and structure)
- 8.75 h Tutorials: architectural analysis, load analysis and structural design in relation to construction techniques
- 2 h site visit
- 33.75 h project work in small groups based on project choices and approach, architectural and structural design, justification of choices, digital modelling, quantification, technical design details, definition and calculations of load transfers and environmental impact study of construction materials.

Objectives

- Make the link between the mechanical, physical and chemical properties of construction materials (metals, ceramics and polymers) and the characteristics of these materials on an atomic (crystallographic) and microstructural (binary phase diagram) scale.
- Make a reasoned selection of metallic materials for mechanical construction by making the link between the mechanical characteristics and the nature of the metallic alloy: chemical composition, microstructure, nature of the phases, heat treatment possibilities, etc;
- Implement a design procedure based on specifications and acquire a technological culture.
The student may choose to approach this general objective with either a 'Mechanical Engineering' or a 'Civil Engineering' teaching aid.

If the student chooses to approach the objectives with 'Mechanical Engineering' oriented teaching aids, he/she must :

- Propose one or more solutions in the form of a kinematic diagram, based on a set of specifications.
- Calculate the powers involved and choose a motor.
- Design and size a simple gearbox.
- Design and size a radial contact ball bearing assembly.
- Calculate the isostatism of an assembly of fixed parts and a moving mechanism.
- Produce a digital model of the mechanism using CAD software.
- Give an oral and written presentation of the project.
- Participate and get involved in a work group.
- Identify the links to be implemented using real components for the bearings.
- Be familiar with 4-stroke and 2-stroke cycles.
- Be familiar with distribution and supply systems.
- Be familiar with the principles of turbojet and turboprop engines.
- Be able to identify the functional elements of an engine from a drawing.
- Be familiar with the secondary functions (cooling, lubrication, electrical generation, etc.).
- Be familiar with the terminology of the component parts.

If the student chooses to approach the objectives using 'Civil Engineering' oriented materials, he or she will be able to :
- Develop an interdisciplinary culture around sustainable urban development,
- To immerse themselves in the complexity of civil engineering design projects and in multi-criteria, multi-actor and multi-scale spatial and temporal decision-making.
- Discover the concepts of eco-design
- Design architectural programmes
- Define, select and specify construction materials

- Justify and assess the environmental impact of the solutions prescribed
- Design the load-bearing structure of buildings

(vertical loads only)
- Calculating and predicting load transfer (gravity and operational loads only)

This course is designed to be closely linked to the development of skills in civil engineering project methods, the use of digital tools, the development of design project practices, the discovery of architectural design, the choice of construction techniques and materials and the use and development of multi-criteria and quantitative approaches.

The module provides an introduction to the dual Architect/Engineer curriculum, and develops analytical skills and design methods for building projects within an urban fabric. The project also provides an opportunity to practise the concepts of Resistance of Materials 2 seen in S4, with an understanding of beams, loads and the practical application of the principles of statics.

Necessary prerequisites

For the common core of materials: Notion of Crystallography and Thermodynamics from 1A

If the student chooses to approach the objectives with 'Mechanical Engineering' oriented materials
- I2ICTI31 teaching in semester 3 (kinematic diagram, isostatism applied to the assembly of fixed parts, design of an assembly of radial contact ball bearings, knowledge of the rules of industrial drawing, knowing how to use the basic functions of CREO.
- Teaching I2ICME31 in semester 3 (knowing how to use the Fundamental Principle of Statics).

If the student chooses to approach the objectives with 'Civil Engineering' oriented materials
- I2ICTI31 teaching in semester 3 GC BIM design with tools linked to the use of a 3D modeller, technical approach to parametric families and objects, collaborative approach.
- I2ICME31 teaching in semester 3 (knowing how to use the Fundamental Principle of Statics).

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

Thermodynamics

Introducing

Description

Fundamental concepts (concept of systems, evolution of a system, mathematical tools in thermodynamics, ideal gas model). Work and heat. The first law of thermodynamics and the internal energy function. The enthalpy function and the steady-state systems. Thermodynamic functions changes during reactions. Thermodynamic machines (heat engines).

Objectives

At the end of this module, students should have understood and be able to explain:
- the inductive approach, specific to thermodynamics, which is to generalize, by defining them as laws, the conditions for energy conservation and evolution of systems;
- the significance, the relevance and the application areas of the main thermodynamic functions (internal energy, enthalpy, entropy and Gibbs function).

Students should be able to:
- identify the system under study and to establish, for this system, routinely and systematically, the material balance, the energy balance and the balance of entropy;
- explain the operation of thermodynamic machines, based on the two laws of thermodynamics and on phases equilibria.

Necessary prerequisites

Math: Concept of function of several variables and partial derivatives.

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

Foreign language 1

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

Foreign language 2

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 2nd 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

Physical Activities and Sports

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

Analysis 1

Introducing

Description

Integration

Improper integrals: integrals of positive functions, functions of any sign, absolute convergence and semi-convergence

Parameter-dependent integrals: dominated convergence theorem, continuity, differentiability

Multiple integrals: Fubini's theorem, change of variable theorem

Numerical Series

Introduction, partial sums and summation techniques

Series with positive terms, comparison theorem

Series with arbitrary terms: absolute convergence, alternating series test

List of Competencies:
1_1: Master the mathematical concepts and computational tools of the engineer
1_2: Establish rigorous scientific reasoning and develop the capacity for abstraction
2_1: Master the fundamental tools of the mathematical engineer

Objectives

The student shall be able to:

Study the differentiability of a function of several variables and perform a limited (Taylor) expansion

Perform integral calculations of functions of several variables or over unbounded domains

Search for extrema of a function of class C1C1 or C2C2

Study the convergence of a numerical series using bounding and comparison methods

The student shall have understood and be able to explain (main concepts):

The notion of the differential of a function of several variables, partial derivatives, and their relation to the differential

The notion of improper integrals, integrals of parameter-dependent functions or of functions of several variables

The notion of numerical series and the concept of convergence of numerical series

Necessary prerequisites

First-year Linear Algebra: Vector spaces, linear maps, matrices, concept of image and kernel of a linear map.
First-year Analysis Course: Functions, limits, continuity, differentiability in one dimension, linear algebra (vector spaces, linear maps, matrices, vectors).

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

Algebra

Introducing

Description

Solving Linear Systems

Gaussian elimination, row and column operations, matrix interpretation

Pre-Hilbert and Euclidean Spaces

Scalar product: examples and properties

Orthogonality: Pythagoras' theorem, orthogonal bases, orthogonal projection

Reduction of Endomorphisms

Eigen-elements: eigenvalues, eigenvectors, characteristic polynomial

Diagonalization, triangularization

Applications: differential systems and linear recurrences

Endomorphisms of Euclidean Spaces

Isometries, orthogonal matrices

Reduction

Bilinear Algebra

Symmetric positive definite matrices: definition, properties, characterization

Orthogonality

List of Competencies:

1_1: Master the mathematical concepts and computational tools of the engineer

1_2: Develop rigorous scientific reasoning and the capacity for abstraction

2_1: Master the fundamental tools of the mathematical engineer

Objectives

The student should be able to:

Solve linear systems using row and column operations and provide a matrix-based interpretation.

Compute an orthogonal basis and perform orthogonal projections.

Provide a matrix interpretation of the main classes of endomorphisms in Euclidean spaces.

Diagonalize and triangularize simple matrices.

The student should have understood and be able to explain (main concepts):

The main results concerning matrix reduction.

The concept of scalar product and orthogonality.

The notion of Euclidean space and isometry.

Necessary prerequisites

First-year Linear Algebra: Vector spaces, linear maps, matrices, the concepts of image and kernel of a linear transformation.

First-year Analysis: Functions, limits, continuity, differentiability in one dimension, linear algebra (vector spaces, linear maps, matrices, vectors).

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

Continuous automatics

Introducing

Description

This course deals with the modeling, analysis and control of continuous linear systems. It presents the classical methods of frequency automata. They are based on the transfer function representation, obtained from the Laplace transform. The stability property and their temporal and frequency responses, in the form of Bode and Nyquist diagrams, are studied. We analyze the performance of a servo system, in terms of accuracy, transient regime and stability margins. Finally, the synthesis of correctors is approached by studying the effects of elementary corrections, before combining them to set PI, PID and phase lead controller.

Objectives

At the end of this module, the student should have understood and be able to explain the main concepts of the automatic control of continuous linear systems:
- model a continuous linear system in the form of transfer functions and block diagrams
- calculate the time and frequency responses of a continuous linear system, and analyze its stability
- analyze the main properties of a servo system (stability, transient regime, accuracy and stability margins)
- synthesize, using the classical frequency method, some controller (elementary corrections, PI, PID, phase lead)

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

Discrete automatics

Introducing

Description

The second part covers discrete event systems control. It includes the general structure of a sequential system and the study of elementary sequential functions (flip-flops, counters). It also addresses the synthesis and analysis of a sequential logic system. The Huffman method is introduced, as well as simplified sequencer synthesis. The realization will be done using flip-flops for synchronous systems. Additional information is provided on Huffman synthesis for asynchronous sequential logic systems (issues of hazards and races). The formalism of Petri nets is introduced for specifying problems related to parallelism, synchronization, and critical resource management, as well as the statecharts formalism.

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):
• Sequential logic: synthesis and analysis
The student should be capable of:
• Conducting minimal synthesis and analysis of a sequential system based on flip-flops, including that of a sequencer (synchronous systems).
• Analyzing and synthesizing complex asynchronous sequential logic systems, identifying and resolving issues related to static hazards and races.
• Modeling a system with parallelism, synchronization, and shared resources using the formalism of Petri nets or statecharts, and analyzing properties (safe, live, and sound) of a network through the marking graph.

Necessary prerequisites

Combinatory logic

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

Electrostatics (Elective course)

Introducing

Description

Mathematics needed to solve problems
Electric charge and distribution of electric charges
Electric field
Electric potential
Gauss's theorem

Objectives

Acquisition of the basics of electrostatics.
Learning formalism, implementation of scientific reasoning and calculation methods.

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

Algorithmics and Programming 1

Introducing

Description

Formal study of algorithms (expression, correction, complexity).
Recursion.
Good programming practices.
Memory management.
ADA and Python programming languages.

Objectives

Learn to decompose the development of a program, from the expression of an algorithm on paper to its implementation in different languages.

Necessary prerequisites

First-year algorithmic course at INSA :
- basics of imperative algorithmics: variable, instruction, conditional branching, loop, sub-algorithm,
- ADA programming: syntax, typing.

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

Unix

Introducing

Description

The command interpreter (the shell), variables, iterative structures, control structures,
Programming using the command language (essentially bash),
Handling the file system and, in particular, access rights,
User management (uid, gid, home directory, etc),
I/O and pipe redirection mechanisms.
Some general information on documentation, archiving, compression and a few network commands.

Objectives

At the end of this module, the student will be able to use the command interface of the Unix operating system independently.

Necessary prerequisites

No required

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

Combinatorial logic

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

Electronic systems for communication

Introducing

Description

The objective of this course is to introduce the fundamentals of analog and digital electronic systems used by engineers designing electronic communications systems. Organized into thirteen sections, the course aims to cover the analog and digital functions typical of a telecommunications system, such as that of a cell phone. The signal conditioning aspect is addressed by presenting various analog filter structures, with the canonical expressions demonstrated. Operational amplifiers (Op Amps) are studied in linear mode in Laplace space, followed by their study in saturated mode.

The second part of the course covers the concepts of digital electronics: combinational and sequential logic, gates, flip-flops, registers, multiplexers, converters, and memories. The connection to digital signal processing is introduced through CAN and DAC architectures. The issue of communication and interfacing between different logic families is analyzed, associating communication protocols with transmission modes (synchronous, asynchronous, duplex, etc.).

Objectives

At the end of this module, the student should have understood and be able to explain the following main concepts:
- Basic concepts of signal processing (amplification, filtering, Fourier transform)
- Operation of an ideal amplifier and limitations of a real operational amplifier
- Basic Op Amp-based analog electronics setups
- Linear and saturated operating conditions of an Op Amp-based circuit
- The difference between analog and digital electronics
- Basic principles of analog-to-digital conversion (sampling, quantization, Shannon's theorem)
- Physical characteristics of digital circuits
- Gate and flip-flop architectures of simple digital circuits (counter, register, multiplexer)
- Basic principles of digital signal transmission
- Basic principles of analog and digital modulation

The student should be able to:
- Calculate the Laplace transform of the transfer function of an analog circuit
- Design a first-order filter
- Design a simple Op Amp-based analog function (amplifier, integrator, summing circuit)
- Set up an analog-to-digital conversion chain
- Wire analog and digital circuits

Necessary prerequisites

General laws of electricity.
Signal processing basics (Fourier transform, frequency domain representation).
Logic systems.

