



# COURSE CATALOGUE 2026-27

## ENGINEERING GRADUATE PROGRAM

# Graduate Course Catalogue

This course catalogue presents the graduate programmes and course offerings available to international exchange students at Efrei.

Exchange students are expected to complete a **full - time academic workload of 30 ECTS credits per semester** . To prepare their **Learning Agreement** , students must select a coherent study plan that includes **technical modules** together with the complementary components required for the chosen semester.

A typical semester is composed of:

- **Technical Modules (mandatory )**: Students must choose the technical courses corresponding to their level and field of study.
- **Optional Thematic Tracks**: Students may select a thematic track to deepen their knowledge in a specific area of expertise.
- **Cross- Disciplinary Training and Projects** : Courses designed to develop project management, innovation, teamwork, and interdisciplinary skills.
- **General Engineering Education** : Modules that strengthen the broader competencies expected of engineering graduates, including management, communication, ethics, and professional development.
- **Research Internship (where applicable)** : Students opting for a research internship will undertake a supervised research project within one of Efrei's research laboratories. To complete the required **30 ECTScredits** , they must also enrol in complementary technical modules as indicated in the catalogue.

Students should ensure that their course selection is approved by both their home institution and Efrei's International Office before the start of the semester.

**Please note that all courses are offered subject to availability . Efrei reserves the right to modify course offerings , schedules , teaching methods , or programme content without prior notice .**



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# Introduction

This document provides a structured overview of the courses delivered in Efrei's Engineering Graduate Programs.

## Program Objectives

- To train competent, innovative, and committed engineers who are curious about the uses of technology and who act as responsible drivers of digital transformation within organizations.
- To prepare professionals capable of working and evolving in a wide range of careers in the fields of information technology and digital technologies.
- To foster the emergence of talents who can thrive in rewarding careers both in France and internationally by combining a high level of scientific and technical education with strong managerial skills.

The Graduate Program aims to educate competent, innovative, and responsible engineers who are curious about the applications of technology and committed to driving digital transformation across industries.

The program prepares graduates to develop and evolve within a broad range of careers in computer science, digital technologies, and emerging technological sectors.

At the graduate level, 13 majors are available across 4 thematic tracks. Majors highlighted in blue are offered in English, while those in black are taught exclusively in French.

Please contact the International Relations Office to confirm whether your chosen major is available at our Bordeaux campus, as the Paris campus offers the full range of specializations.

List of 4 Tracks and majors :

### 1. Information Technology Tracks

- *Information Systems Strategy and Governance (ISSG)*
- *Software Engineering (SE)*
- *IT for Finance (ITF)*
- *Immersive technologies & Artificial intelligence (TIIA)*

### 2. Data Science Tracks

- *Data & Artificial Intelligence (DAI)*
- *Data Engineering (DE)*
- *Business Intelligence & Analytics (BIA)*
- *Bioinformatics (BIO)*

### 3. Networks and Security Tracks

- *Cybersécurité et infrastructure logicielle (CIL)*
- *Cybersécurité, SI et gouvernance (CSIG)*
- *Cybersécurité et Cloud (CC)*

### 4. Embedded Systems Tracks

- *Systèmes robotiques et drones (SRD)*
- *Transports intelligents (TI)*



# **Information Technology Track**

# Information Technology (IT) Track

## Overview

The emergence of new technologies such as **Virtual Reality** and **Cloud Computing** is transforming many professions, including those in finance and software development.

Through a set of common courses in **Year 4 - Semester 7** and four specialized majors, the **IT Track** offers students the opportunity to specialize in one of the following areas:

- Virtual Reality and Artificial Intelligence: Immersive Technologies & Artificial Intelligence (TIIA)
- Finance: IT for Finance (ITF)
- Software Development: Software Engineering (SE)
- Information Systems and Cloud Computing: Information Systems Strategy and Governance (ISSG)

The curriculum has been designed based on the competencies commonly sought across the majors of the stream during technical internships.

## Semester 7 common to all 4 majors of the track

Students must select one major elective among the 4 offered to complete 10 ECTS. Then they must complete their learning agreement by selecting courses from page 41 to totalize 30 ECTS !

| Code                                                                              | Course Title                             | Total Hours | ECTS | Assessment Weighting (%)             |
|-----------------------------------------------------------------------------------|------------------------------------------|-------------|------|--------------------------------------|
| UE71IT                                                                            | Information Technology                   | 150         | 10   |                                      |
| <b>Common Core Courses</b>                                                        |                                          |             |      |                                      |
| ST2AIM                                                                            | AI and Machine Learning for IT Engineers | 30          | 2    | LW* 50% · Project 50%                |
| ST2BDA                                                                            | Databases for IT Engineers               | 30          | 2    | Directed Exercises 50% · LW 50%      |
| ST2AWD                                                                            | Interface Development and Design         | 30          | 2    | LW 50% · Project 50%                 |
| ST2OOS                                                                            | OO Systems Development                   | 30          | 2    | Directed Exercises 50% · LW 50%      |
| <b>Information Systems Strategy and Governance (ISSG) Major Elective</b>          |                                          |             |      |                                      |
| ST2ERP                                                                            | Enterprise Resource Planning (ERP)       | 30          | 2    | LW 100%                              |
| <b>IT for Finance (ITF) Major Elective</b>                                        |                                          |             |      |                                      |
| ST2IFM                                                                            | Introduction to Financial Markets        | 30          | 2    | Directed exercises 50% · LW 50%      |
| <b>Immersive Technologies &amp; Artificial Intelligence (TIIA) Major Elective</b> |                                          |             |      |                                      |
| ST2IRV                                                                            | Introduction to Virtual Reality          | 30          | 2    | Directed exercises 60% · Project 40% |
| <b>Software Engineering (SE) Major Elective</b>                                   |                                          |             |      |                                      |
| ST2SAS                                                                            | Docker Containers                        | 30          | 2    | LW 40% · Project 60%                 |

\*LW: Laboratory Work

# Information Systems Strategy & Governance (ISSG) Major

## Program Coordinator:

Lazhar HAMEL

## Overview

The **Information Systems Strategy and Governance (ISSG)** major trains engineers who support organizations in their digital transformation initiatives. They design and orchestrate information systems strategies that address business needs while ensuring the company's operational performance.

Implementing such architectures requires the ability to understand business and organizational challenges, and to propose the technological solutions best suited to address them. Formal business process modeling, performance measurement—including energy efficiency indicators—cloud architecture design and management, and information systems security governance are among the key competencies developed for future engineers.

All courses within this major are taught in English.

## Targeted Competencies

Students will learn to:

- Identify and formulate client requirements;
- Analyze existing environments through information systems mapping;
- Propose and justify an architectural model based on private, public, or hybrid cloud solutions;
- Implement the chosen architecture by selecting the most appropriate hardware and software solutions;
- Define and deploy relevant performance indicators.

## Keywords

Information Systems, Enterprise Computing, Business Process Management (BPM), Business Process Digitalization, Cloud Computing, Information Systems Security.

## SEMESTER 8– UE81ISSG

| Code   | Module Title                                      | Total Hours | ECTS | Assessment Weighting (%) |
|--------|---------------------------------------------------|-------------|------|--------------------------|
| ST2CBD | From Relational to Non-Relational Data Management | 30          | 2    | Project 100%             |
| ST2CT  | Collaborative Tools                               | 30          | 2    | LW 50% · Project 50%     |
| ST2IOT | Internet of Things                                | 30          | 2    | Project 100%             |
| ST2KM  | Knowledge Management and the Semantic Web         | 30          | 2    | FA* 60% · Project 40%    |
| ST2MLE | AI and Machine Learning for IT Engineers          | 30          | 2    | FA 60% · Project 40%     |
| ST2MOD | Information Systems Modeling                      | 30          | 2    | FA 60% · Project 40%     |

**Semester Credits : 12 ECTS**

FA : Final Assessment

## SEMESTER 9 UE91ISSG

| Module Code | Module Title                                                 | Total Hours | ECTS | Assessment Weighting (%)        |
|-------------|--------------------------------------------------------------|-------------|------|---------------------------------|
| ST2BPM      | Business Process Management                                  | 30          | 2    | FA 100%                         |
| ST2DCCC     | Cloud Computing                                              | 30          | 2    | FA 100%                         |
| ST2IISG     | Performance Indicators for Information Systems Governance    | 30          | 2    | FA 100%                         |
| ST2ISG      | Product Management                                           | 30          | 2    | Project 50% · LW 50%            |
| ST2ISS      | Information Systems Security                                 | 30          | 2    | Directed Exercises 60% · LW 40% |
| ST2RDT      | Responsible Digital Transformation for a Sustainable Society | 30          | 2    | FA 100%                         |

**Semester Credits : 12 ECTS**

FA : Final Assessment

# Software Engineering (SE) Major

## **Program Coordinator:**

Lazhar HAMEL

## **Overview**

Software Engineering encompasses all activities related to the integration of software components and application services. It involves designing, developing, deploying, and maintaining software solutions that meet identified business requirements.

