# BACHELOR OF SCIENCE IN ENGINEERING

2024-2025

YEAR 1

PROGRAMME SUPERVISOR :

Gregory LEGRAIN

# YEAR 1 – Autumn Semester

## CORE COURSES

| Course code | Title | ECTS Credits |
|---|---|---|
| MATHSI | Mathematics I: analysis I | UE11 12 ects |
| MATHSII | Mathematics II: linear algebra I | |
| INFOI | Algorithmics | |
| INFOII | Introduction to scientific computing | |
| CADBASIS | CAD & Design – Basis | UE12 12 ects |
| STATICS | Statics | |
| OPTICS | Introduction to Physics I : Optics | |
| MATTER | Matter and Materials | |
| FLE1 | French 1 | UE13 6 ects |
| ALL1 | German 1 | |
| ESP1 | Spanish 1 | |
| BUSEN1 | Business English 1 | |
| SHS1 | Professional skills 1 | |
| PREPRO1 | Pre-professionnal activities 1 | |

# Bachelor of science in engineering

# YEAR 1 – Spring Semester

## CORE COURSES

| Course code | Title | Credits |
|---|---|---|
| MATHSIII | Mathematics I: analysis II | UE21 12 ects |
| MATHSIV | Mathematics II: linear algebra IV | |
| INFOIII | Scientific programming | |
| INFOIV | Data structures management | |
| DYNAMICS | Dynamics and Vibrations | UE22 12 ects |
| ELECTROMAG | Introduction to Physics II : Electromagnetism | |
| ELECTRICBASICS | Electrical Engineering Basics | |
| DESIGN | Product Design Methodology | |
| CADREVERSE | CAD & Design – Reverse engineering | |
| FLE2 | French 2 | UE23 6 ects |
| ALL2 | German 2 | |
| ESP2 | Spanish 2 | |
| BUSEN2 | Business English 2 | |
| SHS2 | Professional skills 2 | |
| PREPRO2 | Pre-professionnal activities 2 | |
| SUSTAIN1 | Sustainable engineering I | |

# BACHELOR OF SCIENCE IN ENGINEERING

2024/2025 - Year 1 - Autumn Semester - UE11

## Mathematics I: analysis I [BDM_MATHSI]

*LEAD PROFESSOR(S): Mazen SAAD*

### Requirements

### Objectives

The aim of this course is to help students acquire the basic notions of Calculus.
The fundamental concepts and methods of calculus for functions of one real variable are presented with the primary purpose of letting students assimilate their effective employment. We focus on trigonometric functions and introduce the complex numbers. This course provides an opportunity to upgrade the initial knowledge in analysis.

### Course contents

1) Basic notions: sets, elements of mathematical logic
2) Functions: domain, image, injective, surjective, bijective, inverse, monotone
3) Exponential, logarithmic, trigonometric functions
4) Complex numbers
5) Limits and continuity

### Course material

1- K. R. Davidson, A.P. Donsig. Real Analysis and Applications, Theory in Practice, Springer,
2- E.D. Bloch. The Real Numbers and Real Analysis, Springer.
3-K.A. Ross, Elementary Analysis. The Theory of Calculus, Springer.
4-A. Browder, Mathematical Analysis. An Introduction, Springer.

### Assessment

Collective assessment:      EVC 1 (coefficient 0.3)

Individual assessment:      EVI 1 (coefficient 0.7)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LAB | PROJECT | EXAM |
|---|---|---|---|---|---|---|
| English | 3 | 12 hrs | 0 hrs | 12 hrs | 0 hrs | 2 hrs |

# Mathematics II: linear algebra I [BDM_MATHSII]

*LEAD PROFESSOR(S): Françoise FOUCHER*

## Requirements


## Objectives

The aim of this course is to help students acquire the basic notions of linear algebra. It focuses on vectorial spaces, linear mappings and Euclidean spaces.

## Course contents

- Vectorial spaces: real vector spaces, subspaces, linear dependence or independence, finite dimension, bases, sum of subspaces, direct sum, complementary subspace
- Linear mappings: addition and composition, kernel and image, projection and symmetry, isomorphism, rank nullity theorem
- Euclidean spaces: inner product, norm, triangle inequality, Cauchy-Schwartz inequality, orthogonal and orthonormal family and basis, Pythagorean theorem, Gramm-Schmidt orthogonalization, orthogonal complement, orthogonal projection

## Course material

▪ Sheldon Axler, Linear algebra done right, third edition, Undergraduate texts in mathematics, Springer, 2015.
▪ Erwin Kreyszig, Advanced Engineering Mathematics, 10th edition, John Wiley & Sons, 2010.G. Strang, Introduction to Linear Algebra, Addison-Wesley Professional, 2015.
▪ Seymour Lipschutz, Marc Lipson, Linear algebra, 5th edition, Scaum's outline series, Mc Graw Hill, 2013.

