

TOOLS AND METHODS FOR ENGINEERS FIELD_11 ECTS

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 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

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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

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Practical info

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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 ?
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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.

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Practical info

Location(s)

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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.

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Practical info

Location(s)

 Toulouse

Elective scientific course

Introducing

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Practical info

Location(s)

 Toulouse