The role of a Software Engineer includes:

- Understanding, analyzing, and formalizing business requirements;
- Designing solutions based on functional specifications;
- Developing software solutions in accordance with industry best practices;
- Implementing and maintaining fully or partially automated software delivery pipelines;
- Ensuring software quality through appropriate testing procedures.

All these activities must be carried out while respecting cost, schedule, and resource constraints.

The Software Engineer is a versatile engineer with a strong background in computer science. They are capable of analyzing requirements, designing functional and technical software solutions, developing them, and deploying them effectively. As security and reliability requirements continue to increase, software development must be conducted within rigorous and proven methodological frameworks.

All courses within this major are taught in English.

## **Targeted Competencies**

Upon completion of the program, Software Engineering graduates will possess:

- A solid understanding of computer science fundamentals;
- A broad skill set and strong versatility across multiple areas of expertise;
- Mastery of established methodologies, best practices, and standardized techniques;
- The ability to solve complex technological problems;
- The ability to work effectively in teams and to plan and manage projects;
- Open-mindedness, creativity, and strong critical-thinking skills.

## **Keywords**

Software Design, Information Systems, Architectures, Services, Data, Machine Learning, Software Craftsmanship, Cloud Computing, Software Development, Algorithms, Security, DevOps, Object-Oriented Programming, Functional Programming, Quality Assurance, Web Technologies.

## SEMESTER 8-UE81SE

| Code   | Course Title                                      | Total Hours | ECTS | Assessment Weighting (%)             |
|--------|---------------------------------------------------|-------------|------|--------------------------------------|
| ST2CBD | From Relational to Non-Relational Data Management | 30          | 2    | FA 100%                              |
| ST2DCD | DevOps and Continuous Delivery                    | 30          | 2    | Directed Exercises 40% · Project 60% |
| ST2TST | Software Testing                                  | 30          | 2    | Directed Exercises 40% · Project 60% |
| ST2FUP | Functional Programming                            | 30          | 2    | Directed Exercises 40% · Project 60% |
| ST2MLE | AI and Machine Learning for IT Engineers          | 30          | 2    | Directed Exercises 60% · Project 40% |
| ST2SDM | Software Design and Modeling                      | 30          | 2    | Directed Exercises 40% · Project 60% |

**Semester Credits : 12 ECTS**

FA : Final Assessment

## SEMESTER 9- UE91SE

| Module Code | Module Title                       | Total Hours | ECTS | Assessment Weighting (%) |
|-------------|------------------------------------|-------------|------|--------------------------|
| ST2APR      | Advanced Programming               | 30          | 2    | Project 100%             |
| ST2DCE      | DevOps and Continuous Deployment   | 30          | 2    | FA 40% · LW 60%          |
| ST2DSY      | Distributed Systems                | 30          | 2    | FA 40% · Project 60%     |
| ST2SCL      | Software Engineering for the Cloud | 30          | 2    | LW 100%                  |
| ST2SCO      | Secure Coding                      | 30          | 2    | FA 40% · LW 60%          |
| ST2SSA      | Software Systems Architectures     | 30          | 2    | FA 40% · LW 60%          |

**Semester Credits : 12 ECTS**

FA : Final Assessment

# Immersive Technologies & Artificial Intelligence (TIIA) Major

## Program Coordinators:

Faten CHAKCHOUK

Daniel MAI

## Overview

The objective of this program is to train engineers capable of mastering the key concepts and tools of **immersive technologies** (Augmented Reality, Virtual Reality, and Mixed Reality) and **Artificial Intelligence (AI)**.

Students learn to design, develop, and implement immersive applications enhanced by AI, covering key competencies such as computer vision, image and video analysis, 3D modeling, and human-computer interaction. The program also addresses machine learning and deep learning algorithms for 3D environment recognition and user experience enhancement.

Through practical use cases and collaborative projects, students explore the integration of immersive technologies and AI, particularly in the fields of simulation, entertainment, industry, healthcare, and education. The program aims to develop experts capable of creating intelligent immersive environments while addressing the growing needs of these sectors.

## Targeted Competencies

Upon completion of the program, graduates will have acquired the following competencies:

- Design, development, and implementation of Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR) applications;
- Creation and manipulation of interactive and immersive environments;
- Mastery of AI fundamentals and implementation of Machine Learning, Deep Learning, and Generative AI algorithms;
- Application of AI to computer vision, image processing, object recognition, 3D scene analysis, and content generation;
- 3D modeling and object recognition within virtual environments;
- Ability to identify and monitor technological advances in the fields of AI and immersive technologies.

## Keywords

Image Processing and Analysis, Computer Vision, Virtual Reality, Augmented Reality, Mixed Reality, Unity 3D, Artificial Intelligence (AI), Generative AI, Human-Computer Interaction (HCI).

## SEMESTER 8 UE81TEIA

| Code   | Course Title                                                | Total Hours | ECTS | Assessment Weighting (%)      |
|--------|-------------------------------------------------------------|-------------|------|-------------------------------|
| ST2IAI | Pattern Recognition and Machine Learning                    | 30          | 2    | FA 50% · LW 50%               |
| ST2IHM | Virtual Reality and Human-Computer Interaction              | 30          | 2    | FA 50% · LW 25% · Project 25% |
| ST2ITI | Introduction to Image Processing                            | 30          | 2    | FA 60% · LW 40%               |
| ST2MPG | 3D Geometric Modeling                                       | 30          | 2    | LW 100%                       |
| ST2SIM | Computer Graphics                                           | 30          | 2    | FA 60% · LW 40%               |
| ST2SNE | Functional and Technical Specifications for XR Applications | 30          | 2    | LW 50% · Project 50%          |

**Semester Credits : 12 ECTS**

FA : Final Assessment

## SEMESTER 9 UE91TEIA

| Module Code | Module Title                                   | Total Hours | ECTS | Assessment Weighting (%)      |
|-------------|------------------------------------------------|-------------|------|-------------------------------|
| ST2ARVA     | Scientific and Technology Watch                | 30          | 2    | Project 100%                  |
| ST2CDJS     | Design and Development of Serious Games        | 30          | 2    | Project 50% · Tutorials 50%   |
| ST2DLRA     | Deep Learning for Computer Vision              | 30          | 2    | Project 100%                  |
| ST2RA3D     | Augmented Reality and 3D Registration          | 30          | 2    | FA 50% · Project 30% · LW 20% |
| ST2V3D      | Generative AI and Large Language Models (LLMs) | 30          | 2    | Project 50% · LW 50%          |
| ST2VAAS     | 3D Modeling and Optimization for XR            | 30          | 2    | FA 60% · LW 40%               |

**Semester Credits : 12 ECTS**

FA : Final Assessment

# IT for Finance (ITF) Major

## Program Coordinator:

Johannes GOMOLKA

## Overview

The **IT for Finance** major trains engineers capable of modeling real-world systems, implementing these models using advanced computing techniques, and analyzing the resulting outputs to gain a deeper understanding of the systems being studied. The primary systems addressed throughout the program are **financial markets**.

Financial engineers seek to understand how these markets operate in order to design investment strategies and build resilient, high-performance financial infrastructures. More broadly, students acquire the quantitative and computational methods required to analyze, size, design, and implement complex systems operating within financial markets.

In addition, financial engineers develop transferable skills in quantitative modeling, software implementation, and results analysis, enabling them to work effectively in other application domains such as telecommunications networks, transportation, energy, and civil engineering.

All courses within this major are taught in English.

## Targeted Competencies

Upon completion of the program, graduates will be able to:

- Understand the functioning of financial markets and financial products;
- Model real-world systems;
- Implement computational solutions, including programming and deployment across different platforms;
- Analyze real-world systems and mathematical models;
- Adapt quantitative and computational approaches to domains beyond financial markets.

## Keywords

Mathematical Modeling, Optimization, Statistics, Numerical Analysis, Financial Markets, Numerical Simulation, High-Performance Computing (HPC).