## Assessment

Collective assessment:      EVC 1 (coefficient 0.3)

Individual assessment:      EVI 1 (coefficient 0.7)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LAB | PROJECT | EXAM |
|---|---|---|---|---|---|---|
| English | 3 | 12 hrs | 0 hrs | 12 hrs | 0 hrs | 2 hrs |

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# Algorithmics [BDM_INFOI]

LEAD PROFESSOR(S): Hugues DIGONNET

## Requirements

## Objectives

The goal of this course is to help students acquire basic concepts in algorithms, regardless of the programming language.

## Course contents

- Top-down analysis
- Algorithmic structures
- Simple data types, arrays, and structures
- Functions
- Data organization: searching and sorting

## Course material

## Assessment

Collective assessment:      EVC 1 (coefficient 0.3)

Individual assessment:      EVI 1 (coefficient 0.7)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LAB | PROJECT | EXAM |
|---|---|---|---|---|---|---|
| English | 3 | 12 hrs | 0 hrs | 12 hrs | 0 hrs | 2 hrs |

# Introduction to scientific computing [BDM_INFOII]

*LEAD PROFESSOR(S): Luisa ROCHA DA SILVA*

## Requirements

## Objectives

The goal of this course is to help students learn the basics of Python as a scientific programming language.

## Course contents

- Why and how to learn Python
- Data types and variables
- Loops
- Functions
- Advanced data types I: tables and classes
- Data organization: search and sorting

## Course material

- J.V. Guttag, J. Sussman, Introduction to Computation and Programming Using Python, Third Edition, With Application to Computational Modeling and Understanding Data, MIT Press, 2021
- R. Sedgewick, K. Wayne, Introduction to Programming in Python: An Interdisciplinary Approach, Addison-Wesley Professional, 2015
- www.python.org
- https://openclassrooms.com/en/courses2304731-learn-python-basics-for-data-analysis

## Assessment

Collective assessment:     EVC 1 (coefficient 0.3)

Individual assessment:     EVI 1 (coefficient 0.7)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LAB | PROJECT | EXAM |
|---|---|---|---|---|---|---|
| English | 3 | 12 hrs | 0 hrs | 12 hrs | 0 hrs | 2 hrs |

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# BACHELOR OF SCIENCE IN ENGINEERING

2024/2025 – Year 1 – Autumn Semester – UE12

# CAD and Design – Basis [BSC_CADBASIS]

*LEAD PROFESSOR(S): Grégory LEGRAIN / Julien TERRIER*

## Requirements

## Objectives

At the end of the course the students will be able to understand the main tools of industrial design and how Computer Aided tools are able to help the experts in their Design tasks.

## Course contents

This introductory course will address the following items:
- Introduction to Engineering Drawing
- Introduction to Design and Computer Aided Design
    o What are the main functions of a CAD tool
    o Design of simple parts
    o Design simple assemblies

## Course material

## Assessment

Individual assessment:      EVI 1 (coefficient 1)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LAB | PROJECT | EXAM |
|---|---|---|---|---|---|---|
| English | - | 4 hrs | 12 hrs | 8 hrs | 0 hrs | 0 hrs |

# Statics [BSC_STATICS]

*LEAD PROFESSOR(S): Vito RUBINO*

## Requirements

## Objectives

This course studies the equilibrium of bodies subjected to a set of forces. At the end of the course, students will be able to model loads and reactions of a static problem and write conditions that ensure equilibrium of rigid body systems.

## Course contents

The course covers the following topics:
- Forces with a common point of application
- Equilibrium of a rigid body for a general system of forces
- Center of Gravity, Center of Mass and Centroids
- Energy methods and principle of virtual work
- Static and kinetic friction

## Course material

Engineering Mechanics 1, Gross, Hauger, Schröder, Wall and Rajapakse. Springer

## Assessment

Individual assessment:     EVI 1 (coefficient 1)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LAB | PROJECT | EXAM |
|---|---|---|---|---|---|---|
| English | - | 10 hrs | 8 hrs | 4 hrs | 0 hrs | 2 hrs |

# Introduction to Physics I: Optics [BSC_OPTICS]

LEAD PROFESSOR(S): Grégory LEGRAIN

## Requirements

## Objectives

-Learn basics of geometrical optics : nature of light, Snell-Descartes Laws, dispersion, thin lenses and mirrors.
- Comprehension of classical optical devices : microscope, telescope, eye.