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

Expression

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

Contemporary economy and ecological transition

Introducing

Description

The main areas studied are as follows:

- The market
- Economic actors
- Income and distribution
- Economic growth
- Unemployment
- Financing the economy
- Currency and inflation
- Economic policies
- New economic models

Objectives

The objective of this course is to provide basic concepts allowing students to better understand their current and future environment and to identify the main issues.

Students will be able to carry on a conversation and debate using arguments based on knowledge of fundamental economic mechanisms and some theories of economic thought.

Necessary prerequisites

None

Évaluation

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Practical info

Location(s)

Toulouse

Foreign Language 1

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

Internship defense

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

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Professional path initiative

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

Physical Activities and Sports

Introducing

Description

The APS (Physical and Sports Activities) offering is structured around several categories:

Team sports: football, basketball, volleyball

Individual sports: tennis, badminton, climbing, judo, strength training, gymnastics

Artistic and expressive activities: circuit training, dance

Outdoor activities: outdoor physical and nature-based activities (OPNA), golf

Adapted sports: adapted strength training, learn-to-swim, learn-to-ride, Pilates, sophrology

At the beginning of the academic year, students use a dedicated platform ("choix APS") to rank the available APS options in order of preference. Each student is then assigned an activity based on their choices and availability.

All APS sessions are supervised by certified PE teachers, either permanent staff (CAPEPS, AGREGATION holders) or external instructors.

Objectives

At the end of this module, the student should have understood and be able to explain the following key concepts:

Deepened self-awareness.

Ability to interact effectively with others.

The student should be able to:

Analyze a problem collaboratively (identify the issue, define possible approaches through interactive discussion).

Facilitate group expression and decision-making, allowing everyone to share their opinion.

Adjust and regulate their behavior in response to others.

Identify their own strengths and weaknesses, as well as those of others.

Apply these insights in the context of physical and sports practice.

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 1

Introducing

Description

Program (detailed contents):
- Hilbert Spaces : scalar products, projection onto a vector subspace, approximation of a vector in a basis.
- Fourier series : definition, properties, Parseval's theorem and Dirichlet's theorem. Gibbs phenomenon.

Objectives

At the end of this course, the student will have understood and be able to explain (main concepts):
- Fourier coefficients, partial sums and Fourier series of piece-wise continuous functions.
- Various notions of convergence of Fourier Series.

The student will be able to:
- Compute the Fourier coefficients of a function.
- Compute some series and solve equations using Fourier coefficients.

Necessary prerequisites

Integrals, complex numbers, series.

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Energy Mix and Transition

Introducing

Description

The main concepts covered during the course are: conversion, transport, storage and usage efficiencies / power flux density / material resource intensity / load factor / stock and flow concepts / production and demand profiles / networking / energy mix / energy transition scenarios for 2050.
The course covers the following technologies: wind generation, electrolytic storage (H2), photovoltaics, electrochemical batteries, hydroelectricity / WWTP, fossil-nuclear-biomass power stations, biogas production.

Objectives

To understand the stakes involved in supplying energy to our production system.
To be able to answer the following questions:
- How do we obtain our energy today (knowing the different means of conversion and storage, and the different mixes) ?
- What are the orders of magnitude for our individual and national energy consumption on a day-to-day basis ?
- Where are the dependencies, weaknesses and limits of our energy supply ?
- How can we build an energy mix that meets our demand profile up to 2050 and the challenge of decarbonization ?

Necessary prerequisites

Be familiar with the concepts of electrical power and energy, as well as the general concepts of efficiency and density.
Have acquired the knowledge and skills of the first year at INSA, especially in electrokinetics, mechanics and thermodynamics.

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

Analysis 2

Introducing

Description

Sequences of Functions

Pointwise convergence, uniform convergence

Properties of limits of functions

Series of Functions

Pointwise, uniform, and normal convergence

Properties of series of functions

Case of power series

Linear Ordinary Differential Equations (ODEs)

Examples, general framework of affine ODEs

Particular case of linear ODEs with constant coefficients

Objectives

The student should be able to:

Study the pointwise and uniform convergence of a sequence and a series of functions

Analyze functions defined as sums

Solve linear differential equations with or without a forcing term

Solve linear systems of differential equations with or without a forcing term

Necessary prerequisites

First-year linear algebra: vector spaces, linear maps, matrices, the concepts of image and kernel of a linear transformation.
Manipulation of sets, calculations of sums and numerical series, derivatives, integrals (single and multiple), improper integrals, equivalent expressions, and limits.

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

Probability and statistics 1

ECTS

Hourly volume
26h

Introducing

Description

Program (detailed contents):

- Probability spaces

- Conditional probability and independence

- Random variables (discrete or continuous) and their characteristics

- Multidimensional random variables, conditional distributions and independence

- Limit theorems (LLN and CLT) and approximation of laws

Objectives

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

- what a probability space is

- the notion of conditional probability and independence between events

- what a random variable (discrete or continuous) and its characteristics are

- how to apply limit theorems such as the Law of Large Numbers (LLN) or the Central Limit Theorem (CLT)

The student will be able to:

- to compute probabilities using Bayes formula

- to determine the law of a random variable, to compute its expectation, variance, cumulative distributive and characteristic functions, etc

- to study the independence of random variables

- to approximate distributions by using underlying limit theorems

Necessary prerequisites

Basic set theory, summations and series, derivation, integration (both simple and multiple), improper integrals, equivalents and limit computations.

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

Algorithm and programming 2

Introducing

Description

Abstract types and implementation.
Linear data structures: stacks, queues, linked lists.
Tree-like data structures: binary trees, binary heaps, n-ary trees.
Hash tables.

Objectives

Learn to implement and use classic linear and tree data structures.

Necessary prerequisites

Algorithms and Programming I (previous semester).

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Hardware architecture

Introducing

Description

- Functional description of the processor, its memory and caches, and associated technologies.
- Hardware-level functional description of paging and memory virtualization.

Objectives

At the end of this module, students will be able to describe how a computer works, based on its internal structural elements, and define the actions required at hardware level to perform a given task.

Necessary prerequisites

Basic notions of algorithmics and logic.

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

Language (C)

Introducing

Description

The conventional aspects (variables, types, control structures, iterative structures) are presented as well as the more specific points of the language (bit-by-bit operators, generalised use of pointers, parameter passing, input/output, etc.).

Objectives

At the end of this module, the student should have understood and be able to explain the programming of a particularly widespread computer language (C), including in particular the hardware-related aspects.

Necessary prerequisites

Notions of assembler and programming in an advanced language are welcome, as well as a minimum knowledge of computer architecture.

Évaluation

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Practical info

Location(s)

Toulouse

Digital culture and skills 1

Introducing

Description

Introductory course to AI: history, algorithms, issues.
"No code" discovery of neural networks on Vittascience; notebook for building a small character recognition network.
Presentation of PIX and study of a certain number of themes independently with the objective of passing the PIX certification at the end of the 3rd year.

Objectives

At the end of this module, the student will have discovered the first dimensions of the field of AI: history, examples of what AI allows, distinction between supervised and unsupervised learning, rapid scope of techniques and algorithms, ethical aspects, risks and controversies. In a second part, the student will have advanced his PIX course according to the defined program.

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

Mathematics tools (elective course)

Introducing

Description

Detailed Programme:
Topology
1. Sequences in a normed vector space (NVS)
2. Topology: open and closed sets, closure, density
3. Limits, continuity of functions, compactness (Bolzano) and Heine theorems
4. Linear maps between NVS: continuity, operator norms
Numerical Analysis
1. Concept of numerical error, floating-point number representation
2. LU and Cholesky factorization, matrix conditioning
3. Singular Value Decomposition (SVD)
4. Least squares solutions to Ax=bAx = bAx=b, QR factorization
5. Power method
6. Newton's method for solving F(X)=0F(X) = 0F(X)=0
7. Fixed-point method (lab work)
8. Numerical integration
9. Gradient method
Probability and Statistics
• Multidimensional random variables, conditional distributions, and independence

Objectives

List of Competencies:
• 1_1: Master mathematical concepts and computational tools relevant to engineering.
• 1_2: Develop rigorous scientific reasoning and abstraction skills.
• 2_1: Master the fundamental tools of the mathematical engineer.
(Based on the CTI Competency Framework, 2019)

Necessary prerequisites

• Working with sets, computing sums and numerical series, derivatives, integrals (single and multiple), improper integrals, equivalent expressions, and limits
• Programming in Python

Évaluation

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Practical info

Location(s)

Toulouse

Physics 2 (elective course)

Introducing

Description

Materials: Introduction to Materials Science

Atomistics (electronic structure)

Structure and concept of order in matter

Crystalline matter (lattices / perfect crystal and real crystal / crystalline defects + concept of microstructure)

Mechanical properties of crystalline materials (tensile test / elastic deformation / plastic deformation / fracture)

Electromagnetism:

Supplementary electrokinetics for magnetostatics

Lorentz force and Laplace force

Magnetostatics (Biot–Savart law, Ampère's theorem)

Introduction to electromagnetism: Quasi-static approximation (ARQS) and induction phenomena

Brief introduction to waves (general concepts, harmonic waves, progressive and stationary waves, interference and diffraction)

Prerequisite: Electrostatics
Supplementary Control Engineering:

This course deals with sequential logic. The general structure of a sequential system and basic sequential systems (counters, flip-flops) are studied. A method for designing synchronous sequential systems with implementation via flip-flops is covered.
This course prepares for and includes three practical lab sessions.

Objectives

Course Objective:
The aim of this course is to provide students with additional physics knowledge, especially for those who wish to continue their studies in AE (Automatic Engineering) or GP (General Physics).

The course covers three subjects:

Materials:
At the end of this course, students should be able to describe the main macroscopic mechanical properties of materials and identify their microscopic origins related to the structural arrangement of matter.

Electromagnetism:
Introduction to waves and induction phenomena.

Supplementary Control Engineering:
At the end of this module, the student should understand and be able to explain:

The concepts of sequential systems

The methods for designing and implementing these systems

The student should be able to:

Design a sequential logic system

Additionally, the student should have applied the concepts seen in Continuous Control:

System modeling

System performance analysis

Implementation of controllers

Necessary prerequisites

Electrostatics

Combinational Logic

Continuous Control

Évaluation

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Practical info

Location(s)

Toulouse

Foreign language 1

Introducing

Description

Évaluation

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Practical info

Location(s)

Toulouse

Foreign language 2

Introducing

Description

Évaluation

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Practical info

Location(s)

Toulouse

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Professional Path Initiative 2nd 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

Physical Activities and Sports

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

Fluid mechanics

Introducing

Description

From the complete Navier Stokes model, we develop the usual restricted models of incompressible flows such as: Stokes (creeping flow), Euler (inertial flow without viscosity), Prandtl (laminar boundary layer) and Reynolds (turbulent flow). We describe and apply the following usual basics of fluid mechanics: Euler's theorem, Bernoulli's theorem, perfect fluid, irrotational flow, fluid wall interaction (dynamic and thermal boundary layer), drag coefficient. Turbulence is studied through the notion of turbulent viscosity, the universal logarithmic law profile, the k-epsilon model and the different scales of turbulence.

Objectives

To learn the basics of fluid mechanics modeling in order to understand the operation and to size the laboratory devices and the industrial installations involving flows.
1. To understand and apply global mass and momentum balances on a control domain
1. To understand the mechanical energy balance and apply Bernoulli's theorem
2. To master the concepts of dynamic and thermal boundary layers and use the associated transfer coefficients
3. To write a force balance on an inclusion by choosing the appropriate drag law
4. To write and to use the universal velocity profile in turbulent flow
5. To estimate the characteristic spatial and temporal scales of turbulence in reactors

Necessary prerequisites

I2BEMT10 : Mathématiques

I2BEBT10 : Bases de transfert

Évaluation

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Practical info

Location(s)

Toulouse

Heat Transfer

Introducing

Description

Common Section :
The student should be able, for plan, cylindrical, and spherical systems in steady-state conditions, with or without heat generation, to:
-Establish and solve the energy balance equations in steady-state conditions to calculate heat fluxes and characterize temperature gradients,
-Calculate heat fluxes, thicknesses of materials composing walls, pipes, spherical tanks in steady-state conditions,
-Calculate temperatures at interfaces.

Section GP3E:
The student should be able to:
-Explain the different heat fluxes
-Establish energy balances on reactive or non-reactive systems
-Integrate differential equations to determine temperature profiles and assess heat fluxes
-Know how to transmit a given amount of heat between two systems
-Know how to limit heat losses through a surface
-Study cases applicable to processes.