## SEMESTER- 8 UE81ITF

| Code   | Course Title                                                               | Total Hours | ECTS | Assessment Weighting (%)      |
|--------|----------------------------------------------------------------------------|-------------|------|-------------------------------|
| ST2IBO | Investment Banking Operations: Back Office, Middle Office and Front Office | 30          | 2    | FA 50% · LW 50%               |
| ST2CPP | Introduction to C++ in Finance                                             | 30          | 2    | FA 50% · Project 50%          |
| ST2ECN | Econophysics: Financial Modeling with Natural Science                      | 30          | 2    | FA 40% · LW 10% · Project 50% |
| ST2EFA | Empirical Financial Analysis                                               | 30          | 2    | LW 50% · Project 50%          |
| ST2FIR | Financial Risk in Modern Finance                                           | 30          | 2    | LW 50% · Project 50%          |
| ST2SPL | Scientific Programming Languages, and Linux in Finance                     | 30          | 2    | LW 50% · Project 50%          |

**Semester Credits : 12 ECTS**

FA : Final Assessment

## SEMESTER 9- UE91ITF

| Module Code | Module Title                                                  | Total Hours | ECTS | Assessment Weighting (%)      |
|-------------|---------------------------------------------------------------|-------------|------|-------------------------------|
| ST2ACPP     | Applications of C++ in Finance                                | 30          | 2    | FA 50% · Project 50%          |
| ST2AECN     | Applied Econophysics: Financial Market Analysis Using Physics | 30          | 2    | FA 40% · Project 50% · LW 10% |
| ST2DFI      | Digital Finance, Cryptocurrencies and NFTs                    | 30          | 2    | Project 50% · LW 50%          |
| ST2IEI      | Infrastructure Exchanges and Institutions                     | 30          | 2    | FA 50% · LW 50%               |
| ST2PMA      | Pricing of Derivatives, Commodities and Energy Trading        | 30          | 2    | FA 50% · LW 50%               |
| ST2POM      | Portfolio Management in Modern Finance                        | 30          | 2    | Project 50% · LW 50%          |

**Semester Credits : 12 ECTS**

FA : Final Assessment

# Data Science Track

# Data Science (DS)Track

## Overview

The volume of digital data generated worldwide has grown exponentially in recent years. These massive datasets, commonly referred to as **Big Data**, are produced at high velocity through multiple channels and in a wide variety of formats. Within these raw data lie valuable insights across numerous sectors, including healthcare, telecommunications, energy, business, security, and many others.

**Data Science** enables the extraction of this value by combining interdisciplinary skills in mathematics, computer science, artificial intelligence, and related fields. It allows organizations to turn data into actionable knowledge.

Through the various courses offered in the program, students learn how to carry out a complete Data Science project, covering all key stages: understanding business use cases, data collection, data preparation, exploratory analysis, modeling, and visualization.

## Semester 7 common to all 4 majors of the track

Students must select one major elective among the 4 offered to complete 10 ECTS. Then they must complete their learning agreement by selecting courses from page 41 to totalize 30 ECTS!

| Code   | Course Title                  | Total Hours | ECTS | Assessment Weighting (%) |
|--------|-------------------------------|-------------|------|--------------------------|
| ST2ADB | Advanced Databases            | 30          | 2    | FA 50% · Project 50%     |
| ST2AIC | Cloud Computing               | 30          | 2    | Project 100%             |
| ST2DVZ | Data Analysis & Visualization | 30          | 2    | LW 40% · FA 60%          |
| ST2ML1 | Machine Learning              | 30          | 2    | FA 60% · LW 40%          |

## Electives

| Code   | Course Title                 | Total Hours | ECTS | Assessment Weighting (%) |
|--------|------------------------------|-------------|------|--------------------------|
| ST2MDS | Mathematics for Data Science | 30          | 2    | Final Assessment 100%    |

| Code   | Course Title                | Total Hours | ECTS | Assessment Weighting (%) |
|--------|-----------------------------|-------------|------|--------------------------|
| ST2IBI | Data-Driven Decision Making | 30          | 2    | LW 40% · FA 60%          |

| Code   | Course Title                | Total Hours | ECTS | Assessment Weighting (%) |
|--------|-----------------------------|-------------|------|--------------------------|
| ST2IBI | Data-Driven Decision Making | 30          | 2    | LW 40% · FA 60%          |

# Data & Artificial Intelligence (DAI) Major

## Program Coordinator:

Malika CHARRAD

## Overview

The volume of digital data generated worldwide continues to grow exponentially. Often referred to as the “new oil” of the 21st century, data, combined with Artificial Intelligence (AI), is transforming sectors such as healthcare, business, urban planning, security, and many others.

The **Data & Artificial Intelligence (DAI)** major trains engineers capable of supporting organizations in their data-driven transformation by providing the skills needed to leverage large-scale datasets, improve decision-making strategies, enhance operational efficiency, and anticipate future trends.

The curriculum is structured around Mathematics, Artificial Intelligence, and more specifically Machine Learning and Deep Learning, while also covering regulatory frameworks and ethical considerations.

All courses within this major are taught in English.

## Targeted Competencies

Upon completion of the program, graduates will be able to:

- Apply Machine Learning methods to enterprise data;
- Implement Big Data processing and analytics solutions;
- Select appropriate Big Data technologies according to business requirements;
- Leverage data assets to create value for organizations.

## Keywords

Data Analytics, Machine Learning, Data Science, Data Engineering, Big Data, Python, Scala, Spark, Deep Learning, Artificial Intelligence.

## SEMESTER 8 UE81DAI

| Code        | Course Title                      | Total Hours | ECTS | Assessment Weighting (%)        |
|-------------|-----------------------------------|-------------|------|---------------------------------|
| ST2CXO      | Convex Optimization               | 30          | 2    | FA 60% · Directed Exercises 40% |
| ST2DLS8     | Neural Networks and Deep Learning | 30          | 2    | Final Assessment 100%           |
| ST2FPS      | Functional Programming with Scala | 30          | 2    | LW 100%                         |
| ST2ML2      | Machine Learning II               | 30          | 2    | Final Assessment 100%           |
| ST2NOS      | NoSQL Databases                   | 30          | 2    | Project 100%                    |
| ST2DLCI-DAI | Data Integration & Applications   | 30          | 2    | Final Assessment 100%           |

**Semester Credits : 12 ECTS**

FA : Final Assessment

## SEMESTER 9 UE91DAI

| Module Code | Module Title                   | Total Hours | ECTS | Assessment Weighting (%)      |
|-------------|--------------------------------|-------------|------|-------------------------------|
| ST2BDP      | Big Data Ecosystem             | 30          | 2    | LW 100%                       |
| ST2DLAI     | Natural Language Processing    | 30          | 2    | Project 100%                  |
| ST2CRS      | Chatbots & Recomender Systems  | 30          | 2    | LW 100%                       |
| ST2ML3      | Reinforcement Learning         | 30          | 2    | LW 100%                       |
| ST2MLP      | Machine Learning in Production | 30          | 2    | LW 100%                       |
| ST2DMG-DAI  | Data Management & Ethics       | 30          | 2    | Directed Exercises 50% LW 50% |

**Semester Credits : 12 ECTS**

FA : Final Assessment

# Data Engineering (DE) Major

## Program Coordinator:

Ralph BOU NADER

## Overview

In the digital age, data generation is growing exponentially. The ability to leverage data has become a strategic challenge across all sectors, including healthcare, business, urban planning, and security. Collecting, storing, processing, and securing data is now essential to transform raw information into actionable value.

The **Data Engineering** major trains professionals capable of designing, building, and maintaining robust and scalable data infrastructures. These engineers ensure that data—often heterogeneous and produced at massive scale—remain accessible, reliable, and usable throughout the organization.

The program covers all the skills required to master the data lifecycle, including data engineering and architecture, large-scale data processing and integration, as well as best practices related to security, privacy, and ethics. Its objective is to prepare students to address the technical, organizational, and regulatory challenges of the data-driven world.

## Targeted Competencies

- **Business Requirements Analysis**: Identify challenges related to the exploitation of large-scale datasets and propose appropriate solutions.
- **Infrastructure Design**: Develop and deploy architectures for collecting, preparing, and transforming data.
- **Data Enablement**: Make data accessible and usable for Data Scientists and Machine Learning specialists.
- **Performance and Scalability**: Ensure high performance and scalability of Big Data infrastructures.
- **Security and Integrity**: Guarantee data quality, integrity, and confidentiality, and publish reliable APIs for enterprise applications.