## Course contents

- Geometrical optics approximation
- Objects and images
- Spherical mirrors
- Thin lenses

## Course material

## Assessment

Individual assessment:     EVI 1 (coefficient 1)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LAB | PROJECT | EXAM |
|---|---|---|---|---|---|---|
| English | - | 6 hrs | 8 hrs | 10 hrs | 0 hrs | 0 hrs |

# BACHELOR OF SCIENCE IN ENGINEERING

2024/2025 - Year 1 - Autumn Semester - UE12

# Matter and Materials [BSC_MATTER]

*LEAD PROFESSOR(S): Thomas CORRE*

## Requirements

## Objectives

This course is an introduction to material science and provides basic knowledge on the microstructure and physical properties of solids. By the end of the course, the students will be able to:
- Describe the perfect crystal model
- Define the solubility and manipulate simple phase diagrams
- Describe the microstructure of structural materials and establish the link with simple macroscopic properties

## Course contents

- Atoms, molecules and atomic bounding
- Atomic architecture of solids and defects in crystals
- States of matter: miscibility and phase diagrams
- Introduction to mechanical properties of engineering materials
- Structure of engineering materials (metals, ceramics, polymers)

## Course material

JP Baïlon et JM Dorlot: Des Matériaux, PIP, third édition

Callister Jr, W. D., & Rethwisch, D. G. (2020). Materials science and engineering. John Wiley & Sons.

## Assessment

Individual assessment:      EVI 1 (coefficient 1)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LAB | PROJECT | EXAM |
|---|---|---|---|---|---|---|
| English | - | 12 hrs | 12 hrs | 0 hrs | 0 hrs | 0 hrs |

# BACHELOR OF SCIENCE IN ENGINEERING

2024/2025 - Year 1 - Autumn Semester - UE13

## French language [BSC_FLE1]

*LEAD PROFESSOR(S): Silvia ERTL*

## Requirements

N/A

## Objectives

The objective is to familiarize the learner with the French language and French culture through an entertaining task-based communicative language teaching, focused on speaking combined
with:

Phonetics
Self-correcting exercises online
Learning Lab activities
Project work
Tutoring

## Course contents

Course objectives include the acquisition and reinforcement of vocabulary, syntax, and pronunciation by both traditional means and through the use of digital resources.
Students will learn general French, develop language skills of oral and written comprehension and expression.
Learners will be able to use the foreign language in a simple way for the following purposes:

1. Giving and obtaining factual information:
personal information (e.g. name, address, place of origin, date of birth, education, occupation)
non-personal information (e.g. about places and how to get there, time of day, various facilities and services, rules and regulations, opening hours, where and what to eat, etc.)

2. Establishing and maintaining social and professional contacts, particularly:
meeting people and making acquaintances

## Course material

Full range of practical communication language exercises: reading comprehension, listening comprehension, written expression, oral expression.
Education material on our pedagogical platform

## Assessment

Individual assessment:      EVI 1 (coefficient 1)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LAB | PROJECT | EXAM |
|---|---|---|---|---|---|---|
| English | - | 0 hrs | 32 hrs | 0 hrs | 0 hrs | 0 hrs |

# BACHELOR OF SCIENCE IN ENGINEERING

2024/2025 - Year 1 - Autumn Semester - UE13

## German language [BSC_ALL1]

LEAD PROFESSOR(S): Silvia ERTL

## Requirements

N/A

## Objectives

The objective is to familiarize the learner with the German language and German culture through an entertaining task-based communicative language teaching, focused on speaking combined
with:

Phonetics
Self-correcting exercises online
Learning Lab activities
Project work
Tutoring

## Course contents

Course objectives include the acquisition and reinforcement of vocabulary, syntax, and pronunciation by both traditional means and through the use of digital resources.
Students will learn general German, develop language skills of oral and written comprehension and expression.
Learners will be able to use the foreign language in a simple way for the following purposes:

1. Giving and obtaining factual information:
personal information (e.g. name, address, place of origin, date of birth, education, occupation)
non-personal information (e.g. about places and how to get there, time of day, various facilities and services, rules and regulations, opening hours, where and what to eat, etc.)