Section GB:
The student should be able to:
-Choose a technology and configuration of heat exchanger according to its uses
-Calculate heat exchange between fluids within a heat exchanger based on steady-state configurations
-Calculate the efficiency of a heat exchanger based on steady-state configurations
-Size the heat exchange surface of a heat exchanger according to its steady-state configuration
-Calculate the performance of heat exchangers based on flow rates and inlet and outlet temperatures of fluids
-Solve, in transitional regime, the energy balance equations on a perfectly stirred tank to calculate heating and cooling times according to the implemented technologies (coil, double-wall, external heat exchanger) with or without thermal loss

Objectives

Common Section :
At the end of this common teaching section, the student should have understood and be able to explain (main concepts):
-The general equation of energy conservation,
-The different modes of heat transfer and the associated laws into the phenomena of conduction (Fourier's law) and forced and natural convection (Newton's law),
-The expressions for heat flux by conduction and convection and temperature profiles within different systems in steady-state conditions (simple and composite walls, cylindrical and spherical layers, simple and composite).

Section GP3E:
At the end of this common teaching section, the student should have understood and be able to explain (main concepts):
-Heat transfer in solids with and without heat production in steady-state
-Heat transfer in solids with and without heat production in transitional regime
-Heat transfer by radiation

Section GB:
At the end of this teaching section, the student should have understood and be able to explain (main concepts):

-Different technologies of heat exchangers (tubular, plate, coil, double-wall) implemented industrially
-Principles and operating theories of heat exchangers
-Sizing of heat exchangers

Necessary prerequisites

-Thermodynamics
-Differential Equations and Partial Differential Equations

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

Hydraulic engineering

ECTS

Hourly volume
39h

Introducing

Description

Macroscopic mass, momentum and energy balances
Fluid rheology
application of energy balances (Bernoulli) ducted and free flows
Linear and singular pressure losses
Turbomachinery: Pumps and turbines
Hydraulic networks
Extension to total energy balance (EC thermodynamics)

Objectives

dimension a complete plant (processes, plants, hydropower turbine) from the hydraulic point of view

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

Microbiology

Introducing

Description

Section I Microorganisms
I - Reminder of nomenclature rules
II - Principles and methods of classification and identification II.1 Principles of classification; II.2 Identification characteristics and procedures; II.3
Main characteristics and classification of some microorganisms
Section II. Respiration, photosynthesis and microbial growth
Section III Microbial viruses
III.1 Definition and history; II.2 Phage morphology and structural diversity; II.3 Distribution in ecosystems; II.4 Phage infection cycles; II.5 Genetic material and replication/transcription/translation; II.6 The example of T4 and Lambda phages
II.5 Genetic material and replication/transcription/translation; II.6 The example of Phage T4 and Phage Lambda
Section IV IV Symbioses
IV.1 Definition IV.2 The human intestine IV.3 Corals

Objectives

The aim of the microbiology course is to learn the rules of microorganism nomenclature, as well as the principles and methods of classification and identification of microorganisms. Students must know the characteristics and procedures for identifying microorganisms based on traditional techniques (collection of information directly, after culture or based on biochemical methods, antigenic characteristics, etc.). They will also need to understand and apply molecular methods based on nucleic acid analysis (use of nucleic probes, gene amplification, restriction or molecular profiling) or protein profiling.
In a second section, students will be able to independently investigate the reactions involved in respiration and photosynthesis of microorganisms and acquire the tools necessary to calculate average and specific growth rates.
A third section will focus on microbial viruses, and students will be expected to be able to describe their diversity, their ecological niche, and their role in regulating terrestrial and marine microbial biodiversity. They'll also need to know how to analyze and count them. The final section presents examples of symbiosis, human gut microbiota and corals.

Necessary prerequisites

I2BEBS10 Structural biochemistry of carbohydrates, lipids and proteins.
I2BEMI20 Microbiology

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

Molecular biology

Introducing

Description

Molecular biology :
- Structure of nucleic acids
- Replication
- Transcription and operons
- RNA maturation
- Regulatory and other non-coding RNAs
- Translation
- Protein folding, modification, interaction, secretion and degradation
- Examples of prokaryotic and eukaryotic gene regulation

Objectives

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

Properties of nucleic acids, organisation of genomes and DNA replication. Gene transcription and translation of messenger RNA leading from DNA to proteins. RNA maturation and modification. Protein folding, modifications, interactions, secretion and degradation. Main modes of regulation of gene expression.

The student should be able to:
Define and describe the main molecular elements involved in the organisation and expression of genomes. Explain and analyse data relating to the regulation of prokaryotic and eukaryotic genome expression.

Necessary prerequisites

I2BEBS10 Structural biochemistry of carbohydrates, lipids and proteins.
I2BEMI20 Microbiology

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

Processes

Introducing

Description

Introduction to the concept of process, the way of building it, constraints of the industrial production.
Representation and estimate of the cost of a process.
Description of some large production channels.
Critical analysis of a transformation channel of matter or energy, through a project in group.

Objectives

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

- the principle of raw materials transformation processes (oil, coal, gas, ore, biomass), of organic and mineral heavy chemistry (refining, petrochemistry, NH3, H2SO4, Na2CO3, NaOH, Cl2, manure¿) and of energy production (thermal, nuclear, biomass)
- the principle of the diagrammatic representation of a process (flowsheet) and associated graphics
- the principles of cost estimation of a process
- the industrial context of the sector

The student will be able to:
- describe a production system
- read, interpret, propose an installation flowsheet
- to write global balances on a process in order to calculate matter and energy flows
- identify of information fluxes
- make an critical analysis of a process
- estimate the cost of a process
- know to work in autonomy starting from a schedule of conditions to find and analyze scientific documentation.

Necessary prerequisites

Mineral and organic chemistry, biochemistry
Thermodynamics
Chemical kinetics, reactors
Unit operations of chemical engineering
Regulation
Metrology

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:

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

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

Humanities elective course

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

Physical Education

Introducing

Description

Évaluation

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Practical info

Location(s)

Toulouse

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Fluid mechanics

Introducing

Description

From the complete Navier Stokes model, we develop the usual restricted models of incompressible flows such as: Stokes (creeping flow), Euler (inertial flow without viscosity), Prandtl (laminar boundary layer) and Reynolds (turbulent flow). We describe and apply the following usual basics of fluid mechanics: Euler's theorem, Bernoulli's theorem, perfect fluid, irrotational flow, fluid wall interaction (dynamic and thermal boundary layer), drag coefficient. Turbulence is studied through the notion of turbulent viscosity, the universal logarithmic law profile, the k-epsilon model and the different scales of turbulence.

Objectives

To learn the basics of fluid mechanics modeling in order to understand the operation and to size the laboratory devices and the industrial installations involving flows.
1. To understand and apply global mass and momentum balances on a control domain
1. To understand the mechanical energy balance and apply Bernoulli's theorem
2. To master the concepts of dynamic and thermal boundary layers and use the associated transfer coefficients
3. To write a force balance on an inclusion by choosing the appropriate drag law
4. To write and to use the universal velocity profile in turbulent flow
5. To estimate the characteristic spatial and temporal scales of turbulence in reactors

Necessary prerequisites

I2BEMT10 : Mathématiques

I2BEBT10 : Bases de transfert

Évaluation

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Practical info

Location(s)

Toulouse

Physical chemistry

Introducing

Description

The program includes:
Definitions and properties of interfaces (liquid-gas, liquid-liquid, solid-liquid).
Measurement and role of surface tensions.
Capillarity and related laws (Jurin, Young-Laplace).
Wettability and contact angle.
Adhesion work and Young-Dupré laws.
Surfactants: structure, classification, micelles, applications.
Intermolecular and colloidal forces (Van der Waals, electrostatic, hydrophobic).
Colloidal stabilization/destabilization (DLVO theory, polymers, flocculation).
Applications: emulsions, foams, detergents.

Objectives

The course aims to provide an understanding of the physical chemistry of surfaces and colloids: surface tension and energy, capillarity, wettability, adhesion, the role of surfactants, molecular interactions, and applications to colloids, emulsions, foams, and detergents.

Necessary prerequisites

Fundamentals of thermodynamics and physical chemistry.
Basic knowledge of molecular kinetics and intermolecular interactions.
General understanding of solution chemistry (solubility, polarity, pH).

Évaluation

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Practical info

Location(s)

Toulouse

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Dispersed systems

Introducing

Description

- Basic concepts:
 - Motion of particles, drops and bubbles in a fluid (various separation regimes, spherical and non spherical particles, concentrated media)
 - fluid flow through a porous media (pressure drop, resistance)
 - hydrodynamics of packed towers
- Unit operations:
 - cake filtration
 - sedimentation
 - fluidisation
- Dimensional analysis

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):
- basic concepts of unit operations associated with momentum transfer phenomena for dispersed systems (bubbles, drops, particles)
- basic concepts of fluid flow through a porous medium
- principle of dimensional analysis
- mass and energy balance

The student will be able to apply these concepts:
- to the design of different unit operations: sedimentation, filtration
- to the calculation of hydrodynamics of a packed tower, of a fluidised bed

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

Heat Transfer

Introducing

Description

Common Section :
The student should be able, for plan, cylindrical, and spherical systems in steady-state conditions, with or without heat generation, to:
-Establish and solve the energy balance equations in steady-state conditions to calculate heat fluxes and characterize temperature gradients,
-Calculate heat fluxes, thicknesses of materials composing walls, pipes, spherical tanks in steady-state conditions,
-Calculate temperatures at interfaces.

Section GP3E:
The student should be able to:
-Explain the different heat fluxes
-Establish energy balances on reactive or non-reactive systems
-Integrate differential equations to determine temperature profiles and assess heat fluxes
-Know how to transmit a given amount of heat between two systems
-Know how to limit heat losses through a surface
-Study cases applicable to processes.

Section GB:
The student should be able to:
-Choose a technology and configuration of heat exchanger according to its uses
-Calculate heat exchange between fluids within a heat exchanger based on steady-state configurations
-Calculate the efficiency of a heat exchanger based on steady-state configurations
-Size the heat exchange surface of a heat exchanger according to its steady-state configuration
-Calculate the performance of heat exchangers based on flow rates and inlet and outlet temperatures of fluids
-Solve, in transitional regime, the energy balance equations on a perfectly stirred tank to calculate heating and cooling times according to the implemented technologies (coil, double-wall, external heat exchanger) with or without thermal loss

Objectives

Common Section :
At the end of this common teaching section, the student should have understood and be able to explain (main concepts):
-The general equation of energy conservation,
-The different modes of heat transfer and the associated laws into the phenomena of conduction (Fourier's law) and forced and natural convection (Newton's law),
-The expressions for heat flux by conduction and convection and temperature profiles within different systems in steady-state conditions (simple and composite walls, cylindrical and spherical layers, simple and composite).

Section GP3E:
At the end of this common teaching section, the student should have understood and be able to explain (main concepts):
-Heat transfer in solids with and without heat production in steady-state
-Heat transfer in solids with and without heat production in transitional regime
-Heat transfer by radiation

Section GB:
At the end of this teaching section, the student should have understood and be able to explain (main concepts):
-Different technologies of heat exchangers (tubular, plate, coil, double-wall) implemented industrially
-Principles and operating theories of heat exchangers
-Sizing of heat exchangers

Necessary prerequisites

-Thermodynamics
-Differential Equations and Partial Differential Equations

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

Hydraulic engineering

ECTS

Hourly volume
39h

Introducing

Description

Macroscopic mass, momentum and energy balances
Fluid rheology
application of energy balances (Bernoulli) ducted and free flows
Linear and singular pressure losses
Turbomachinery: Pumps and turbines
Hydraulic networks
Extension to total energy balance (EC thermodynamics)

Objectives

dimension a complete plant (processes, plants, hydropower turbine) from the hydraulic point of view

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

Processes

Introducing

Description

Introduction to the concept of process, the way of building it, constraints of the industrial production.
Representation and estimate of the cost of a process.
Description of some large production channels.
Critical analysis of a transformation channel of matter or energy, through a project in group.

Objectives

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

- the principle of raw materials transformation processes (oil, coal, gas, ore, biomass), of organic and mineral heavy chemistry (refining, petrochemistry, NH_3, H_2SO_4, Na_2CO_3, NaOH, Cl_2, manure¿) and of energy production (thermal, nuclear, biomass)
- the principle of the diagrammatic representation of a process (flowsheet) and associated graphics
- the principles of cost estimation of a process
- the industrial context of the sector

The student will be able to:
- describe a production system
- read, interpret, propose an installation flowsheet
- to write global balances on a process in order to calculate matter and energy flows
- identify of information fluxes
- make an critical analysis of a process
- estimate the cost of a process
- know to work in autonomy starting from a schedule of conditions to find and analyze scientific documentation.