## Keywords

Big Data • ETL/ELT • CI/CD • Hadoop • Spark • Scala/Python • Data Pipelines • Real-Time Data Integration and Processing • NoSQL/SQL • Streaming • Data Governance & Security • Cloud Computing • Data Lakes • APIs & Microservices

## SEMESTER 8 - UE81DE

| Code       | Course Title                             | Total Hours | ECTS | Assessment Weighting (%)          |
|------------|------------------------------------------|-------------|------|-----------------------------------|
| ST2TADE    | Theory & Algorithms for Data Engineering | 30          | 2    | FA 70% LW 30%                     |
| ST2APIWS   | APIs and Web Services                    | 30          | 2    | Project 100%                      |
| ST2DML     | DevOps and MLOps                         | 30          | 2    | FA 40% · Project 60%              |
| ST2DLDI-DE | Data Integration & Integration           | 30          | 2    | Direct Exercises 50% Projects 50% |
| ST2MDE     | Machine Learning for Data Engineers      | 30          | 2    | Direct Exercises 100%             |
| ST2NOS     | NoSQL Databases                          | 30          | 2    | Projects 100%                     |

**Semester Credits : 12 ECTS**

FA : Final Assessment

## SEMESTER 9UE91DE

| Module Code | Module Title                                           | Total Hours | ECTS | Assessment Weighting (%) |
|-------------|--------------------------------------------------------|-------------|------|--------------------------|
| ST2ABD      | Data Engineering Applications                          | 30          | 2    | Project 50% · LW 50%     |
| ST2ADI      | Advanced Data Integration & Real-Time Data Engineering | 30          | 2    | FA 50% · LW 50%          |
| ST2BDF2     | Big Data Frameworks II                                 | 30          | 2    | FA 40% · LW 60%          |
| ST2CCBD     | Cloud Certification for Big Data                       | 30          | 2    | Project 50% · LW 50%     |
| ST2DMG-DE   | Data Management and Ethics                             | 30          | 2    | Project 50% · LW 50%     |
| ST2IOA      | Infrastructure Orchestration & Automation              | 30          | 2    | FA 50% · LW 50%          |

**Semester Credits : 12 ECTS**

FA : Final Assessment

# Business Intelligence & Analytics (BIA) Major

## Program Coordinator:

Mondher MADDOURI

### Overview

The **Business Intelligence (BI)** major trains engineers capable of designing and implementing the tools, methods, and processes required to collect, consolidate, model, and present enterprise data in order to support decision-making. These systems enable managers and executives to gain a comprehensive view of business activities while providing insight into future trends and potential market developments. Business Intelligence is the field of information technology dedicated to supporting organizational decision-makers and executives. All courses within this major are taught in English.

### Targeted Competencies

Upon completion of the program, graduates will be able to:

- Identify the business needs and challenges faced by decision-makers within organizations;
- Design and deploy Decision Support Systems (DSS);
- Collect, prepare, and transform enterprise data to feed decision-support systems;
- Model organizational data using mathematical, computational, and artificial intelligence techniques to support decision-making.

### Keywords

Decision Support Systems, Business Analyst, Data Analyst, Data Scientist, Big Data, Business Intelligence, ERP, Data Visualization, Dashboards, Reporting.

## SEMESTER 8- UE81BIA

| Code       | Course Title                       | Total Hours | ECTS | Assessment Weighting (%) |
|------------|------------------------------------|-------------|------|--------------------------|
| ST2ABI     | Business Intelligence Applications | 30          | 2    | LW 100%                  |
| ST2DMBI    | Data Mining                        | 30          | 2    | LW 40% · Project 60%     |
| ST2DME     | Data Management and Ethics         | 30          | 2    | LW 100%                  |
| ST2ERPBI   | Enterprise Resource Planning (ERP) | 30          | 2    | Project 100%             |
| ST2DSBI    | Enterprise Data Warehousing        | 30          | 2    | FA 60% · Project 40%     |
| ST2NOS-BIA | NoSQL Databases                    | 30          | 2    | Project 100%             |

**Semester Credits: 12 ECTS**

FA : Final Assessment

## SEMESTER 9UE91BIA

| Module Code | Module Title                       | Total Hours | ECTS | Assessment Weighting (%) |
|-------------|------------------------------------|-------------|------|--------------------------|
| ST2AAN      | Data Integration and Analytics     | 30          | 2    | Project 100%             |
| ST2AML      | Machine Learning for Data Analysts | 30          | 2    | FA 60% · Project 40%     |
| ST2BDPV     | 3D Data Visualization              | 30          | 2    | FA 50% · Project 50%     |
| ST2BIG      | Big Data Processing                | 30          | 2    | FA 60% · Project 40%     |
| ST2CGAI     | Chatbots & Generative AI           | 30          | 2    | LW 100%                  |
| ST2DABI     | Data Analyst Certification         | 30          | 2    | LW 100%                  |

**Semester Credits : 12 ECTS**

FA : Final Assessment

# Bio-informatics (BIO) Major

## Program Coordinator:

To be confirmed

## Overview

Digital health has experienced significant growth in recent years, driven by the need to process data generated by emerging biotechnologies and the pharmaceutical industry, particularly **multi - omics data**. As these technologies have diversified and the volume of data to be analyzed has increased, Bioinformatics has evolved into a discipline at the intersection of computer science, statistics (Big Data), biology, and medicine.

From an industrial perspective, the sector is expected to continue growing rapidly in response to advances in healthcare, particularly in personalized medicine for both diagnosis and treatment. This growth will require a new generation of specialists who understand biomedical data, digital health technologies, artificial intelligence, and who can develop innovative software solutions adapted to advances in biomedicine and computing.

## Targeted Competencies

Upon completion of the program, graduates will be able to:

- Apply Machine Learning techniques to medical data;
- Implement solutions for the processing, storage, and analysis of NGS (Next-Generation Sequencing) data;
- Design data visualizations to communicate analytical results effectively;
- Understand the various stages of Bioinformatics projects and the value they generate;
- Apply Machine Learning methods to medical datasets, including medical imaging, genomics, and clinical text data.

## Keywords

Clinical Epidemiology, Medical Terminology, Computational Biology, Genomics, Medical Imaging, Data Analytics, Python, R, Deep Learning.

## SEMESTER 8 -UE81BIO

| Code    | Course Title                                        | Total Hours | ECTS | Assessment Weighting (%) |
|---------|-----------------------------------------------------|-------------|------|--------------------------|
| ST2BDMT | Cloud Computing for Health                          | 30          | 2    | TP 40% · Project 60%     |
| ST2GEA  | Genomics, Epigenetics and Applications              | 30          | 2    | TP 40% · Project 60%     |
| ST2MIV  | Medical Image Processing and 3D Modeling            | 30          | 2    | TP 40% · Project 60%     |
| ST2MPGP | Metagenomics, Population Genetics and Phylogenomics | 30          | 2    | TP 50% · Project 50%     |
| ST2NDL  | Neural Networks and Deep Learning                   | 30          | 2    | Project 100%             |
| ST2TBS  | Biosignal Processing                                | 30          | 2    | TP 40% · Project 60%     |

**Semester Credits : 12 ECTS**

FA : Final Assessment

## SEMESTER 9 - UE91BIO

| Module Code | Module Title                            | Total Hours | ECTS | Assessment Weighting (%) |
|-------------|-----------------------------------------|-------------|------|--------------------------|
| ST2CSRE     | Cybersecurity, Regulation & Ethics      | 30          | 2    | Project 60% · TP 40%     |
| ST2CTHA     | Clinical Terminology & Human Anatomy    | 30          | 2    | Project 60% · TP 40%     |
| ST2GAIH     | Generative AI for Digital Health        | 30          | 2    | Project 60% · TP 40%     |
| ST2MRO      | Medical Robotics                        | 30          | 2    | Project 60% · TP 40%     |
| ST2SBDD     | Structural Bioinformatics & Drug Design | 30          | 2    | Project 60% · TP 40%     |
| ST2WSDH     | Web Services in Digital Health          | 30          | 2    | Project 60% · TP 40%     |

**Semester Credits : 12 ECTS**

FA : Final Assessment

**Cybersecurity  
&  
Networks Track**  
Track taught in  
French ONLY

# Cybersecurity & Networks Track

## Overview

A corporate computer network is a critical infrastructure that enables interconnection between business functions and supports the delivery of products and services. This infrastructure is currently undergoing a major transformation through the **softwarization of network functions**, including routers, intrusion detection systems (IDS), and load balancers.

At the same time, both network infrastructures and business applications are increasingly targeted by cyberattacks, which may result in partial or complete disruption of organizational activities.