2. Establishing and maintaining social and professional contacts, particularly:
meeting people and making acquaintances

## Course material

Full range of practical communication language exercises: reading comprehension, listening comprehension, written expression, oral expression.
Education material on our pedagogical platform

## Assessment

Individual assessment:     EVI 1 (coefficient 1)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LAB | PROJECT | EXAM |
|---|---|---|---|---|---|---|
| German | - | 0 hrs | 32 hrs | 0 hrs | 0 hrs | 0 hrs |

# CENTRALE NANTES

## BACHELOR OF SCIENCE IN ENGINEERING
2024/2025 - Year 1 - Autumn Semester - UE13

## Spanish language [BSC_ESP1]

LEAD PROFESSOR(S): Silvia ERTL

## Requirements

N/A

## Objectives

The objective is to familiarize the learner with the Spanish language and Spanish culture through an entertaining task-based communicative language teaching, focused on speaking combined
with:

Phonetics
Self-correcting exercises online
Learning Lab activities
Project work
Tutoring

## Course contents

Course objectives include the acquisition and reinforcement of vocabulary, syntax, and pronunciation by both traditional means and through the use of digital resources.
Students will learn general Spanish, develop language skills of oral and written comprehension and expression.
Learners will be able to use the foreign language in a simple way for the following purposes:

1. Giving and obtaining factual information:
personal information (e.g. name, address, place of origin, date of birth, education, occupation)
non-personal information (e.g. about places and how to get there, time of day, various facilities and services, rules and regulations, opening hours, where and what to eat, etc.)

2. Establishing and maintaining social and professional contacts, particularly:
meeting people and making acquaintances

## Course material

Full range of practical communication language exercises: reading comprehension, listening comprehension, written expression, oral expression.
Education material on our pedagogical platform

## Assessment

Individual assessment:     EVI 1 (coefficient 1)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LAB | PROJECT | EXAM |
|---|---|---|---|---|---|---|
| Spanish | - | 0 hrs | 32 hrs | 0 hrs | 0 hrs | 0 hrs |

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# Business English 1 [BSC_BUSEN1]

*LEAD PROFESSOR(S): Anna POLONYI*

## Requirements

## Objectives

Presentation Skills

capturing interest with good introduction
avoiding reading notes
managing the room
producing text-free slides
remaining interactive throughout
anticipating what audience already knows and needs to know
maintaining interest
using metaphors for clarity
pacing & pausing
ensuring clarity
ending with memorable conclusion

## Course contents

group analysis of skills and language required with teacher guidance
teacher input
practice activities
final group presentation
peer-correction & feedback
teacher feedback

## Course material

na

## Assessment

Individual assessment:     EVI 1 (coefficient 1)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LAB | PROJECT | EXAM |
|---|---|---|---|---|---|---|
| English | - | 0 hrs | 16 hrs | 0 hrs | 0 hrs | 0 hrs |

# Professional skills 1 [BSC_SHS1]

*LEAD PROFESSOR(S): Julie BERGER*

## Requirements

None

## Objectives

The objective of this teaching unit is to allow students to have a better understanding of the importance of team cohesion. Through the various courses offered, the emphasis will be placed on the relational and interpersonal aspects which will allow these future engineers to integrate serenely into the professional world.

## Course contents

Teambuilding

## Course material

None

## Assessment

Individual assessment:      EVI 1 (coefficient 1)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LAB | PROJECT | EXAM |
|---|---|---|---|---|---|---|
| English | - | 0 hrs | 24 hrs | 0 hrs | 0 hrs | 0 hrs |

# Pré-professional activities 1 [BSC_PREPRO1]

*LEAD PROFESSOR(S): Grégory LEGRAIN*

## Requirements

## Objectives

The objective of this course is to provide an opening to business world through various activities.

## Course contents

- Company tours
- Professional days
- Company driven workshops
- Hackaton
- Startup challenge
- Ideation workshops
- Innovation workshops
- Industrial mentoring

## Course material

## Assessment

Individual assessment:     EVI 1 (coefficient 1)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LAB | PROJECT | EXAM |
|---|---|---|---|---|---|---|
| English | - | 0 hrs | 36 hrs | 0 hrs | 0 hrs | 0 hrs |

# Mathematics I: analysis II [BDM_MATHSIII]

*LEAD PROFESSOR(S): Mazen SAAD*

## Requirements

## Objectives

The course completes the introduction to Analysis (MATHS I) with a deeper insight into the single variable function Calculus. The course focuses on limits, expansion of functions around a point, and integration.
Examples will be taken from appropriate engineering applications.