Necessary prerequisites

Mineral and organic chemistry, biochemistry
Thermodynamics
Chemical kinetics, reactors
Unit operations of chemical engineering
Regulation
Metrology

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:

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

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Job search

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Humanities elective course

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

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

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

Biophysics

Introducing

Description

Programme (detailed contents):
- Introduction to Biophysics
- Protein structure
- Ion channels and electrophysiology
- Random walk in biology
- Organisation and dynamics of membranes
- Fluorescence microscopy and spectroscopy
- Stochasticity in gene expression
- Cell signalling

Objectives

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

Advanced methods in molecular and cellular biophysics:
- Fluorescence microscopy and correlation spectroscopy
- Flow cytometry, imaging flow cytometry, fluorescence/image-activated cell sorting
- Electrophysiology, nanopore sensing and sequencing
- PyMol to visualize protein structures
- Surface-sensitive techniques

Main concepts in molecular and cellular biophysics:
- Macromolecular crowding
- Noise as a general principle underlying biological organisation and functions (stochasticity in gene expression, random walk, protein conformational changes)
- Cell signalling in space and time

The student will be able to:

- Interpret data from biophysical experiments and link the results to the studied concepts
- Apply biophysical insights to solve new problems in biology and bioengineering.

Necessary prerequisites

Has already followed a general biology course at university level

Évaluation

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Practical info

Location(s)

Toulouse

Organic chemistry

Introducing

Description

Stereochemistry: prochirality, synthesis of enantiomerically pure compounds.
The carbonyl function (related organic and anzymatic reactions).
- Nucleophilic addition: main reaction of aldehydes and ketones
- Nucleophilic substitution on C sp2: main reaction of the derivatives

Multidisciplinary experimental project at the interface of chemistry and biology.

Objectives

At the end of this module, the student will have understood and will be able to explain:
- reaction mechanisms encountered in chemistry and biology.

The student must be able to:

- Understand and explain the reaction mechanisms.
- Carry out a multidisciplinary experimental mini-project in a group (design an experiment based on bibliographic research, propose an analytical monitoring approach, implement an experimental approach and analytical techniques, generate data, interpret, criticize and promote the experimental results, communicate orally).

Necessary prerequisites

I1ANETCH Chimie
I2BECH10 Chimie organique
I2BEBS10 Biochimie Structurale
I2BEAN20 Méthodes d'analyse I

Évaluation

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Practical info

Location(s)

Toulouse

Structural chemistry

Introducing

Description

Training at spectroscopic methods applied to a rational approach of the structural determinations in deepening and broadening the theoretical basis of Nuclear Magnetic Resonance, Infra Red spectroscopy Ultra Violet and the Mass Spectrometry. Use of the complementarity of these different techniques for the determination of structure of molecules.
Principle and application of analytical methods, (NMR, MS, IR, UV) in Chemistry/Biochemistry. Spectroscopy NMR 1D and 2D: 1H, 13C. Mass spectrometry: EI, CI, Electrospray, MALDI, SIMS, … .

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):
- the theory and practice of the main analytical techniques used in chemistry and biochemistry.

The student must be able to:
- solving structure of chemical compounds and simple biochemistry molecule using analytical methods: NMR, Mass Spectrometry, IR, UV.

Necessary prerequisites

I1ANETCH Chemistry
I2BECH10 Organic chemistry
I2BEBS10 Biochemistry
I2BEAN20 Analysis methods

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

Bioseparation

Introducing

Description

Bioseparation : Precipitation: definition, review of precipitation processes, type of precipitation. Centrifugation and ultracentrifugation: introduction principle theory of sedimentation, and centrifugation, centrifuge equipment and operations. Membrane separation: principles and theory, membrane type and module, membrane fouling. Electrophoresis: principle and theory, electrophoresis equipment, gel electrophoresis, SDS-PAGE, isoelectric focusing, 2-D electrophoresis, capillary electrophoresis.

Objectives

Bioseparation: At the end of this module,
Students should understand and be able to explain
- the mechanisms exploited by the separative techniques commonly used in biochemistry and biotechnology, particularly in the case of biocatalysts
- the properties of biological molecules exploited in the application of separative techniques
- Precipitation (proteins, nucleic acids),
- centrifugation and ultracentrifugation,
- membrane separation (MF, UF, NF, dialysis, electrodialysis)
- electrophoresis

Necessary prerequisites

I1ANETCH Chemistry
I2BECH10 Organic Chemistry
I2BEBS10 Structural Biochemistry
I2BEAN20 Analytical Methods
I2BEGR20 Reaction Engineering

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Enzymology

Introducing

Description

Enzymology: Detailed description of
- Classifications of enzymes, general and specialized databases
- Kinetic models: Michaelian enzymes, inhibition mechanisms, kinetic models of multi-substrate enzymes, allosteric enzymes and regulation
- Principles of nucleic acid and protein sequence alignment (local and global alignment)
- Biophysical methods used to determine 3D protein structure
- Visualization of catalytic site and analysis of catalytic mechanisms

Objectives

At the end of this module, students should understand and be able to explain
- the importance of studying enzymes and the use of these biocatalysts in biotechnology in the context of ecological transition, sustainable development related to the bioeconomy.
- the methods for measuring the velocity of an enzymatic reaction
- the equations applied to model the kinetics of enzymatic reactions
- the influence of the main physico-chemical parameters on the catalytic efficiency.
- the methods used to determine and analyze the enzyme three-dimensional structure

Students will also learn to use:
- databases of nucleic acids as well as databases of protein sequences and three-dimensional structures
- computational tools used for sequence alignments (nucleic acids or proteins), visualization of tertiary protein structures and for structure-function relationship studies.

Necessary prerequisites

I1ANETCH Chemistry
I2BECH10 Organic Chemistry
I2BEBS10 Structural Biochemistry
I2BEAN20 Analytical Methods
I2BEGR20 Reaction Engineering

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

Bacterial genetics

Introducing

Description

The mechanisms leading to mutations, whether specific or broader, will be reviewed (mutagens, horizontal transfer mechanisms, transposition). The course will address prokaryotic transcriptional and translational regulations. It will present the biotechnology applications of this knowledge, as well as the tools for regulation, expression measurement and screening.

Objectives

The objective of this EU is to address the mechanisms that allow bacteria to evolve their genetic sequence and best respond to environmental conditions.

Necessary prerequisites

French.

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

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES 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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

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

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES 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

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Societal Openness Modules

Introducing

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.

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

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

Analytical methods II

Introducing

Forcing students to use all of their scientific knowledge in order to analyze the experimental results of their experiments and if necessary modify the protocols

Description

1. formulate a scientific problem related to analysis methods in order to illustrate it by manipulations.
2. Make a bibliography with the aim of proposing, adapting or creating experiments which will illustrate the chosen issue.
3. Gather its theoretical and practical knowledge of the previous years and implement them to solve the chosen problem.
4. Plan the experimental work of the group and organize the interactions with the other groups.
5. Explain the principle and learn how to implement the experimental techniques for the analysis.
6. teach yourself on the new analysis techniques necessary to undertake the project when this methods haven't been taught previously.
7. carry out an experiment at the laboratory
8. Analyze the experimental results.
9. Share and debate the results in the scientific point of view with both your teachers and inside your students group. Suggest improvements or work lead.
10. Verbally explain the objectives desired, the chosen scientific approach, and the results of the debate during an oral presentation.
11. Give explanation on the scientific approach followed and the results reached in a written scientific report.

Objectives

Learning by experimental project: illustrate a scientific problem using various experiments involving analytical techniques.

Necessary prerequisites

- Molecular structure and reactivity.
- Thermodynamics, chemistry, electrochemistry.
- Techniques of separation, extraction.
- Analytical methods: chromatographic, UV-visible, electrochemical.

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

Mass transfer

Introducing

Description

Thermodynamic properties of gas/liquid equilibria in the perfect gas state, concepts of fugacity and Henry's equilibrium. Transfer properties (viscosity, thermal conductivity, diffusivity) and phase equilibria of multi-constituent real fluids.
Introduction to matter transfer: establishment of the continuity equation, resolution of this equation in a few special cases. Introduction to the notion of transfer coefficient, dimensional analysis, transfer models (film and double film), experimental determination of transfer coefficient, concept of Height of Transfer Unit (HUT) and Number of Transfer Unit (NUT). Introduction to basic sizing of some G/L exchangers (packed column, bubble column, spray column).

Objectives

At the end of this module, the student will be familiar with the equations needed to determine the thermodynamic equilibrium properties (fugacity) of real fluids in multiphase systems. This knowledge will be applied to the determination of exchange potentials and transfer properties (viscosity, diffusivity, etc.).
Students will master the notion of transfer coefficient and be able to estimate it in a given operation.
Students will be able to apply these quantities to the generalized material balance equation applied to multiphase contactors, and will be able to dimension industrial installations such as bubble, packed and spray columns.

The student should be able to: size industrial installations such as bubble, packing and spray columns.

Necessary prerequisites

Advanced thermodynamics and application to physicochemical systems: I2BETH11
Roustan M., Transferts gaz-liquide dans les procédés de traitement des eaux et d'effluents gazeux, Editions TEC & DOC, 2003

Évaluation

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Practical info

Location(s)

Toulouse

Chemical reaction engineering 2

Introducing

Description

Material balances in ideal reactors: general form of the balance, application to different ideal reactors, application to complex reaction schemes, yields and selectivities. Combining ideal reactors to optimize conversion and yield.

Influence of temperature on reactor performance. Notion of Optimal Temperature Progression (OTP). Energy balances for ideal reactors.

Description of real reactor flows. Residence time distribution. Hydrodynamic interpretation and modeling. Application to a packed reactor.

Mixing/reaction interactions: mixing mechanisms, methodology for identifying and solving a mixing/reaction problem, analysis and calculation of characteristic times, probability density function, micromixing models. Modeling/simulation of a case study.

Objectives

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

- reactors with variable volume / flow rates
- yield and selectivity in multiple stoichiometry reaction systems
- reactor arrangements (series, parallel, plug flow with recycling)
- mixing mechanisms and their relationship to reaction progress
- influence of reactor non-ideality on conversion: residence time distribution (transfer function concept) and concentration distribution (mixing)
- the influence of temperature on reactor performance, notion of Optimal Temperature Progression
- the general equation for energy conservation in a reactor.

The student should be able to :

- calculate ideal open reactors under variable flow conditions
- calculate the size or yield or selectivity of ideal open reactors for multiple stoichiometry systems, and the conversion rate that can be achieved by arranging the reactors
- determine the DTS of a reactor
- apply a mixing or flow model to predict conversion in a non-uniform reactor
- calculate the POT for a given system
- establish and solve enthalpy balances for reactional and non-reactional systems.

Necessary prerequisites

Ideal reactors, reaction rates and reaction progress parameters
Linear differential equations
Basis of Laplace transforms
Basis of transport phenomena
Basis of thermodynamics

Évaluation

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Practical info

Location(s)

Toulouse

Thermodynamics and energy

Introducing

Description

Évaluation

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Practical info

Location(s)

Toulouse

Water, Environment and Risks

Introducing

Description

1- Environmental legislation and regulation
Basics of law and regulatory instruments (TD)
Design office project: Water in a region: from use to discharge

2- Environment
- Pollutant dispersion (mechanisms, consequences)
- Characterisation and typology of waste, waste management (treatment and storage methods), ordinary and radioactive waste, environmental impact of waste.

3- Process safety
Definitions of the main types of risk in the field of processes: calculation of the probability of human impact, toxicity, different types of explosion, thermal runaway. Protection methods and devices.

4- Water: issues for actors and industries
Environmental and health issues, indicators of pollution
Main treatment stages and processes

Objectives

- Explain the principles of environmental law in France and be familiar with legal and regulatory information tools.

- Describe the main environmental problems, the principles of water and waste management and the main treatment processes.

- Know the main risks in the process industry and the mechanisms of accidents.

Necessary prerequisites

Chemistry for solutions / Unit operations . Mass and Energy balances / kinetics and thermodynamics

Évaluation

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Practical info

Location(s)

Toulouse

Careers in Chemical Engineering (1)

Introducing

Description

presentation of various possible careers in process engineering: design office engineer (preparing calls for tender, responding to calls for tender, business management, contracts and public finance, etc.), project manager, R&D engineer, teacher-researcher, consulting and environmental management engineer, regional engineer.... . The tools specific to these professions (which form part of their knowledge and skills), the ways of accessing them and career paths are discussed.

Objectives

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

- Identify the sectors of activity of GP3E engineers; the different possible professions (design office, territorial engineer, environmental management, research and development, production, consulting, business engineer, etc.), their specific features and the conditions for accessing them.
- build a professional network based on meetings and information provided by speakers

Évaluation

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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

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

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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

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES 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

Partial Differential Equations and Numerical Analysis

Introducing

Description

Chapter 1 - Introduction to PDEs and classification -
Prerequisites in linear algebra, integration, resolution of ordinary differential equations, functions of several variables; Terminology and Examples of PDEs; Classification of linear PDEs of order 2.

Chapter 2 - Fourier Series -
Physical motivation; Space of periodic functions of square integrable; Trigonometric series; Fourier coefficient; Fourier series in L^1 (Dirichlet Thm) then in L^2 (Parseval Identity).