Within the **Cybersecurity and Networks (SR)** stream, students develop a common foundation of competencies that supports the three majors:

- **Cybersecurity and Software Infrastructure (CIL)**
- **Cybersecurity, Information Systems and Governance (CSIG)**
- **Cybersecurity and Cloud (CC)**

Core competencies include:

- TCP/IP Protocol Suite
- Virtualization
- Network Security
- Operating System Security
- Information Systems Security
- Ethical Hacking

## Semester 7 common to all 4 majors of the track

Students must select all the modules below to complete 10 ECTS. Then they must complete their Learning agreement by selecting courses from page 41 to totalize 30 ECTS !

| Code   | Course Title                 | Total Hours | ECTS | Assessment Weighting (%) |
|--------|------------------------------|-------------|------|--------------------------|
| ST2EH  | Ethical Hacking              | 30          | 2    | FA 50% · Project 50%     |
| ST2SR  | Network Security             | 30          | 2    | FA 60% · Project 40%     |
| ST2SSE | Operating System Security    | 30          | 2    | FA 60% · Project 40%     |
| ST2SSI | Information Systems Security | 30          | 2    | FA 60% · Project 40%     |
| ST2VS  | Virtualization and Storage   | 30          | 2    | FA 50% · LW 50%          |

# Cybersecurity, Infrastructure and Software (CIL) Major

## **Program Coordinator:**

Nadjib AIT SAADI

### **Overview**

Ensuring the day-to-day security of an organization is a broad and complex challenge. Each time information technology is used to enhance existing services or deliver new ones, it also creates new opportunities for attackers with diverse motivations to access, alter, or damage sensitive information.

The costs associated with such malicious actions can be considerable, ranging from reputational damage and the loss of competitive advantages gained through decades of R&D investment to, in the worst-case scenario, the complete cessation of business activities.

In this constantly evolving environment, the Cybersecurity, Infrastructure and Software (CIL) major provides both theoretical and practical training to address cybersecurity challenges from a comprehensive perspective. The program aims to train engineers with a global vision of cybersecurity, capable of designing and implementing solutions that mitigate risks and prevent hostile attacks targeting sensitive information systems and organizational assets.

### **Targeted Competencies**

Upon completion of the program, graduates will be able to:

- Design, implement, and maintain software systems that support the organization's cybersecurity policy;
- Assess cybersecurity risks faced by organizations;
- Evaluate the human, technical, and operational resources required to reduce risks and mitigate the impact of both internal and external attacks;
- Securely manage the development and evolution of information systems.

## SEMESTER 8-UE81CIL

| Code    | Course Title                                 | Total Hours | ECTS | Assessment Weighting (%) |
|---------|----------------------------------------------|-------------|------|--------------------------|
| ST2APM  | Digital Forensics and Post-Mortem Analysis   | 30          | 2    | FA 50% · LW 50%          |
| ST2CLV  | Cloud Security and Virtualization            | 30          | 2    | FA 50% · Project 50%     |
| ST2LXA  | Advanced Linux Security                      | 30          | 2    | FA 50% · Project 50%     |
| ST2PENT | Penetration Testing                          | 30          | 2    | FA 50% · Project 50%     |
| ST2PWAD | Security Projects (Windows & Forensics)      | 30          | 2    | Project 100%             |
| ST2SWAD | Advanced Windows Security & Active Directory | 30          | 2    | FA 50% · LW 50%          |

**Semester Credits:** 12 ECTS

FA: Final Assessment

**Note:** Due to the major's **SecNumEdu accreditation**, the program elective is taken in addition to the major-specific modules.

## SEMESTER 9-UE91CIL

| Module Code | Module Title                                     | Total Hours | ECTS | Assessment Weighting (%) |
|-------------|--------------------------------------------------|-------------|------|--------------------------|
| ST2AVL      | Secure Architecture and Vulnerability Assessment | 30          | 2    | FA 50% · Project 50%     |
| ST2CDA      | Cyber Defense and Attack                         | 30          | 2    | FA 50% · LW 50%          |
| ST2EDR      | Endpoint Detection & Response (EDR)              | 30          | 2    | FA 50% · LW 50%          |
| ST2PCDA     | Security Projects (Defence & EDR)                | 30          | 2    | Project 100%             |
| ST2RGPD     | GDPR and Risk Management                         | 30          | 2    | FA 50% · Project 50%     |
| ST2SCA-CIL  | Cloud Azure Security                             | 30          | 2    | FA 50% · LW 50%          |

**Semester Credits:** 12 ECTS

FA : Final Assessment

# Cybersecurity, Information Systems and Governance (CSIG) Major

## **Program Coordinator:**

Nadjib AIT SAADI

## **Overview**

The growing number and increasing sophistication of cyberattacks targeting both public-sector organizations (ministries, local authorities, hospitals, etc.) and private-sector entities (Operators of Vital Importance (OIV), Essential Service Operators (OSE), SMEs, and mid-sized companies) have created significant societal challenges, particularly regarding the protection of personal and industrial data.

As a result, organizations require cybersecurity engineers who can address not only technical issues but also governance, risk management, and compliance with European and international regulations governing information systems security.

The Cybersecurity, Information Systems and Governance (CSIG) major aims to train engineers who master the technical, functional, governance, and regulatory dimensions of cybersecurity.

## **Targeted Competencies**

Upon completion of the program, graduates will be able to:

- Manage and oversee cyber risk;
- Conduct organizational cybersecurity audits;
- Handle cyber crises and security incidents;
- Propose, test, validate, and deploy technical solutions to secure information systems;
- Define Business Continuity Plans (BCP) and Disaster Recovery Plans (DRP) to ensure organizational resilience in the event of disruptions.

## SEMESTER 8- UE81CSIG

| Code    | Course Title                                             | Total Hours | ECTS | Assessment Weighting (%) |
|---------|----------------------------------------------------------|-------------|------|--------------------------|
| ST2ARS  | Secure Architectures                                     | 30          | 2    | FA 50% · LW 50%          |
| ST2CDO  | Data Classification                                      | 30          | 2    | FA 50% · Project 50%     |
| ST2IAM  | Identity and Access Management (IAM)                     | 30          | 2    | FA 50% · Project 50%     |
| ST2ISO  | ISO 27005 & EBIOS-RM                                     | 30          | 2    | FA 50% · Project 50%     |
| ST2PSCL | Security Projects (Secure Architecture & Cloud Security) | 30          | 2    | Project 100%             |
| ST2SCLO | Cloud Security                                           | 30          | 2    | FA 50% · LW 50%          |

**Semester Credits:** 12 ECTS

FA : Final Assessment

**Note:** Due to the major's **SecNumEdu accreditation**, the program elective is taken in addition to the major-specific modules.

## SEMESTER 9 UE91CSIG

| Module Code | Module Title                                         | Total Hours | ECTS | Assessment Weighting (%) |
|-------------|------------------------------------------------------|-------------|------|--------------------------|
| ST2CCR      | Cybercrime, Cyber Warfare, Laws and Regulations      | 30          | 2    | FA 50% · Project 50%     |
| ST2ISO1     | ISO 27001 / ISO 27003                                | 30          | 2    | FA 50% · LW 50%          |
| ST2ISO3     | Security Projects (ISO 27003 & Risk Management)      | 30          | 2    | Project 100%             |
| ST2PCA      | Risk Management & Business Continuity Planning (BCP) | 30          | 2    | FA 50% · LW 50%          |
| ST2PEN      | Penetration Testing                                  | 30          | 2    | FA 50% · Project 50%     |
| ST2VIR      | Malware and Virus Techniques                         | 30          | 2    | FA 50% · Project 50%     |

**Semester Credits:** 12 ECTS

FA : Final Assessment

# Cybersecurity and Cloud (CC) Major

## Program Coordinator:

Nadjib AIT SAADI

### Overview

The widespread adoption of cloud computing, the increasing hybridization of Information Systems (IS) within enterprises and telecommunications networks (5G), and the rapid growth of Artificial Intelligence have created new attack vectors and cybersecurity challenges.

In response to these emerging threats, traditional approaches to Information Systems security must be reconsidered to account for evolving paradigms and modern architectures.

The **Cybersecurity and Cloud (CC)** major at Efrei Paris spans the final two years of the engineering curriculum (**M1 and M2**) and aims to train cybersecurity engineers capable of addressing security challenges from a holistic perspective, particularly those related to the deployment and operation of cloud-based architectures and services.