## Course contents

1) Limits and continuity: More fundamental limits and undetermined form
2) Derivation
3) Taylor expansions and applications
4) Integral calculus

## Course material

1-Kenneth A. Ross; Elementary Analysis, the theory of calculus, Springer
2-Ethan D. Bloch; The real numbers and real analysis, Springer
3-Kenneth R. Davidson, Allan P. Donsig;  Real Analysis and Applications, Theory in Practice, Springer
4-A. Browder, Mathematical Analysis. An Introduction, Springer.

## Assessment

Collective assessment:      EVC 1 (coefficient 0.3)

Individual assessment:      EVI 1 (coefficient 0.7)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LAB | PROJECT | EXAM |
|---|---|---|---|---|---|---|
| English | 3 | 12 hrs | 0 hrs | 12 hrs | 0 hrs | 2 hrs |

# Mathematics II: linear algebra IV [BDM_MATHSIV]

*LEAD PROFESSOR(S): Françoise FOUCHER*

## Requirements

## Objectives

The objective is to provide mathematical knowledge for theoretical and practical use. This course focuses on matrix linear algebra.

## Course contents

- Matrix of a linear transformation, matrix multiplication, rank of a matrix
- Determinant of a matrix, properties of determinants
- Inverse of a square matrix
- Eigenvalues and eigenvectors of a matrix, characteristic polynomial of a matrix,
- Matrix diagonalization, some applications

## Course material

- Sheldon Axler, Linear algebra done right, third edition, Undergraduate texts in mathematics, Springer, 2015.
- Erwin Kreyszig, Advanced Engineering Mathematics, 10th edition, John Wiley & Sons, 2010.
- Seymour Lipschutz, Marc Lipson, Linear algebra, 5th edition, Scaum's outline series, Mc Graw Hill, 2013.

## Assessment

Collective assessment:      EVC 1 (coefficient 0.3)

Individual assessment:      EVI 1 (coefficient 0.7)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LAB | PROJECT | EXAM |
|---|---|---|---|---|---|---|
| English | 3 | 12 hrs | 0 hrs | 12 hrs | 0 hrs | 2 hrs |

# Scientific programming [BDM_INFOIII]

*LEAD PROFESSOR(S): Hugues DIGONNET*

## Requirements

## Objectives

The goal of this course is to help students acquire skills in data manipulation and visualization, as well as problem-solving using the Numpy, Matplotlib, and Pandas libraries.

## Course contents

1) Discovering Numpy (8h)
- Introduction to Numpy
- Creating Numpy arrays and data objects
- Operations on Numpy arrays
- Random numbers and probabilities
- Matrix algebra with Numpy
- Reading and writing data files: ndarrays
- Scipy for high-level scientific computing

2) Mastering Matplotlib (8h)
- Overview
- Formatting plots
- Object hierarchy
- Axes, ticks, legends, and annotations
- Creating subplots
- Types of plots: histograms, contour plots, etc.
- Image processing with Python and Matplotlib

3) Transitioning from Numpy to Pandas (8h)
- Introduction to Pandas
- Pandas DataFrames: accessing and modifying values by group
- Reading and writing data in Pandas
- Grouping and multi-level indexing
- Data visualization
- Date and time management, time series
- Plotting with Seaborn

## Course material

## Assessment

Collective assessment:     EVC 1 (coefficient 0.3)

Individual assessment:     EVI 1 (coefficient 0.7)

# BACHELOR OF SCIENCE IN ENGINEERING

2024/2025 - Year 1 - Spring Semester - UE21

## Data structures management [BDM_INFOIV]

*LEAD PROFESSOR(S): Luisa ROCHA DA SILVA*

## Requirements

## Objectives

The objective of this course is to help students acquire the advanced notions on managing complex data structures with Python.

## Course contents

Extension of the INFO_II course on:
- Lists, tuples, aliasing, mutability, cloning
- Recursion, dictionaries
- Classes and object oriented programming, inheritance
- Searching and sorting
Advanced user defined structures:
- Arrays vs List
- Stack, Queue
- Trees
- Linked lists
- Graphs, Hash maps
Advanced memory management in Python

## Course material

## Assessment

Collective assessment:     EVC 1 (coefficient 0.3)

Individual assessment:     EVI 1 (coefficient 0.7)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LAB | PROJECT | EXAM |
|---|---|---|---|---|---|---|
| English | 3 | 12 hrs | 0 hrs | 12 hrs | 0 hrs | 2 hrs |

# Dynamics and Vibrations [BSC_DYNAMICS]

*LEAD PROFESSOR(S): Vito RUBINO*

## Requirements

## Objectives

This course is dedicated to the characterization of the motion of point masses and rigid bodies, and the influence of external forces on the kinematics.
Two main aspects are treated for both point masses and rigid bodies: (i) the kinematic description of the movement (velocity, acceleration) ; (ii) the interplay between kinematics and external forces.