Chapter 3 - Fourier Transform -
Analysis and Synthesis of the Fourier transform on L^1, algebraic and derivation properties, inverse Tf and Plancherel Formula, Convolution; TF on L^2 and illustrative examples.

Chapter 4 - Sturm Liouville Problem -
Definition, examples and properties of the solutions.

Chapter 5 - Solving PDEs by Separation of Variables
Well-posed problem and Boundary conditions; Homogeneous 1D heat equation; Homogeneous 1D wave equation; Generalities on the method of separation of variables (homogeneous Eq, then with source term, then with non-homogeneous boundary conditions, and interest in knowing the associated Sturm Liouville problem)

Students will be provided with a course handout, TD statements (then their corrections) and TP. The TP will be carried out under Python

Objectives

This UE aims to master some basic mathematical concepts for the study of partial differential equations (PDE) by the future engineer in Civil Engineering or Mechanical Engineering. This UE is naturally composed of academic knowledge presented in lectures, and computational know-how (studied in tutorials) and numerical know-how (implemented in practical work). Students will learn to identify and classify PDEs according to their nature (elliptic, parabolic, hyperbolic). They will approach the basic concepts, properties and theorems concerning Fourier series and Fourier transforms, which are powerful tools for solving PDEs, particularly in areas related to periodic phenomena and vibrations. Finally, the separation of variables, a classic and effective technique for solving certain classes of PDEs, will be formalized and studied. This method will be illustrated through several concrete examples linked to wave-type equations (vibration phenomenon) or heat (diffusion phenomenon).

Necessary prerequisites

Mathematics UE for years 1 and 2.
More specifically:
- linear algebra (Diagonalization of matrices)
- integration (change of variable, Integrations by parts)
- resolution of ordinary differential equations (characteristic polynomial, solution of the homogeneous equation and particular solution…)
- functions with several variables (derivation)

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

Solid mechanics

Introducing

Description

Theory of stresses, theory of strains, displacement-strain relationship, linear elasticity constitutive law, formulation of the elasticity problem, analytical methods for solving the general problem of linear elasticity. Applications in practical exercises using Python programming language.

Objectives

At the end of this module, the student should have a comprehensive understanding of solid deformation mechanics, stresses, linearized strains, displacement fields and the constitutive relationship in elasticity.
The student should be able to:
- Analyze the state of stress and strain of a solid under loading.
- Calculate the stress state based on the strain state and vice versa.
- Calculate the strain state based on the displacement field.
- Establish equations for the local equilibrium of the solid at every point.
- Propose a relevant modeling of a real problem, particularly in terms of boundary conditions.
- Calculate the stresses from the diagrams of internal solicitations obtained from beam theory.

Necessary prerequisites

Mathematics (analysis, linear algebra, numerical analysis), general mechanics (statics and kinematics), beam theory (internal solicitations, stresses in beams...), basics in 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

Fluid mechanics

Introducing

Description

Fluid Mechanics: Introductory definitions and general properties of a fluid, forces acting on a fluid particle. Fluid statics for incompressible and compressible fluids, manometry, buoyant force, forces and moments exerted by a fluid on flat and curved surfaces, and pressure distribution in rigid body motion. Fluid dynamics and kinematics, Euler's equation, Bernoulli's equation, mass conservation, control volume and Reynolds transport theorem, linear momentum equation.

Objectives

Fluid Mechanics:

At the end of this module, the student should have understood and be able to explain (main concepts):
- The concept of a fluid and the forces acting on a fluid particle.
- The distribution of static pressure within a fluid and the forces exerted by the fluid on a solid surface.
- The ideal fluid in motion: kinematics and dynamics.

The student should be able to:
- Calculate the forces exerted by a fluid on flat and curved solid surfaces.
- Use Bernoulli's equation (energy conservation) and Euler's theorem (momentum conservation) in a wide range of practical applications.

Necessary prerequisites

Basic thermodynamics concepts facilitate a better understanding of the fundamental principles.

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

Cementitious materials

Introducing

Description

The course covers the following topics
- history of cementitious materials
- cement manufacture and composition
- structure and texture of cement paste
- hydration, setting and hardening
- behavior of hardened concrete
- deferred behavior of concrete
- concrete durability
- fire resistance and freeze/thaw cycles
- formulation optimization

Objectives

This course develops a materials science culture concerning cementitious materials.

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

Ecodesign and Civil Engineering

Introducing

Description

Teaching mainly in the form of project-based learning (PBL) (construction technology + concrete engineering) and group work (eco-design).

Objectives

- Concrete engineering
Drawing up specifications (NF EN 206) and then formulating concrete according to the properties required for the fresh and/or hardened material
Be aware of the standard (NF EN 206), regulatory and economic environment concerning concrete materials
Familiarise yourself with certain concretes for specific uses: use of mineral additives, admixtures, etc.

- Eco-design
Learn how to design buildings to take account of environmental issues.
Learn how to specify and understand the issues involved in choosing concrete materials.
Learn how to specify construction systems.

- Construction technology
Locate the structures - represent and quantify them - explain the functions - find the most appropriate method of construction - propose a phasing plan - propose a QSE control plan.

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

Architecture double track

Introducing

Description

Évaluation

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Practical info

Location(s)

Toulouse

Job Hunting Techniques

Introducing

Description

Évaluation

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Practical info

Location(s)

Toulouse

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Job search

Introducing

Description

Évaluation

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Practical info

Location(s)

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

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Practical info

Location(s)

Toulouse

Partial Differential Equations and Numerical Analysis

Introducing

Description

Chapter 1 - Introduction to PDEs and classification -
Prerequisites in linear algebra, integration, resolution of ordinary differential equations, functions of several variables; Terminology and Examples of PDEs; Classification of linear PDEs of order 2.

Chapter 2 - Fourier Series -
Physical motivation; Space of periodic functions of square integrable; Trigonometric series; Fourier coefficient; Fourier series in L^1 (Dirichlet Thm) then in L^2 (Parseval Identity).

Chapter 3 - Fourier Transform -
Analysis and Synthesis of the Fourier transform on L^1, algebraic and derivation properties, inverse Tf and Plancherel Formula, Convolution; TF on L^2 and illustrative examples.

Chapter 4 - Sturm Liouville Problem -
Definition, examples and properties of the solutions.

Chapter 5 - Solving PDEs by Separation of Variables
Well-posed problem and Boundary conditions; Homogeneous 1D heat equation; Homogeneous 1D wave equation; Generalities on the method of separation of variables (homogeneous Eq, then with source term, then with non-homogeneous boundary conditions, and interest in knowing the associated Sturm Liouville problem)

Students will be provided with a course handout, TD statements (then their corrections) and TP. The TP will be carried out under Python

Objectives

This UE aims to master some basic mathematical concepts for the study of partial differential equations (PDE) by the future engineer in Civil Engineering or Mechanical Engineering. This UE is naturally composed of academic knowledge presented in lectures, and computational know-how (studied in tutorials) and numerical know-how (implemented in practical work). Students will learn to identify and classify PDEs according to their nature (elliptic, parabolic, hyperbolic). They will approach the basic concepts, properties and theorems concerning Fourier series and Fourier transforms, which are powerful tools for solving PDEs, particularly in areas related to periodic phenomena and vibrations. Finally, the separation of variables, a classic and effective technique for solving certain classes of PDEs, will be formalized and studied. This method will be illustrated through several concrete examples linked to wave-type equations (vibration phenomenon) or heat (diffusion phenomenon).

Necessary prerequisites

Mathematics UE for years 1 and 2.
More specifically:
- linear algebra (Diagonalization of matrices)
- integration (change of variable, Integrations by parts)
- resolution of ordinary differential equations (characteristic polynomial, solution of the homogeneous equation and particular solution...)

- functions with several variables (derivation)

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

Solid mechanics

Introducing

Description

Theory of stresses, theory of strains, displacement-strain relationship, linear elasticity constitutive law, formulation of the elasticity problem, analytical methods for solving the general problem of linear elasticity. Applications in practical exercises using Python programming language.

Objectives

At the end of this module, the student should have a comprehensive understanding of solid deformation mechanics, stresses, linearized strains, displacement fields and the constitutive relationship in elasticity.
The student should be able to:
- Analyze the state of stress and strain of a solid under loading.
- Calculate the stress state based on the strain state and vice versa.
- Calculate the strain state based on the displacement field.
- Establish equations for the local equilibrium of the solid at every point.
- Propose a relevant modeling of a real problem, particularly in terms of boundary conditions.
- Calculate the stresses from the diagrams of internal solicitations obtained from beam theory.

Necessary prerequisites

Mathematics (analysis, linear algebra, numerical analysis), general mechanics (statics and kinematics), beam theory (internal solicitations, stresses in beams...), basics in 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

Fluid mechanics

Introducing

Description

Fluid Mechanics: Introductory definitions and general properties of a fluid, forces acting on a fluid particle. Fluid statics for incompressible and compressible fluids, manometry, buoyant force, forces and moments exerted by a fluid on flat and curved surfaces, and pressure distribution in rigid body motion. Fluid dynamics and kinematics, Euler's equation, Bernoulli's equation, mass conservation, control volume and Reynolds transport theorem, linear momentum equation.

Objectives

Fluid Mechanics:

At the end of this module, the student should have understood and be able to explain (main concepts):
- The concept of a fluid and the forces acting on a fluid particle.
- The distribution of static pressure within a fluid and the forces exerted by the fluid on a solid surface.
- The ideal fluid in motion: kinematics and dynamics.

The student should be able to:
- Calculate the forces exerted by a fluid on flat and curved solid surfaces.
- Use Bernoulli's equation (energy conservation) and Euler's theorem (momentum conservation) in a wide range of practical applications.

Necessary prerequisites

Basic thermodynamics concepts facilitate a better understanding of the fundamental principles.

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

Dynamic Systems

Introducing

Description

Fundamentals of signals and systems. Transfer functions of linear time-invariant systems. Systems of 1st order, generalized 1st order, 2nd order, system delay. Frequency response in Bode diagram and its asymptotic plot. Introduction to state space representation.

Objectives

At the end of this module, the student should have understood the basics on signals and linear systems as well as the dynamical and frequency performances of the systems.

The student should be able to:
- Build in Matlab/Simulink a dynamic model of a system out of its algebro-differential equations;
- Determine and analyze the dynamic and frequency performances of a system of intermediate complexity (1st or 2nd order) based on its dynamic model;
- Carry out the preliminary sizing of a system of intermediate complexity (1st or 2nd order) to fulfill the dynamic specifications.

Necessary prerequisites

Laplace transform. Basic notions to model mechanical, electrical, thermal and hydraulic systems

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

Mechanical design

Introducing

Description

The EU is divided into 3 parts:
1/ Mechanical Design:
 - Modeling of mechanisms
 - Design of complete removable links
 - Design of the pivot links: friction and bearing
2/ Tolerancing:
 - Geometric: ISO method
3/ Manufacturing Analysis

Objectives

The objective of this teaching unit is to increase skills in the design and manufacture of mechanical products.

Necessary prerequisites

2IC CO12
2IC CT12

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

Mechanical manufacturing

Introducing

Description

Tolerancing : CM 3,75h, TD 7,5h,
Manufacturing Analysis : TD 15h, TP 5h

Objectives

At the end of the Tolerancing-Manufacturing Analysis (TMA) module, the student should be able to develop a process plan for a simple part using appropriate methods, after decoding, interpreting, and/or creating the definition drawing.

Necessary prerequisites

Industrial Drawing, Design

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES 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:

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

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Humanities elective course

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

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

Fluid mechanics

Introducing

Description

Fluid mechanics for Civil Engineers :
- Properties of real fluids
- Pressurized flows in cylindrical pipes (gravity networks; pump-network coupling)
- Open-channel flows in uniform flow conditions

Objectives

Fluid Mechanics of Real Fluids
By the end of the session, the student will be able to:
- Apply the generalized Bernoulli equation and perform head loss calculations;
- Design gravity-driven and pressurized flow networks;
- Select an appropriate pump;
- Estimate flow rates for uniform open-channel flows.

Necessary prerequisites

Fluid statics. Real fluid flow.

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

Heat transfers

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Analysis of Static Structures

ECTS

Hourly volume
56h

Introducing

Description

1. Notion of hyperstaticity
2. Force method
2.1 Associated system: static equivalence and kinematic equivalence
2.2 Energetic method
2.3 Special cases: articulated trusses
2.4 Special cases: continuous beams
3. Displacement method
3.1 Kinematic analysis
3.2 Locking and embedding moments
3.3 Principle of virtual work for Rigid Body Motion

Objectives

By the end of this module, students should have understood and be able to explain :
- the distribution of internal forces in structures under static mechanical loads (continuous beams, trusses, frameworks, etc.) and the associated fields of stress, strain and displacement;
- the essential elements of a calculation note.