Throughout the program, students develop expertise in:

- Security requirements analysis and specification;
- Design of secure Cloud and Hybrid architectures;
- Security auditing and penetration testing, particularly in hybrid environments;
- Automation of security tasks and testing during the deployment of cloud services, applications, and networks.

### Targeted Competencies

Upon completion of the program, graduates will be able to:

- Design and administer public, private, and hybrid cloud infrastructures aligned with organizational security policies;
- Assess cybersecurity risks affecting organizations, particularly those associated with cloud-hosted infrastructures;
- Securely manage the development and evolution of cloud infrastructures and services;
- Conduct penetration tests on hybrid and fully cloud-based environments;
- Automate security tasks and testing processes within DevOps environments.

## SEMESTER 8 - UE81CC

| Code     | Course Title                    | Total Hours | ECTS | Assessment Weighting (%)      |
|----------|---------------------------------|-------------|------|-------------------------------|
| ST2ACL   | Cloud Architecture              | 30          | 2    | FA 50% · LW 20% · Project 30% |
| ST2COR   | Container Orchestration         | 30          | 2    | FA 50% · LW 50%               |
| ST2GID   | Identity Management – IAM & PKI | 30          | 2    | FA 50% · LW 20% · Project 30% |
| ST2SOC   | SOC Overview (SIEM/EDR)         | 30          | 2    | FA 50% · LW 50%               |
| ST2PTEST | Penetration Testing             | 30          | 2    | FA 60% · Project 40%          |
| ST2SWD   | Hybrid Identity Security        | 30          | 2    | FA 50% · LW 50%               |

**Semester Credits : 12 ECTS**

FA : Final Assessment

**Note:** Due to the major's **SecNumEdu accreditation**, the program elective is taken in addition to the major-specific modules.

## SEMESTER 9 UE91CC

| Module Code | Module Title                                         | Total Hours | ECTS | Assessment Weighting (%)        |
|-------------|------------------------------------------------------|-------------|------|---------------------------------|
| ST2DSO      | DevSecOps                                            | 30          | 2    | FA 50% · Project 50%            |
| ST2GRP      | Risk Management & Business Continuity Planning (BCP) | 30          | 2    | FA 50% · Directed Exercises 50% |
| ST2MLW      | Malware Analysis                                     | 30          | 2    | FA 50% · Project 50%            |
| ST2RIF      | Incident Response                                    | 30          | 2    | FA 50% · Project 30% · TP 20%   |
| ST2SCA-CC   | Azure Cloud Security                                 | 30          | 2    | FA 50% · LW 50%                 |
| ST2SECL     | Cloud Security                                       | 30          | 2    | FA 50% · LW 50%                 |

**Semester Credits: 12 ECTS**

FA : Final Assessment

# Embedded Systems Track

Track taught in  
French ONLY

# Embedded Systems Track

## Overview

The Embedded Systems stream is an interdisciplinary program designed to provide comprehensive training in the field of embedded systems.

It prepares students, as future engineers, for the design, development, and testing of embedded systems at both the hardware and software levels.

The curriculum covers:

- **Hardware aspects**, including hardware description languages, reconfigurable architectures, and various technological platforms used as execution targets;
- **Software aspects**, including microprocessor-based system programming, compilation techniques, concurrent programming, and system modeling.

## Semester 7 is common to all 4 majors of the track

Students must select one major elective among the 4 offered to complete 10 ECTS. Then they must complete their Learning agreement by selecting courses from page 41 to totalize 30 ECTS!

| Code   | Course Title              | Total Hours | ECTS | Assessment Weighting (%) |
|--------|---------------------------|-------------|------|--------------------------|
| ST2STR | Real-Time Systems         | 30          | 2    | FA 50% · LW 50%          |
| ST2LE  | Embedded Software         | 30          | 2    | FA 50% · LW 50%          |
| ST2CN  | Digital Communications    | 30          | 2    | FA 70% · LW 30%          |
| ST2TNS | Digital Signal Processing | 30          | 2    | FA 100% ·                |

## Electives:

### Robotic Systems and Drones (SRD) Major Elective

| Code   | Course Title             | Total Hours | ECTS | Assessment Weighting (%) |
|--------|--------------------------|-------------|------|--------------------------|
| ST2ROB | Introduction to Robotics | 30          | 2    | LW 40% · Project 60%     |

### Intelligent Transportation Systems (TI) Major Elective

| Code   | Course Title                                     | Total Hours | ECTS | Assessment Weighting (%) |
|--------|--------------------------------------------------|-------------|------|--------------------------|
| ST2QSM | Quality, Safety and Modeling of Critical Systems | 30          | 2    | FA 60% · LW 40%          |

# Intelligent Transportation Systems (TI) Major

## **Program Coordinator:**

Dina FAKIH

## **Overview**

The Intelligent Transportation Systems major is dedicated to the study of embedded systems (electronic, electrical, and computing components) that form part of autonomous transportation systems, including aircraft, autonomous vehicles, autonomous rail systems, drones, and related technologies.

At a time when the automotive, aeronautics, and aerospace industries are facing the critical challenge of the ecological transition, Intelligent Transportation Systems engineers are expected to contribute to the next generation of technological breakthroughs.

## **Targeted Competencies**

Upon completion of the program, graduates will be able to:

- Analyze and process images and signals in order to perform diagnostics;
- Model automatic control systems and integrate real-time embedded constraints into processing algorithms;
- Integrate control systems into connected devices;
- Implement machine learning techniques (supervised and unsupervised) and reasoning methods to solve complex problems;
- Develop and deploy perception, localization, and navigation strategies;
- Identify threats to communication security and evaluate appropriate countermeasures.

This program combines expertise in:

- Embedded Systems: Design, Optimization, Simulation, and Validation (Hardware and Software);
- Avionics;
- Signal and Image Processing;
- Artificial Intelligence and Deep Learning.

## **Keywords**

Critical Systems, Multiphysics Modeling, Real-Time Embedded Systems, ADAS Architectures, Decision Support, Data Analytics, Big Data, Digital Twins, Artificial Intelligence and Deep Learning, Space Telecommunications, Communication Security, Remote Sensing, Future Cockpit, Augmented Reality, Autonomous Vehicle Cybersecurity, Perception, Localization, and Autonomous Navigation.

## SEMESTER 8 UE81TI

| Code    | Course Title                            | Total Hours | ECTS | Assessment Weighting (%) |
|---------|-----------------------------------------|-------------|------|--------------------------|
| ST2BDSI | Big Data and Intelligent Systems        | 30          | 2    | FA 50% · LW 50%          |
| ST2ECE  | Eco-Design for Electronics              | 30          | 2    | LW 30% · Project 70%     |
| ST2AES  | Advanced Embedded Systems               | 30          | 2    | LW 50% · Project 50%     |
| ST2SMP  | Multiphysics Simulation                 | 30          | 2    | FA 50% · LW 50%          |
| ST2RCTR | Real-Time Communication Networks        | 30          | 2    | LW 60% · Project 40%     |
| ST2VSI  | Computer Vision for Intelligent Systems | 30          | 2    | FA 60% · LW 40%          |

**Semester Credits : 12 ECTS**

FA : Final Assessment

## SEMESTER 9 UE91TI

| Module Code | Module Title                                       | Total Hours | ECTS | Assessment Weighting (%)        |
|-------------|----------------------------------------------------|-------------|------|---------------------------------|
| ST2ADAS     | ADAS and Autonomous Systems Architecture           | 30          | 2    | Directed Exercises 100%         |
| ST2AFGV     | Aircraft of the Future and Flight Management       | 30          | 2    | FA 60% · LW 40%                 |
| ST2AMCE     | Modular Avionics and Embedded Computers            | 30          | 2    | FA 60% · LW 40%                 |
| ST2IAE      | Embedded Artificial Intelligence                   | 30          | 2    | Project 50% · LW50%             |
| ST2NAPE     | Autonomous Navigation and Environmental Perception | 30          | 2    | Directed Exercises 50% · LW 50% |
| ST2SSSI     | Safety and Security of Intelligent Systems         | 30          | 2    | Directed Exercises 100%         |

**Semester Credits : 12 ECTS**

FA : Final Assessment

# Robotic Systems and Drones (SRD) Major

## **Program Coordinator:**

Laurie CONTEVILLE

## **Overview**

This major trains engineers capable of designing autonomous drones and robotic systems that interact naturally and in real time with people and within dynamic environments.

The program is multidisciplinary and combines expertise in:

- Electronics (both hardware and software aspects);
- Robotics;
- Signal processing (image and speech processing);
- Communications and communication security;
- Ambient intelligence;
- Artificial Intelligence.