At the end of this course, the students will be able to:
- analyze the kinematics of point masses and rigid bodies
- compute the velocity and acceleration of point masses and rigid bodies
- write the equations of motion of point masses and rigid bodies by making use of Newton's Laws or principles of linear and angular momentum.

## Course contents

The course will cover the following topics:
- Kinematics of point masses
- Dynamics of point masses
- Kinematics of rigid bodies
- Dynamics of rigid bodies
- Work, power and kinetic energy

## Course material

Engineering Mechanics 3, Gross, Hauger, Schröder, Wall and Govindjee. Springer

## Assessment

Individual assessment:     EVI 1 (coefficient 1)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LAB | PROJECT | EXAM |
|---|---|---|---|---|---|---|
| English | - | 10 hrs | 8 hrs | 4 hrs | 0 hrs | 2 hrs |

# BACHELOR OF SCIENCE IN ENGINEERING

2024/2025 - Year 1 - Spring Semester - UE22

## Introduction to Physics II: Electromagnetism [BSC_ELECTROMAG]

*LEAD PROFESSOR(S): Grégory LEGRAIN*

## Requirements

## Objectives

At the end of this course, the students will:
- understand the concept of electrical and magnetic fields and their interactions.
- understand the source terms at microscopic scale (charge and current)
- be able to explain Maxwell law and Lorentz force, the basic constitutive models and the simplified models (electro-static, magneto-static)
- be able to prove the existence of electro-magnetic waves
- be able to relate Maxwell laws and basic constitutive models to electric circuit models.
- be able to explain the basic physical observation in electromagnetism
(Laplace force, polarization, Foucault current, Joule effect, dispersion)

## Course contents

- Concept electric and magnetic field in void
- Maxwell universal law (local and balance expression) and Lorentz force
- The SI unit system
- Simplified models derived from Maxwell (magneto-static, electro-static, wave equation).
- From Maxwell laws to electric circuits.
- Interaction between matter and electric/magnetic/field: basic constitutive models

## Course material

Feynmann, Cours de physique à Caltech, (en anglais).
Technique de l'Ingénieur: Electromagnétisme, E1200, Christian Pichot, 1986.
Technique de l'Ingénieur: Electromagnétisme, D1020, Gérard Fournet, 1993.

## Assessment

Individual assessment:     EVI 1 (coefficient 1)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LAB | PROJECT | EXAM |
|---|---|---|---|---|---|---|
| English | - | 14 hrs | 8 hrs | 2 hrs | 0 hrs | 0 hrs |

# Electrical Engineering Basics [BSC_ELECTRIBASICS]

*LEAD PROFESSOR(S): Malek GHANES*

## Requirements

## Objectives

The objectives are to provide basis notions on electrical engineering (see the teaching plan).

## Course contents

- voltages,
- currents,
- power,
- single and three phase systems
- Electronic components : resistance, capacitance, inductance, ...
- Electronic components : diode, transistors, linear and nonlinear behaviors
- Sources (generators)
- Loads

## Course material

https://www.griet.ac.in/nodes/BEEE.pdf

## Assessment

Individual assessment:     EVI 1 (coefficient 1)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LAB | PROJECT | EXAM |
|---|---|---|---|---|---|---|
| English | - | 18 hrs | 0 hrs | 4 hrs | 0 hrs | 2 hrs |

# BACHELOR OF SCIENCE IN ENGINEERING

2024/2025 - Year 1 - Spring Semester - UE22

## Product Design Methodology [BSC_DESIGN]

*LEAD PROFESSOR(S): Tugdual LE NÉEL*

## Requirements

## Objectives

- to understand the different phases of the product design process and the different tools and method associated

## Course contents

- identification of the user need
- the design thinking approach
- axiomatic design and the design process
- the quality function deployment (QFD)
- the ideation phase – creativity  - TRIZ approach
- optimization and design of experiments
- prototype and test – user experience

## Course material

Product Design and Development. K. T. Ulrich and S. D. Eppinger. Third edition, Mc Graw Hill, Irwin.
Product Design. Eger A., Bonnema M., Lutters E., Vand der Voort M. Eleven international publishing

## Assessment

Individual assessment:     EVI 1 (coefficient 1)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LAB | PROJECT | EXAM |
|---|---|---|---|---|---|---|
| English | - | 8 hrs | 8 hrs | 8 hrs | 0 hrs | 0 hrs |

# CAD and Design - Reverse engineering [BSC_CADREVERSE]

*LEAD PROFESSOR(S): Tugdual LE NÉEL*

## Requirements

## Objectives

Use reverse-engineering software and 3D tools for digitalization.