Students should be able to :
- formulate and justify relevant hypotheses for the static resolution of a structure;
- determine the degree of hyperstaticity of a structure;
- solve a hyperstatic structure using the force method;
- solve a hyperstatic structure using the displacement method;
- argue the choice of resolution method;
- calculate the support reactions of the structure;
- draw internal force diagrams (bending moment, shear force, normal force);
- calculate structural deformations (displacements, rotations);
- write a clear, accurate and concise calculation note.

Necessary prerequisites

Solving isostatic systems and determining internal forces.

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

Deepening in Structures

Introducing

Description

Ce module se compose de 3 parties indépendantes.

Un module d'Analyse des Structures Dynamiques présente les bases de modélisation de systèmes sous sollicitation dynamique afin d'en déterminer les modes propres de vibration. La modélisation peut concerner aussi bien des systèmes continus que discret. Les modes propres sont étudiés via une résolution exacte mais aussi par une approximation (méthode de Rayleigh-Ritz).

Un module de Vieillissement des Ouvrages s'intéresse au comportement à long terme des ouvrages de Génie Civil et à leur interaction avec leur environnement : altération physico-chimique et comportement visco-élastique des matériaux du génie civil seront étudiés.

Un module Modélisation d'Ouvrage Existant consiste à choisir un ouvrage réel, en proposer une modélisation de type RDM et rédiger une note de calcul pour en déterminer la répartition des efforts internes.

Objectives

A la fin de cours, l'étudiant aura acquis des compétences de bases relatives :
- au comportement dynamique des structures de Génie Civil ;
- à leur vieillissement au cours de leur durée de service ;
- à la modélisation RDM à partir d'un système réel.

Necessary prerequisites

- Résistance Des Matériaux ;
- Comportement des Matériaux Cimentaires ;
- Principe Fondamental de la Dynamique.

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

Deepening in Climatics – Aerolitics – Fluid Mechanics

Introducing

Description

- Building Hydraulics (Cold water, wastewater)
- Introduction to fire safety for public-access buildings (ERP): basics of fire safety regulations and fundamentals of emergency system design.

Objectives

By the end of the session, the student will be able to:
- Design a cold water and wastewater system for a building.
- Design emergency response systems for a public-access building (ERP).

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

Geotechnic 1

Introducing

Description

Geotechnical engineering covers all activities relating to the application of soil mechanics, rock mechanics and engineering geology.
Geotechnics plays an essential role in all building, civil engineering and development projects.

Objectives

On completion of this course, students will be able to:
- Quote and measure the physical properties of a soil
- Calculate the stresses in a soil
- Calculate soil settlement
- Calculate soil resistance

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

Reinforced concrete

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

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Prestressed Concrete

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

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES 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

Heat transfers

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

Systems Control

Introducing

Description

A) Frequency analysis of closed-loop systems; rapidity-precision dilemma, stability.
B) Controller design: series, parallel, feed-forward and state feedback.

Objectives

At the end of this module, the student will have understood and be able to explain the fundamentals of control engineering for linear systems in time and frequency domains

The student will have to be able to design a controller to fulfil a set of required dynamic performance, by using Matlab.

Necessary prerequisites

Systems Engineering

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Logical systems

Introducing

Description

A) Combinatorial logic: basic notions, Boole algebra, representation of logical functions.

B) Sequential logic: design of sequential production systems
– detailed study of a specification language: Grafcet
– study of the Statechart language
– how to define operating modes using both language.

C) Realization of sequential control systems using Programmable Logic Controller.

Objectives

At the end of this module, the student will have understood and be able to use the main tools and methods for the specification and sequential control of automated production systems.

The student will have to be able to:
- Design the sequential control of an automated production system;
- Implement on a Programmable Logic Controller the various operating modes of a sequential automated system of medium complexity.

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

Introduction to Systems Engineering

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

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES 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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Machine elements

Introducing

Description

3 parts :
- First on the modeling of a mechanical architecture using multiphysics simulation software: Making the model/real link, parameters, validation of the model and exploitation of the results
- A second on kinematic modeling of a complex system (kinematic diagram, hyperstatism, equivalent connections)
- A final part on design and sizing of mechanical systems. We will focus on actuators (cylinders and motors) and pivot connections.

- A project, carried out in small groups over the entire semester, will complete and reinforce knowledges acquired in previous parts.

- Disassembly of gearboxes and differentials during practical work sessions

Objectives

Student must be able to :
- Valid a simulation model and exploit results.
- Analyze a technological system from the real object (behavior during different phases of use, identify components ensuring the different functions, etc.), design its kinematic and architectural diagram in 3D, calculate and possibly modify its degree of hyperstatism.
- Choose an actuator (technology and sizing)
- Design and size a pivot connection with radial contact bearings (all types of external loads)
- Create a dimension chain

Necessary prerequisites

Mechanical drawings
Mechanic (Kinematic connections, PFS, PFD)
Mechanical technology

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

Digital Control and Computer-Aided Manufacturing

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

Metrology

Introducing

Description

CM 8,75h, TD 10h, TP 8h

Objectives

At the end of this course, the student should be able to:

_ Adopt a methodology that enables the successful development of a product within a quality-driven approach,
_ Understand the stakeholders involved and identify the documentation generated,
_ Interpret the implementation of production and assembly methods, as well as the means and methods for product inspection and improvement.

Regarding inspection methods and techniques, the student should be able to:

_ Have a basic understanding of cost/quality/time controls at all stages of the development and manufacturing cycle, with the objective of mastering the geometric quality of a product,
_ Be familiar with the main technical tools used for dimensional and geometric inspection of mechanical parts,
_ Be able to establish an inspection plan for a specification by zone or template, using a surface plate or a Coordinate Measuring Machine (CMM),
_ Understand the main surface association criteria (Least Squares, Least Squares Tangent, Mini-Max),
_ Be capable of characterizing a measuring device (calibration, interpretation of measurement uncertainties, etc.),
_ Have some knowledge of arithmetic and statistical functional tolerancing.

Necessary prerequisites

In the INSA courses :

Bureau d'études (cf. UE 3ICCM51 - Conception Mécanique)
Tolérancement (dimensionnel, géométrique), et Analyse de Fabrication (cf. UE 3ICCM51 - TAF du S5)

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

Heat Treatment and Welding

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES 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

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

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES 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

In-depth study of electronic circuits

Introducing

Description

Electrical characteristics of diodes and transistors (MOSFETs, JFETs and bipolar transistors). Biasing circuits and corresponding amplifying classes. Models of active components and equivalent small-signal electrical schemes for LF and/or HF signal analysis. Main functions and associated circuitry (current generation, current mirrors, differential amplifiers, etc. ...). Amplifying, filtering and impedance adaptation. Implementation of models in an electrical circuit simulator.

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts) :
- The electrical characteristics of diodes and transistors.
- The concept of static biasing and the principle of small signal behaviour around the bias point.
- The different amplification classes for transistors based circuits.
- The concepts of low and high frequency modelling in order to design advanced functional circuits.

The student will be able to:
- Design and realise a bias circuit which is well adapted to a given function.
- Extract the equivalent small signal scheme suited for low or high frequency signal analysis.
- Recognize and implement the basic circuitry such as differential amplification, current generators and mirrors.
- Know how to use an electrical circuit simulator and the suited models of active components as well as their limitations.
- Know how to build an amplifying and filtering chain with a view to integration.
- Conceive circuits especially adapted to sensors.
- Conceive a power amplifying stage taking into account the power dissipation.

Necessary prerequisites

Fundamentals of electricity, Kirchhoff's laws, Thévenin and Norton's and superposition theorems, voltage and current sources. Fourier's and Laplace's transforms.

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

Semiconductors

Introducing

Description

Part 1: Fundamentals of Materials Physics

Presentation of quantum mechanics concepts underlying the electronic structures of the atom.
Introduction to chemical bonding and the organization of matter.
Study of crystalline structures.
Understanding band diagrams to distinguish insulators, semiconductors, and metals, as well as the concept of density of states within a material.
Review of elementary statistical physics to explain how to modify charge densities in a semiconductor material through doping.

Part 2: Doping and PN Junction

Understanding different types of semiconductor doping.
Construction of a simple component like the PN junction, introducing band diagrams of these structures at thermodynamic equilibrium and non-equilibrium (under bias or illumination).
Study of charge carrier diffusion laws to establish the laws governing current levels observed in PN junctions under bias.

Part 3: Bipolar Transistors

Understanding the operation of the PN junction and its integration within a bipolar transistor.
Explanation of various physical properties of bipolar transistors, particularly their role as amplifiers.
Highlighting the links between the electronic properties of components and physical phenomena, such as the current gain parameters Alpha and Beta of bipolar transistors.

Part 4: CMOS Technologies

Emphasizing the physical links between materials and the electronic operation of MOS capacitors, MOS transistors, and their integration through CMOS technologies.
This course aims to provide students with the fundamental knowledge and practical skills necessary to understand and apply the principles of materials physics and components in information technologies.

Part 5: Practical Work

As part of our module on semiconductor materials and their characterization, you will have the opportunity to participate in 7 hours of practical work in a cleanroom at AIME. These sessions will allow you to implement the knowledge acquired in lectures and tutorials. During these practical sessions, students will construct and electrically characterize photovoltaic cells following the Lumelec procedure developed at AIME. For more details, the Lumelec manual for this practical work is available at the following link: https://www.aime-toulouse.fr/wp-content/uploads/2024/04/FasciculeLumelec_EN_2024-2.pdf

These practical sessions are an excellent opportunity to enhance your technical skills and understand the practical applications of the theoretical concepts covered in the course.

Objectives

This course introduces the physics of materials and components involved in technologies associated with the transmission, processing, and storage of information. It focuses on timeless fundamental principles in a rapidly developing field.

Expected Competencies:

By the end of this course, the student will be able to:

1- Clearly describe and express the various physical principles involved in the processing, transmission, and storage of information.
2- Comprehend the overall technologies based on semiconductors, from the atomic level to the application of components.
3- Enhance their understanding of the physical properties of semiconductors, particularly the PN junction, which serves as the basic technological building block present in all modern components, whether discrete (such as diodes or bipolar transistors) or integrated (such as field-effect transistors).

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Modeling and Analysis of Continuous Linear Systems

Introducing

Description

This course introduces the notion of state-space representation of dynamic systems. The link with other models (transfer function, differential equation) is particularly discussed, as is how to obtain a model by linearization. Several representation bases are discussed: modal forms, control companion and observation companion. We then look at how to analyze a linear time-invariant system in terms of time response and stability properties.

Objectives

This module focuses on the representation and analysis of continuous linear dynamic systems using the state-space formalism. Students will learn how to change the representation basis, analyze stability and calculate the time response of a linear time-invariant system.

Necessary prerequisites

- Course of 2nd year IMACS « Systèmes bouclés »

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

Digital filtering

Introducing

Description

Digital Filtering
1.Signal conversion and processing (Analog / Digital, Digital /
Analog, Difference equation)
2.Discrete-Time linear systems (Z-transform, transfer function, impulse response)
3.Filter structure and Design. (FIR and IIR Filters, stability, Bilinear transform)

Objectives

Understanding of discrete time signals and discrete systems,
principles of signal theory and methods of signal processing, with emphasize on spectral analysis and digital filter design

Necessary prerequisites

- Fourier transform and series
- Laplace transform and transfer functions
- Bode diagrams

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Numerical analysis

Introducing

Description

The course covers the following topics: numerical errors, solving non-linear equations, numerical integration, direct solutions of linear systems, matrix norms and conditioning, iterative methods for solving linear systems, least squares methods, and ordinary differential equations.

Objectives

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

Some notions of numerical analysis and scientific computing.
The student should be able to:

Choose an appropriate method for solving a mathematical problem.
Use the Python language to implement numerical analysis methods.

Necessary prerequisites

Mathematical concepts are based on undergraduate linear algebra and analysis. Practical work is based on relatively simple 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

Programming in C

Introducing

Description

The student will be able to elaborate simple program illustrating algorithmic problems, but also more complex programs requiring a good knowledge of specific notions (pointer, etc.). Usual notions of programming languages (such as variables, types, control flow instructions) are presented as well as notions more specifically associated with the C language (generalized use of pointers, function parameters, input/outputs functions, etc.).

Objectives

This course aims at presenting to students the fundamental notions of the C programming language so that they can be autonomous with this language.

Necessary prerequisites

bases on Unix and computer organisation are necessary.

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

Experimental physics and stochastic modelling

Introducing

Description

Programme (detailed contents):
Experimental section :
- 5 lab sessions (7h30) chosen from the following: Temperature sensors, Vacuum technologies, Lasers, Extensometers, Thin films, Optical Measurement.
- Each practical deals with different sensors, how do they work, how to use them, how to analyse the results ?
- Statistics section:
Random modeling of measurements: systematic error, random error, confidence intervals.
  Linear model: least squares adjustment, prediction intervals, model validation, model choice.
  Introduction to experimental planning: optimality criteria, estimation of main effects and interaction effects of different factors.
Organization (progress):
  The documents (course handout, tutorial statements, exam subjects) are available on Moodle and distributed to students.
  The practical work will be carried out using a data processing tool (Excel, Python, etc.)