These systems are intended for both consumer and industrial applications and are used in sectors such as:

- Digital Health (particularly assistive technologies);
- Security and surveillance;
- Civilian and military site monitoring;
- Defense;
- Transportation;
- Commerce;
- Internet of Things (IoT), and many others.

## SEMESTER 8 UE81SRD

| Code   | Course Title                      | Total Hours | ECTS | Assessment Weighting (%) |
|--------|-----------------------------------|-------------|------|--------------------------|
| ST2AIR | AI & ROS (Robot Operating System) | 30          | 2    | LW 50% · Project 50%     |
| ST2CC  | Control Systems Engineering       | 30          | 2    | FA 60% · LW 40%          |
| ST2ECE | Eco-Design for Electronics        | 30          | 2    | LW 50% · Project 50%     |
| ST2AES | Advanced Embedded Systems         | 30          | 2    | FA 60% · LW 40%          |
| ST2RMA | Advanced Mobile Robotics          | 30          | 2    | LW 50% · Project 50%     |
| ST2VRA | Robotic Vision and Analysis       | 30          | 2    | FA 60% · LW 40%          |

**Semester Credits : 12 ECTS**

FA : Final Assessment

## SEMESTER 9 UE91SRD

| Module Code | Module Title                        | Total Hours | ECTS | Assessment Weighting (%)        |
|-------------|-------------------------------------|-------------|------|---------------------------------|
| ST2BRI      | Industrial Robotic Arms             | 30          | 2    | Directed Exercises 50% · LW 50% |
| ST2CO       | Control and State Estimation        | 30          | 2    | FA 40% · Project 40% · LW 20%   |
| ST2IASR     | AI for Robotic Systems              | 30          | 2    | Project 50% · LW 50%            |
| ST2RFS      | RF Systems and Secure Transmissions | 30          | 2    | FA 70% · LW 30%                 |
| ST2SMRD     | Multi-Robot and Multi-Drone Systems | 30          | 2    | Project 50% · LW 50%            |
| ST2VPE      | Vision and Environmental Perception | 30          | 2    | FA 60% · Project 20% · LW 20%   |

**Semester Credits : 12 ECTS**

FA : Final Assessment

# **Cross Disciplinary Training and Projetscs**

# Innovation Project

**Program Coordinator:**  
Sophie COLLOMBET

## Overview

The Innovation Project is a **105- hour multidisciplinary** team project carried out during M1. It is structured around a professional simulation designed to mobilize all the technical and transferable skills acquired throughout the program.

Teams select a project topic following the annual call for projects and leverage both their scientific knowledge and their understanding of humanities and social sciences. Students are also required to assess the innovative dimension of their project while integrating **eco-design principles**.

The project is based on a **learning - by- experiencing approach**, supported by focused academic sessions delivered at the beginning of each project phase.

Students manage the entire project lifecycle using an appropriate project management methodology, capitalizing on the information and deliverables produced throughout the process, from initial concept to the development of a functional prototype of the proposed solution.

Teams are supported by **project management mentors** and have access to **expert consultation tokens**, enabling them to seek specialized technical expertise when needed to overcome complex technological challenges.

## Learning Objectives

- Define the project context and objectives;
- Present the project and its organizational structure;
- Formulate the project problem statement using a user-centered approach;
- Participate in thematic workshops (*STATE OF THE ART REVIEW, SKETCHNOTING, ECO-DESIGN, BUSINESS MODELS, ETC.*);
- Develop the product or service using either Agile or Waterfall methodologies;
- Attend project monitoring and mentoring sessions;
- Participate in technical expertise reviews;
- Prepare and deliver a pre-defense presentation;
- Deliver the final presentation, including a poster and a functional demonstration.

## Academic Support

Students benefit from:

- Team mentoring sessions dedicated to project management throughout the project period;
- Scientific and technical expertise to help validate specifications and overcome technological challenges encountered during prototyping;
- Business expertise for projects with entrepreneurial ambitions.

## Project monitoring and Assessment

Assessment is based on:

- Evaluation of project progress at each session through deliverables and meeting reports;
- Submission of a final report and a scientific poster;
- A final oral defense, including poster presentation and a functional demonstration before a panel of academic and scientific experts;
- Participation in the **Best Project of the Year Competition** , judged by industry professionals, who award the **Innovation Poster Prize** to the winning teams.

## Semester 8

| Code   | Course Title   | Project Hours | Total Hours | ECTS |
|--------|----------------|---------------|-------------|------|
| FP2MAS | Master Project | 80            | 105         | 10   |

# Engineering Project (capstone project)

## **Program Coordinator:**

Sophie COLLOMBET

## **Overview**

The Engineering Project is the final year project of the Engineering Program (M2) and represents 135 hours of project work.

Student teams apply for projects proposed by partner companies or by French and international research centers. Students may also submit their own project proposals, subject to approval by a review board.

This engineering-level project is carried out by multidisciplinary student teams working autonomously in an academic environment that brings together students from both the full-time student track (FISE) and the apprenticeship track (FISA).

By applying appropriate project management methodologies and collaborative working practices, teams are expected to integrate ethical, social, and environmental responsibility throughout the project lifecycle.

The program is based on a learning-by-experiencing approach, reinforced by focused academic sessions delivered at the beginning of each project phase.

Students manage the complete project lifecycle using a suitable project management methodology, capitalizing on the information and deliverables generated throughout the project and culminating in the development of a functional prototype of the proposed solution.

Teams are supported by mentors specializing in project management and have access to expert consultation tokens, enabling them to obtain specialized technical assistance whenever necessary to overcome complex technological challenges.

## **Learning Objectives**

- Define the project's context and objectives;
- Formulate the project problem statement using a user- and customer-centered approach;
- Design a solution based on a state-of-the-art review and an analysis of existing solutions;
- Manage and lead a project, including organization, teamwork, planning, risk management, and project closure;
- Develop project specifications while incorporating environmental performance indicators;
- Identify project opportunities, technical feasibility considerations, and business strategies;
- Test and validate a digital solution;
- Develop a functional prototype within its target environment;
- Prepare the final report, poster, and oral defense;
- Share and disseminate best practices.

## **Academic Support**

Students benefit from:

- Team mentoring focused on project management;
- Mandatory scientific and technical expertise sessions to help validate specifications,

## Project monitoring and Assessment

Assessment is based on:

- . Evaluation of project progress during each session through deliverables and meeting reports;
- Submission of a final report;
- A final oral defense, including a presentation and functional demonstration before a panel of academic and scientific experts;
- Participation in the **Best Project Competition**, judged by industry professionals, who award the **Engineering Awards** to the winning teams.

## Semester 9

| Module Code | Module Title        | Project Hours | Other Hours | Total Hours | ECTS | Assessment   |
|-------------|---------------------|---------------|-------------|-------------|------|--------------|
| FP2ENG-FISE | Engineering Project | 15            | 112         | 135         | 10   | Project 100% |

# General Engineering Education

# Business Sciences

## Program Coordinator:

Christine DOUTRIAUX

### Overview

As part of Efrei's educational strategy, the department trains engineers who can optimize technical solutions while taking into account the economic and managerial challenges faced by organizations, as well as user needs and expectations. The economic performance of technological solutions is considered an integral part of the engineer's skill set.

The department's curriculum is structured around **five learning pillars** :

#### **1. Understanding the Economic Ecosystem** *(1ST & 2ND YEARS OF THE ENGINEERING CYCLE)*

Students acquire the economic fundamentals necessary to understand the mechanisms that influence corporate behavior and market developments.

The program also develops business and financial literacy, enabling students to assess the impact of technical decisions on both project costs and the overall performance and profitability of an organization.

#### **2 Innovation, Marketing, and Business Models** *(2ND YEAR OF THE ENGINEERING CYCLE)*

Students are introduced to strategic analysis in innovation contexts.

The program develops expertise in concepts such as markets, business models, and product and service life cycles through strategic frameworks and analytical tools. These concepts are applied in projects focused on developing value propositions by addressing identified needs, differentiating offerings through technological innovation, and creating business value.

#### **3 Project Management** *(1ST & 2ND YEARS OF THE ENGINEERING CYCLE)*

Students learn traditional and agile project management methods and tools in order to work effectively in project environments and integrate successfully into project teams.

Particular emphasis is placed on the **QCD triangle (Quality, Cost, Delivery)**.

The curriculum also develops teamwork capabilities, project team leadership skills, and the ability to communicate project progress effectively.