The objective of this course is to learn about the different 3D digitalization technologies and understand the associated reverse engineering processes.

## Course contents

3 areas will be covered in the course: methods, tools and applications.
A case study will be run to compare several technologies:
1. 3D laser scanning and photogrammetry
2. Point Cloud Processing
3. CAD modeling
4. Topological comparison

## Course material

## Assessment

Collective assessment:      EVC 1 (coefficient 1)

Individual assessment:      EVI 1 (coefficient 1)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LAB | PROJECT | EXAM |
|---|---|---|---|---|---|---|
| English | - | 4 hrs | 0 hrs | 8 hrs | 0 hrs | 0 hrs |

# French language 2 [BSC_FLE2]

*LEAD PROFESSOR(S): Silvia ERTL*

## Requirements

N/A

## Objectives

The objective is to familiarize the learner with the French language and French culture through an entertaining task-based communicative language teaching, focused on speaking combined
with:
Phonetics
Self-correcting exercises online Learning Lab activities
Project work
Tutoring

## Course contents

Course objectives include the acquisition and reinforcement of vocabulary, syntax, and pronunciation by both traditional means and through the use of digital resources.
Students will learn general French, develop language skills of oral and written comprehension and expression.
Learners will be able to use the foreign language in a simple way for the following purposes:
1. Giving and obtaining factual information:
personal information (e.g. name, address, place of origin, date of birth, education, occupation)
non-personal information (e.g. about places and how to get there, time of day, various facilities and services, rules and regulations, opening hours, where and what to eat, etc.)
2. Establishing and maintaining social and professional contacts, particularly: meeting people and making acquaintances

## Course material

Full range of practical communication language exercises: reading comprehension, listening comprehension, written expression, oral expression.
Education material on our pedagogical platform

## Assessment

Individual assessment:      EVI 1 (coefficient 1)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LAB | PROJECT | EXAM |
|---|---|---|---|---|---|---|
| English | - | 0 hrs | 32 hrs | 0 hrs | 0 hrs | 0 hrs |

# German language 2 [BSC_ALL2]

*LEAD PROFESSOR(S): Silvia ERTL*

## Requirements

N/A

## Objectives

The objective is to familiarize the learner with the German language and German culture through an entertaining task-based communicative language teaching, focused on speaking combined
with:
Phonetics
Self-correcting exercises online Learning Lab activities
Project work
Tutoring

## Course contents

Course objectives include the acquisition and reinforcement of vocabulary, syntax, and pronunciation by both traditional means and through the use of digital resources.
Students will learn general French, develop language skills of oral and written comprehension and expression.
Learners will be able to use the foreign language in a simple way for the following purposes:
1. Giving and obtaining factual information:
personal information (e.g. name, address, place of origin, date of birth, education, occupation)
non-personal information (e.g. about places and how to get there, time of day, various facilities and services, rules and regulations, opening hours, where and what to eat, etc.)
2. Establishing and maintaining social and professional contacts, particularly: meeting people and making acquaintances

## Course material

Full range of practical communication language exercises: reading comprehension, listening comprehension, written expression, oral expression.
Education material on our pedagogical platform

## Assessment

Individual assessment:      EVI 1 (coefficient 1)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LAB | PROJECT | EXAM |
|---|---|---|---|---|---|---|
| German | - | 0 hrs | 32 hrs | 0 hrs | 0 hrs | 0 hrs |

# Spanish language 2 [BSC_ESP2]

*LEAD PROFESSOR(S): Silvia ERTL*

## Requirements

N/A

## Objectives

The objective is to familiarize the learner with the Spanish language and Spanish culture through an entertaining task-based communicative language teaching, focused on speaking combined
with:
Phonetics
Self-correcting exercises online Learning Lab activities
Project work
Tutoring