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):
- Operation of the different sensors used during the lab sessions. They will know how to use them in order to solve a problem and view the results critically.
- Stochastic modelling of measurements, confidence intervals, statistical hypothesis tests, linear models.

The student will be able to build a data acquisition system starting from different sensors, to analyse the result and quantify the various components in measurement errors, to build a statistical model from observations.

Necessary prerequisites

Probabilities ans Statistics (Second year - IMACS - I2MADOPOMS20)

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

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES 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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Job search

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Humanities elective course

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

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

In-depth study of electronic circuits

Introducing

Description

Electrical characteristics of diodes and transistors (MOSFETs, JFETs and bipolar transistors). Biasing circuits and corresponding amplifying classes. Models of active components and equivalent small-signal electrical schemes for LF and/or HF signal analysis. Main functions and associated circuitry (current generation, current mirrors, differential amplifiers, etc. ...). Amplifying, filtering and impedance adaptation. Implementation of models in an electrical circuit simulator.

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts) :
- The electrical characteristics of diodes and transistors.
- The concept of static biasing and the principle of small signal behaviour around the bias point.
- The different amplification classes for transistors based circuits.
- The concepts of low and high frequency modelling in order to design advanced functional circuits.

The student will be able to:
- Design and realise a bias circuit which is well adapted to a given function.
- Extract the equivalent small signal scheme suited for low or high frequency signal analysis.
- Recognize and implement the basic circuitry such as differential amplification, current generators and mirrors.
- Know how to use an electrical circuit simulator and the suited models of active components as well as their limitations.
- Know how to build an amplifying and filtering chain with a view to integration.
- Conceive circuits especially adapted to sensors.
- Conceive a power amplifying stage taking into account the power dissipation.

Necessary prerequisites

Fundamentals of electricity, Kirchhoff's laws, Thévenin and Norton's and superposition theorems, voltage and current sources. Fourier's and Laplace's transforms.

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

Semiconductors

Introducing

Description

Part 1: Fundamentals of Materials Physics

Presentation of quantum mechanics concepts underlying the electronic structures of the atom.
Introduction to chemical bonding and the organization of matter.
Study of crystalline structures.
Understanding band diagrams to distinguish insulators, semiconductors, and metals, as well as the concept of density of states within a material.
Review of elementary statistical physics to explain how to modify charge densities in a semiconductor material through doping.

Part 2: Doping and PN Junction

Understanding different types of semiconductor doping.
Construction of a simple component like the PN junction, introducing band diagrams of these structures at thermodynamic equilibrium and non-equilibrium (under bias or illumination).
Study of charge carrier diffusion laws to establish the laws governing current levels observed in PN junctions under bias.

Part 3: Bipolar Transistors

Understanding the operation of the PN junction and its integration within a bipolar transistor.
Explanation of various physical properties of bipolar transistors, particularly their role as amplifiers.
Highlighting the links between the electronic properties of components and physical phenomena, such as the current gain parameters Alpha and Beta of bipolar transistors.

Part 4: CMOS Technologies

Emphasizing the physical links between materials and the electronic operation of MOS capacitors, MOS transistors, and their integration through CMOS technologies.
This course aims to provide students with the fundamental knowledge and practical skills necessary to understand and apply the principles of materials physics and components in information technologies.

Part 5: Practical Work

As part of our module on semiconductor materials and their characterization, you will have the opportunity to participate in 7 hours of practical work in a cleanroom at AIME. These sessions will allow you to implement the knowledge acquired in lectures and tutorials. During these practical sessions, students will construct and electrically characterize photovoltaic cells following the Lumelec procedure developed at AIME. For more details, the Lumelec manual for this practical work is available at the following link: https://www.aime-toulouse.fr/wp-content/uploads/2024/04/FasciculeLumelec_EN_2024-2.pdf

These practical sessions are an excellent opportunity to enhance your technical skills and understand the practical applications of the theoretical concepts covered in the course.

Objectives

This course introduces the physics of materials and components involved in technologies associated with the transmission, processing, and storage of information. It focuses on timeless fundamental principles in a rapidly developing field.

Expected Competencies:

By the end of this course, the student will be able to:

1- Clearly describe and express the various physical principles involved in the processing, transmission, and storage of information.
2- Comprehend the overall technologies based on semiconductors, from the atomic level to the application of components.
3- Enhance their understanding of the physical properties of semiconductors, particularly the PN junction, which serves as the basic technological building block present in all modern components, whether discrete (such as diodes or bipolar transistors) or integrated (such as field-effect transistors).

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

Waves and propagation

Introducing

Description

Program (detailed content):
Electromagnetism in dielectric, conductive, and magnetic media. Propagation of electromagnetic waves in linear, homogeneous, and isotropic media. Continuity relations. Application to reflection and refraction. Propagation in rectangular metallic waveguides and optical fibers.

Objectives

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

The fundamental concepts related to the propagation of electromagnetic waves in simple media (linear, homogeneous, isotropic, as well as dielectric, magnetic, or conductive). Reflection and refraction at the interface between two media, the functioning of metallic and dielectric waveguides (optical fibers), and the associated energy transfer.

The student should be able to:

Waves and Propagation: Use Maxwell's equations generalized for different media to determine the nature of the electromagnetic waves present in a simple system (L.H.I. medium, interface between two media, confined space between two plates of a good conductor). The student should be able to determine the conditions and characteristics of the modes that lead to the propagation of electromagnetic waves in various waveguides.

Necessary prerequisites

Electromagnetism in a vacuum

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

Hamiltonian mechanics

Introducing

Description

Newtonian mechanics, D'Alembert's principle and virtual work, Lagrangian formulation and Hamilton's principle of least action, Hamiltonian formulation, Canonical transformations and Poisson's bracket

Objectives

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

D'Alembert's principle, principle of least action, Lagrangian and Hamiltonian formulation of mechanics, notion of generalized coordinates and generalized forces, canonical transformations, Poisson representation of Hamiltonian mechanics, notion of phase space.

Students should be able to use the Euler-Lagrange and Hamiltonian equations to study the motion of an object.

Necessary prerequisites

Newtonian mechanics

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 analysis

Introducing

Description

The course covers the following topics: numerical errors, solving non-linear equations, numerical integration, direct solutions of linear systems, matrix norms and conditioning, iterative methods for solving linear systems, least squares methods, and ordinary differential equations.

Objectives

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

Some notions of numerical analysis and scientific computing.
The student should be able to:

Choose an appropriate method for solving a mathematical problem.
Use the Python language to implement numerical analysis methods.

Necessary prerequisites

Mathematical concepts are based on undergraduate linear algebra and analysis. Practical work is based on relatively simple 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

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Programming in C

Introducing

Description

The student will be able to elaborate simple program illustrating algorithmic problems, but also more complex programs requiring a good knowledge of specific notions (pointer, etc.). Usual notions of programming languages (such as variables, types, control flow instructions) are presented as well as notions more specifically associated with the C language (generalized use of pointers, function parameters, input/outputs functions, etc.).

Objectives

This course aims at presenting to students the fundamental notions of the C programming language so that they can be autonomous with this language.

Necessary prerequisites

bases on Unix and computer organisation are necessary.

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

Experimental physics and stochastic modelling

Introducing

Description

Programme (detailed contents):
Experimental section :
- 5 lab sessions (7h30) chosen from the following: Temperature sensors, Vacuum technologies, Lasers, Extensometers, Thin films, Optical Measurement.
- Each practical deals with different sensors, how do they work, how to use them, how to analyse the results ?
- Statistics section:
Random modeling of measurements: systematic error, random error, confidence intervals.
Linear model: least squares adjustment, prediction intervals, model validation, model choice.
Introduction to experimental planning: optimality criteria, estimation of main effects and interaction effects of different factors.
Organization (progress):
The documents (course handout, tutorial statements, exam subjects) are available on Moodle and distributed to students.
The practical work will be carried out using a data processing tool (Excel, Python, etc.)

Objectives

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

- Operation of the different sensors used during the lab sessions. They will know how to use them in order to solve a problem and view the results critically.
- Stochastic modelling of measurements, confidence intervals, statistical hypothesis tests, linear models.

The student will be able to build a data acquisition system starting from different sensors, to analyse the result and quantify the various components in measurement errors, to build a statistical model from observations.

Necessary prerequisites

Probabilities ans Statistics (Second year - IMACS - I2MADOPOMS20)

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES 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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES 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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Job search

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

Humanities elective course

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

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

Introduction to networks

Introducing

Description

The course introduction provides a general overview of network applications and their communication needs, followed by an overview of networks and their interconnection within the Internet. The central part of the course presents and illustrates the fundamental concepts associated with network design: connectivity, resource sharing, switching, quality of service and architecture (including the concepts of service and protocol). These concepts are illustrated and explored in depth within the framework of standardized local area networks and their connection to the TCP/IP Internet. A case study on Ethernet local area networks connected to the Internet (networks used in the practical work rooms) punctuates the course. The concepts are illustrated in tutorials and practical work.

Objectives

This course focuses on computer networks (local area networks, wide area networks and the Internet) from the perspective of their main concepts: connectivity, addressing, resource sharing + loss models, switching / routing + desequencing models, quality of service, architecture / service / protocol, basic protocol mechanisms.

Necessary prerequisites

C Language, Operating System, Algorithms and Programming 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

C language and networks

Introducing

Description

The course is structured in two parts :
The first part presents the Socket Programming Interface (Socket API), the basic technology for coding a distributed application (particularly on) the Internet.
The second part consists of a programming project for a distributed client/server application on the Internet.

The objectives are assessed based on a project report and an assessment of student engagement during the practical sessions. An individual written exam may complete the validation of theoretical skills.

Objectives

At the end of this module:
- The student should have understood and be able to explain the fundamental concepts associated with programming distributed applications on the Internet via the Socket API
- The student should be able to use the Socket API to develop (in C language) a distributed client/server application on the Internet

Necessary prerequisites

Introduction to Operating Systems
Introduction to Computer Networks (3rd year IMACS)
C Language (3rd year IMACS)

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Databases

Introducing

Description

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

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):
- The different data models, their advantages and limits
- What is DBMS (Database management system)
- The different concepts of the relational model
- Data integrity constraints
- Relational algebra and SQL languages

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

Assembly language

Introducing

Description

Definition and role of assembly language among programming tools.
Generic assembly language notions: data operations (arithmetic, logic), memory access (addressing modes), execution control (conditional processing).
Application to ARM architecture.
Subroutine calls and returns, role of the stack, interrupts, special case of ARM architecture.
Conventions for calling functions, passing arguments, return values, context preservation.
Development of mixed C-language and ARM-language applications

Objectives

At the end of this module, the student should have understood and be able to explain (main concepts):
o Von Neuman model
o Computation, storage, input-output circuits, control unit, interrupt mechanism, instruction-level pipeline execution
o Instruction set and assembly language programming
o Elements of a development chain : compiler, assembler, linker, loader, debugger
The student should be able to:
o Understand the principles of instruction set creation
o Develop an assembly language program on a microcontroller
o Use cross-development tools

Necessary prerequisites

1st year Algorithms and 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

Hardware architecture

ECTS

Hourly volume
55h

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.

Objectives

At the end of this module, 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.

Necessary prerequisites

- Knowledge of computer architecture and internal functional description (processor, memory, caches).
- C language.

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

Electronics project

Introducing

Description

* LTspice training (OP, AC, DC, Step, Sweep)
* study of differential stage
* common emitter stage study, active load, current sources
* output stage design
* transistor heating, heat sink sizing
* optional routing, PCB construction of the Hifi amplifier studied and designed.

Objectives

The aim of this project is to design and build an audio amplifier using discrete transistors, with a power of around 20W, on a test plate. The power stages are studied (push-pull Darlington,etc...) as well as all the classic architecture of an operational amplifier (differential, active load...). The problem of output dynamics is clearly defined (blocking/saturation limit). The technology used is the bipolar transistor.

Necessary prerequisites

* essential: good understanding of basic electical laws
* strongly recommended prerequisites: bipolar transistor, polarization, dynamic small signal circuits

Évaluation

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Practical info

Location(s)

Toulouse

Telecommunication systems

Introducing

Description

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. 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

Objectives

At the end of this module, the student should have understood and be able to explain (main concepts) the operating principles of telecommunication systems The student will be able to design the architecture of a telecommunication system: choice of the modulation, choice of the media accès type, etc.

Necessary prerequisites

Signal Processing courses
Analog and digital electronics 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

Random signals

Introducing

Description

- Introduction : deterministic signals and spectral chraracterization
- Probability theory and random signal
- Stochastic processes and random signals : first and second order characteristics, stationarity, ergodicity, discrete-time random signals
- Spectral analysis: Wiener-Kintchine Theorem
- Linear filtering

Objectives

Introduce the main concepts allowing a characterization of random signals. In particular, the main properties : stationarity, ergodicity, needed for a spectral characterization useful in electronics and automatic control, are specifically developed. The linear filtering of random signals concludes the course

Necessary prerequisites

Probability theory, random variable, Fourier Series, Fourier Transform, Linear invariant systems (Transfer function)

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Control of continuous linear systems

Introducing

Description

State-space control: specifications, observability-commandability, state feedback (pole placement), observers, algebraic methods (1- and 2-degree-of-freedom correctors).

Objectives

At the end of this module, the student should have understood and be able to explain (main concepts): the main methods for synthesizing state-space control laws for linear time-invariant systems
The basic principles of observer synthesis for linear time-invariant systems.
The student should be able to :
Define the major characteristics of the control law from the specifications
Design the control law in state space (pole placement)

Necessary prerequisites

Linear algebra

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

Modeling and control of discrete-event systems

Introducing

Description

Modeling and Control of Discrete Event Systems: modeling tools (finite state machines, Petri nets, Statecharts) and associated implementation techniques (PLC, FPGA, real-time target)

Objectives

At the end of this module, the student should have understood and be able to explain (main concepts):
Basic principles of discrete-event system modeling tools (Finite State Machines, Statecharts, Petri nets),
Different techniques for controlling a discrete-event system (FPGA, PLC, real-time target).
The student should be able to:
model and implement the control of a discrete-event system

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES 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

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

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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

Thermodynamics

Introducing

Description

Programme (detailed content) :
Introduction: The fundamental mathematical tools of thermodynamics: partial derivatives, Jacobian, exact and inexact total differential, Legendre transformation, notion of extensive and intensive quantities, integrating factor.

I - Part: The formalism of thermodynamics:
- Postulates for simple systems,
- Variables of state, equation of state of simple systems,
- Calorimetric coefficients of simple systems,
- Legendre transforms,
- Thermodynamic potentials, free energies of transformation, and their applications
- Stability conditions of simple systems,
- Order parameter, 1st and 2nd order phase transition.

II - Part: Applications
- thermal machines - balance and efficiency
- Perfect gases, Mixtures of perfect gases,
- Real gases, Van der Waals model
- Solid-liquid-vapour transformation of a simple system
- Changes of state,
- Phase diagram,

III - Part: Heat and matter transport phenomena
- Diffusion phenomena.
- applications: thermoelectric effects (Peltier, Seebeck, ...)

IV - Part : Thermodynamic model of the greenhouse effect.
- Modelling and influence of the atmosphere compositio

Objectives

At the end of this module, the student should have understood and be able to explain (main concepts):
- The laws of thermodynamics, the notions of work, heat, energy associated with a transformation,
- The application to thermal machines, thermodynamic cycles, and the calculation of efficiency.
- This course is intended to provide students with an understanding of the laws of thermodynamics and the concepts of work, heat and energy associated with a transformation,
- simple phase diagrams and binary materials.
- This course is intended to provide students with the opportunity to learn more about the following topics: - The concepts of diffusion and heat/matter transport.

The student will have to integrate notions, contextualise them and then be able to decontextualise them to be able to project them into an adidactic situation.

Necessary prerequisites

Basics of mathematical analysis: functions of several variables, derivatives, integrations, differential equations.
General notions of thermodynamics of physical-chemical systems

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

Point defects and diffusion

Introducing

Description

Program (detailed contents):
Introduction: The role of diffusion mechanisms and defects in materials.
I- Nature of defects: volumetric, surface, linear, point defects, in crystalline materials, ionic crystals, amorphous solids.
II - Thermodynamic aspects of point defects: enthalpy of formation, enthalpy of migration, defect concentration at thermodynamic equilibrium.
III - Basics of diffusion: flow equation, Fick's laws, macroscopic aspects, microscopic aspects, calculating the diffusion coefficient, influence of temperature.
IV - Defect generation and annihilation: generation of defects by radiation exposure and diffusion (lacunae, amorphization, doping), annihilation of defects by heat treatment.
V - Electronic and optical properties: colored centers in ionic crystals, the effect of doping in semiconductor materials.
VI - Techniques for measuring defect concentration: electrical, geometric and specific heat measurements.
VII - Applications.

Objectives

At the end of this module, the student should have understood and be able to explain (main concepts):
- The laws of matter diffusion in solid materials.
- The nomenclature of defects present in solid materials, the mechanisms by which defects are created and annihilated, the electronic and optical properties induced, and their applications.

Students will need to integrate notions, contextualize them and then be able to decontextualize them to project them into an adidactic situation.

Necessary prerequisites

Basic mathematical analysis: functions of several variables, derivatives, integrations, differential equations.
General concepts of the thermodynamics of physical-chemical systems.

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

Quantum physics

Introducing

Description

Program (detailed content) :

Brief review of the wave function and introduction to Dirac's formalism.
Fundamental measurement postulates in quantum mechanics.
Dynamics of quantum systems.
Harmonic oscillator theory.
Kinetic momentum theory.

Main difficulties usually encountered by students :
Difficulties are essentially mathematical (new formalism and notations, solving the eigenvalue equation of a matrix, etc.).

Objectives

At the end of this module, the student should have understood and be able to explain (main concepts):
Fundamental postulates of measurements in quantum mechanics.
The time evolution of a quantum system.
The notion of plane wave and localized wave packet.
Harmonic oscillator theory and its applications.
Angular momentum theory and its applications.

The student should be able to :
Solve Schrödinger's equation (energy and eigenstates) in matrix formalism.
Apply the fundamental postulates relating to the measurement of a physical quantity.
Calculate the time evolution of a quantum state.
Manipulate the ladder operators of the harmonic oscillator and angular momentum.

Necessary prerequisites

-Nanophysics: Optics, Photonics, Nanotechnologies
-Electrostatics
-Classical mechanics

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

Statistical physics

Introducing

Description

Fundamental assumptions of statistical physics. Macroscopic states, microscopic states and density of states.
Closed systems in equilibrium, microcanonical distribution. Temperature and Boltzmann distribution. Z, U and S functions. Thermodynamic link.
Closed systems in contact with a thermostat, canonical distribution.
Systems in contact with a particle reservoir, grand canonical distribution. Chemical potential.
Fermions and Bosons. Fermi Dirac and Bose Einstein distributions. Application examples.

Objectives

At the end of this module, the student should have understood and be able to explain (main concepts):
Basic principles of statistical physics (origin of entropy).
Microcanonical distribution, temperature, partition function and U, S functions.
Canonical and grand canonical distributions
Fermi-Dirac and Bose Einstein distributions.

The student should be able to:
Calculate the equilibrium properties of a simple closed and open system.
use the Fermi Dirac or Bose Einstein distributions in solid-state physics.

Necessary prerequisites

- Classical mecanic
- Hamiltonian Mecanic
- Thermodynamique
- Electrostatic
- Electromagnetism

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

Cohesion

Introducing

Description

Cohesion of Solids :

- Models of cohesive energy of the solid state - Lennard-Jones potential - Condon-Morse potential

- Properties and physical quantities related to cohesion: compressibility, thermal expansion, melting temperature, allotropic transformations

- Applications to ionic crystals and crystals based on van der Waals interaction

Objectives

By the end of this teaching unit, students should have understood and be able to explain (main concepts) the physical models of cohesion of solid materials on the atomic and molecular scales, as well as the links between these models and macroscopic physical quantities.

Necessary prerequisites

L2 degree in physics or materials science

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Dislocations and deformations

Introducing

Description

Plastic deformation and fracture of crystalline materials :
- Brittleness, ductility, plasticity of crystalline materials
- Dislocations : definition, theory of dislocations, interaction, mobility and plasticity.
- Brittle fracture, cleavage.

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts) the relations between defects and dislocations in the atomic structure and some macroscopic mechanical properties of crystals.

The student will be able to describe from a geometric and energetic point of view the dislocations and their interactions, and put them in relations with mechanical properties of the crystalline material : fragility and ductility

Necessary prerequisites

Know how to use tensor notation (seen during anisotropy lectures)

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

Anisotropy

Introducing

Description

Chapter 1: tensors
- Definition of tensor (use, order, transformation rules)
- Writing tensor relations: classical mathematical notation, Einstein convention, matrix notation.
- Tensors and symmetries (symmetric tensors, invariances and symmetries of the system)

Chapter 2: tensors and mechanical properties
- Definition of stress, strain, elasticity and rigidity tensors.
- The different types of stress/deformation (traction, shear).
- Voigt/engineer notation (6-component notation).
- Isotropic elasticity tensor
- Physical constants of isotropic elasticity (Young, Poisson, Coulomb moduli and Lamé coefficients).

Chapter 3: static couplings
- Direct and inverse piezoelectricity
- The piezoelectric tensor.
- The acousto-optic effect
- Couplings between static properties: general concepts and definition of effects (pyroelectricity, thermal expansion, etc.).
- Statistical theory of couplings and matrix representation (Voigt notation).
- Primary and secondary effects (e.g. primary and secondary pyroelectricity)

Chapter 4: anisotropic optics
- The representation of a tensor of order 2: the ellipsoid of indices and its geometric interpretation.
- Permittivity tensors and optical indices.
- Optical propagation along one of the main axes of an anisotropic system and the retarders (quarter-wave and half-wave blades).
- Optical propagation in any direction in an anisotropic system: birefringence and beam-splitters.

Objectives

Learn the fundamental ideas behind tensor theory and operation, as well as how they can be applied to characterize the anisotropic properties of crystals. A number of applications will be discussed in relation to anisotropic optics (wave plates, birefringence, etc.) and couplings (piezoelectricity, acousto-optic effect, etc.).

Necessary prerequisites

Linear algebra, mathematical analysis of functions with several variables, solid mechanics, wave optics.

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

Structure of solids

Introducing

Description

Crystal structure
Part 1. Geometric crystallography
Part 2. Symmetries in crystals
Part 3. X-ray crystallography

Part 1. Description of crystalline solids:
- The perfect crystal: definition and description of typical ionic and covalent structures.
- Point lattice : unit cell, Miller indices, lattice planes, interplannar spacing ;
- Crystallographic asymmetric unit;
- Reciprocal lattice: definition and properties

Part 2. Crystal symmetry
- Definitions of symmetry elements, notions of group theory, crystal systems;
- Stereographic projection and point group representations;
- Description of translational symmetry elements, space groups and representations.

Part 3. X-ray crystallography
- X-ray scattering and absorption by atoms ;
- X-ray diffraction: diffraction conditions (Laue conditions, Bragg relation, Ewald sphere), calculation of diffracted intensities (structure factor);
- Main structural characterization methods for crystals, powders and thin films
- Implementation and analysis of powder diffractograms and thin film diffractograms

Objectives

At the end of this module, the student should have understood and be able to explain (main concepts):
- the structure and symmetry of crystalline solids
- X-ray diffraction by crystalline solids

The student should be able to :
- characterize the structure of a crystal, classify crystalline solids by their symmetry, orient a crystal, apply basic X-ray diffraction techniques and analyze the results of a radiocrystallography experiment.

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

Applied material physics

Introducing

Description

The experiments seen in practical work are: quantitative metallography, calorimetry, tensile tests, hardness, crystalline defects, crystallization and recrystallization, and anisotropic properties.

The concepts covered are optical microscopy, phase diagrams, image processing, calorimetry, phase transitions, mechanical properties, structural hardening, defects and crystal growth, wave propagation in anisotropic medium.

Objectives

This UF constitutes an experimental approach to the physics of materials. The educational objectives are:
- acquire scientific knowledge relating to the techniques used in material science
- acquire practical skills on these techniques,
- acquire an experimental work method in physics (how to choose the experimental parameters, carry out the experiment, analyze the results)

The student should be able to:
- reproduce and apply techniques for the development and characterization of materials among the techniques mentioned in the program.

Necessary prerequisites

- Thermodynamic prerequisite : The following notions must be seen before the practicals: enthalpy, heat capacity and phase diagram.

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

Scientific project

Introducing

Description

Based on a theme defined by a tutor, generally a teacher from the Physics department, students carry out bibliographic research to develop a better knowledge of the proposed theme.
This project is carried out in support of the physics and materials courses which take place in parallel.

Objectives

The project puts students in a real situation and shows them concrete examples of the physics of materials.
It allows you to carry out scientific research using bibliographic data and to present this research during an oral presentation.

Necessary prerequisites

No specific prerequisites.
The courses taught alongside the semester are sufficient.

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

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

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

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES 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

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES 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

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:

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

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

Humanities elective course

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

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

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

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES 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.

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

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

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

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

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

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

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES 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

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Job search

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

Humanities elective course

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

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES 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

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

INSTITUT NATIONAL DES SCIENCES APPLIQUÉES 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

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

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

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

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES 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

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES 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

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).

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

Location(s)

Toulouse

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

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

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

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