## Course contents

Course objectives include the acquisition and reinforcement of vocabulary, syntax, and pronunciation by both traditional means and through the use of digital resources.
Students will learn general Spanish, develop language skills of oral and written comprehension and expression.
Learners will be able to use the foreign language in a simple way for the following purposes:
1. Giving and obtaining factual information:
personal information (e.g. name, address, place of origin, date of birth, education, occupation)
non-personal information (e.g. about places and how to get there, time of day, various facilities and services, rules and regulations, opening hours, where and what to eat, etc.)
2. Establishing and maintaining social and professional contacts, particularly: meeting people and making acquaintances

## Course material

Full range of practical communication language exercises: reading comprehension, listening comprehension, written expression, oral expression.
Education material on our pedagogical platform

## Assessment

Individual assessment:      EVI 1 (coefficient 1)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LAB | PROJECT | EXAM |
|---|---|---|---|---|---|---|
| Spanish | - | 0 hrs | 32 hrs | 0 hrs | 0 hrs | 0 hrs |

# BACHELOR OF SCIENCE IN ENGINEERING

2024/2025 - Year 1 - Spring Semester - UE23

## Business English 2 [BSC_BUSEN2]

*LEAD PROFESSOR(S): Anna POLONYI*

## Requirements

## Objectives

 - to produce a high quality English CV
 - to produce a high quality English cover letter
 - to plan and prepare for a job interview in English

## Course contents

 CVs
- structure and layout
- order and content
- key cultural differences of an English CV

Cover letters
- structure and layout
- key paragraph content
- key cultural elements of an English letter

Interviews
- planning and preparing
- presenting yourself
- tactics and techniques
- types of interview questions
- what to ask

## Course material

na

## Assessment

Individual assessment:     EVI 1 (coefficient 1)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LAB | PROJECT | EXAM |
|---|---|---|---|---|---|---|
| English | - | 0 hrs | 16 hrs | 0 hrs | 0 hrs | 0 hrs |

# Professional skills 2 [BSC_SHS2]

*LEAD PROFESSOR(S): Julie BERGER*

## Requirements

None

## Objectives

The objective of this course is to give students a better understanding of the professional world in all its dimensions.
Through the various courses offered, emphasis will be placed on the relational aspects that will enable these future engineers to fit seamlessly into the corporate world.

## Course contents

- Know my values, my needs, my beliefs, my motivations and my resources.
- How I interact with the group
- The diversity of human personalities and the dynamics of relationships from several approaches evening acquaintance
- Know how to present yourself in a given context

## Course material

None

## Assessment

Individual assessment:    EVI 1 (coefficient 1)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LAB | PROJECT | EXAM |
|---|---|---|---|---|---|---|
| English | - | 0 hrs | 24 hrs | 0 hrs | 0 hrs | 0 hrs |

# Pre-professional activities 2 [BSC_PREPRO2]

*LEAD PROFESSOR(S): Grégory LEGRAIN*

## Requirements

## Objectives

The objective of this course is to provide an opening to business world through various activities.

## Course contents

- Company tours
- Professional days
- Company driven workshops
- Hackaton
- Startup challenge
- Ideation workshops
- Innovation workshops
- Industrial mentoring

## Course material

## Assessment

Individual assessment:     EVI 1 (coefficient 1)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LAB | PROJECT | EXAM |
|---|---|---|---|---|---|---|
| English | - | 0 hrs | 36 hrs | 0 hrs | 0 hrs | 0 hrs |

# BACHELOR OF SCIENCE IN ENGINEERING

2024/2025 - Year 1 - Spring Semester - UE23

## Sustainable engineering I [BSC_SUSTAIN1]

*LEAD PROFESSOR(S): Thomas CORRE*

## Requirements

## Objectives

- Raising awareness of the global challenges of ecological transition and the impacts of human activities
- Understanding the challenges of climate change: from the analysis of physical mechanisms to the governance methods put in place to face it.

## Course contents

- Introduction to the major challenges of the ecological transition. (SDGs, planetary boundaries, impacts of human activities on climate and biodiversity)
- Mechanisms and impacts of climate change
- Climate governance and institutions for sustainable development (IPCC, IPBES, COP, UN SDGs, national targets...)

## Course material

- IPBES/6/15/Add.4 Summary for Policymakers of the Assessment Report on Biodiversity and Ecosystem Services for Europe and Central Asia
- Climate Change 2021: The Physical Science Basis, the Working Group I contribution to the Sixth Assessment Report

## Assessment

Collective assessment:     EVC 1 (coefficient 1)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LAB | PROJECT | EXAM |
|---|---|---|---|---|---|---|
| English | - | 8 hrs | 0 hrs | 16 hrs | 0 hrs | 0 hrs |