#### **4 Organizations, Corporate Culture, and Management** *(THROUGHOUT THE ENGINEERING CYCLE)*

Students learn to understand organizational structures, corporate cultures, and business operations.

The program develops a systemic perspective on organizational issues that extends beyond purely technical considerations.

Students gain insight into collaboration and interaction mechanisms while developing the skills necessary to work effectively in interdisciplinary environments.

Management-related topics focus on the role of motivation, leadership, delegation, and other managerial levers in organizational performance.

#### **5 Corporate Social Responsibility** *(FINAL YEAR OF THE ENGINEERING CYCLE)*

The objective is to train engineers who:

- Understand the environmental impact of technological solutions;

# Humanities & Communication

## **Program Coordinator:**

Jean SOMA

### **Overview**

Situated at the intersection of effective communication and critical thinking—both of which directly influence the ability to manage projects and people—the Humanities and Communication Department focuses primarily on the human dimension of engineering education.

Because human-related challenges are often more complex than technical ones, the associated competencies constitute a distinctive advantage for engineering graduates.

Building upon the structured curriculum delivered during the preparatory cycle, the second-cycle program emphasizes two major educational objectives.

### **➤ Second Year of the Engineering Cycle**

The program broadens students' perspectives through topics such as:

- Storytelling and communication;
- Project pitching;
- Recruitment pitching;
- Editorial communication;
- Interviews with CSR directors;
- Decarbonization strategies.

### **➤ Final Year of the Engineering Cycle**

Students may choose from a wide range of electives offered between November and January in tutorial format, followed by a two-day seminar in February.

Topics include:

- Philosophy (authority, happiness, Artificial Intelligence, etc.);
- Gender sociology;
- Anthropology;
- European geopolitics;
- Clinical psychology;
- Semiotics of communication;
- Intercultural communication;
- Art history;
- Literature;
- Political science;
- Institutional history.

All modules combine theory with practical methods and tools designed to foster both intellectual and interpersonal development. Assessment includes written assignments, projects, and oral presentations.

## Targeted Competencies

Students will be able to:

- Express themselves clearly and structure their ideas effectively;
- Analyze complex situations;
- Contextualize and synthesize diverse sources of information;
- Formulate and frame complex issues critically;
- Integrate multiple analytical perspectives and maintain intellectual openness;
- Deliver effective public presentations;
- Adapt communication to different audiences;
- Demonstrate professional interpersonal skills, including active listening and social awareness.

# International Studies & languages

## Program Coordinator:

Katherine MORAN

## Language 1 – English

### Overview

The English curriculum aims to further develop students' written and oral communication skills while fostering greater autonomy, sophistication, and nuance in expression. Particular emphasis is placed on argumentation and critical thinking.

Students who have already achieved a high level of English proficiency may enroll in specialized thematic seminars where English serves as the medium of exploration rather than the object of study.

Available topics include:

- Trends in the Corporate World
- Issues in Global Finance
- Developing World and Emerging Economies
- Critical Thinking and Public Speaking
- Media Studies and Democracy
- Technology and Well-being
- Technology and Arts
- Technology in Cinema
- Technology and Science Fiction
- Technology and Sports

Students who have not yet achieved the required proficiency level attend General English courses focused on strengthening oral and written communication skills and preparing for the TOEIC examination.

In addition to classroom preparation, students practice independently through **GlobalExam**, an online learning platform.

### Targeted Competencies

Students will be able to:

- Identify and analyze issues related to the themes studied;
- Demonstrate an in-depth understanding of audio recordings and articles;
- Develop arguments and counterarguments in English, both orally and in writing;
- Deliver oral presentations in English.

## French as a Foreign Language (FLE)

### Overview

French as a Foreign Language (**FLE**) programs are tailored to the diverse profiles and needs of international students and students requiring additional support in French. The target audience is divided into two main groups:

#### ➤ *International Students*

International students join Efrei during the second and third years of the Engineering Cycle and follow engineering programs taught in English, specifically designed in collaboration with the International Relations Department.

These students receive FLE instruction to develop the linguistic and communicative skills necessary to function autonomously in both everyday life and professional environments in France.

Particular emphasis is placed on:

- Understanding sociocultural and professional issues in France and the French-speaking world;
- Developing practical communication skills for academic, professional, and social contexts;
- Preparing for the **DELFD(Diplôme d'Études en Langue Française)** examination.

In addition to classroom preparation, students practice independently using **GlobalExam**, an online self-learning platform.

#### ➤ *French Support Courses for Degree - Seeking Students*

Support courses are also available to students from **P1 to ING3** who require additional assistance in French.

These courses are organized according to individual student needs and are designed to address specific difficulties, such as:

- Reading comprehension;
- Written expression;
- Written accuracy and fluency;
- Academic communication skills.

Because class sizes are intentionally small and highly personalized, these support courses contribute significantly to student success.

### Targeted Competencies

Students will be able to:

- Acquire an understanding of selected aspects of French culture;
- Demonstrate comprehension of written and spoken content in French;
- Communicate effectively, both orally and in writing, in everyday and professional situations within a French-speaking environment.

# List of Courses for General Engineering Education

## Semester 7- UE77

This UE is worth 4 ECTS. Please select 4 modules to complete the Learning Agreement.

### ➤ Business Sciences

| Code    | Course Title                                                          | Hours | Coefficient | Assessment      |
|---------|-----------------------------------------------------------------------|-------|-------------|-----------------|
| FE2GFI2 | Financial Management, Economic and Financial Culture for Engineers II | 15    | 1           | DE 60% · TD 40% |
| FE2WUP  | M1 Internship Warm-Up: GP Management                                  | 15    | 1           | Project 100%    |
| FE2WUPE | M1 Internship Warm-Up                                                 | 15    | 1           | Project 100%    |

### ➤ Humanities & communication

| Code   | Course Title                   | Hours | Coefficient | Assessment                     |
|--------|--------------------------------|-------|-------------|--------------------------------|
| FH2ADD | Essay Writing Methodology      | 15    | 1           | DE 30% · Project 70%           |
| FH2CED | Editorial Communication        | 15    | 1           | Project 70% · Presentation 30% |
| FH2STC | Storytelling and Communication | 15    | 1           | Project 100%                   |

### ➤ English Language

Students must choose from the following list if they want to take English classes:

- English 7 – Capacity Building
- English 7 – Trends in the Corporate World
- English 7 – Developing World and Emerging Economies
- English 7 – Issues in Global Finance
- English 7 – Preparation for Graduate Studies Overseas
- English 7 – Media Studies and Democracy
- English 7 – Critical Thinking and Public Speaking
- English 7 – Technology and Arts
- English 7 – Technology in Cinema
- English 7 – Technology and Society
- English 7 – Technology and Sports
- English 7 – Technology and Well-being
- English 7 – Technology and the Written Word
- English 7 – Technology and Science Fiction

The coefficient for each module is 1.

# List of Courses for General Engineering Education

## Semester 7- UE77

### ➤ French as a Foreign Language

Students must choose from the following list if they want to take French classes. **The coefficient for these modules is 1 :**

- FLE7A – French as a Foreign Language
- FLE7B – French as a Foreign Language

### ➤ Professional Development

| Code   | Course Title            | Hours | coefficient | Assessment |
|--------|-------------------------|-------|-------------|------------|
| FE2ENT | Industry Guest Lectures | 15    | 1           | 100%       |

# List of Courses for General Engineering Education

## Semester 8 – UE87

This UE87 is worth 8 ECTS. Students must pick 5 modules to totalize 8 ECTS from either Business Sciences, English Language or French as Foreign Language.

### ➤ Business Sciences

| Code    | Course Title             | Hours | Coefficient | Assessment |
|---------|--------------------------|-------|-------------|------------|
| FE2BPL  | Business Plan            | 15    | 1           | 100%       |
| FE2MGMT | Management               | 15    | 1           | 100%       |
| FE2MKTG | Innovation and Marketing | 15    | 1           | 100%       |

### ➤ English Language

Students must choose from the following list if they want to take English classes. **The coefficient for each module is 1:**

- English 8 – Capacity Building
- English 8 – Critical Thinking and Public Speaking
- English 8 – Developing World and Emerging Economies
- English 8 – Issues in Global Finance
- English 8 – Media Studies and Democracy
- English 8 – Preparation for Graduate Studies Overseas
- English 8 – Technology and Arts
- English 8 – Technology and Science Fiction
- English 8 – Technology and Society
- English 8 – Technology and Sports
- English 8 – Technology and the Written Word
- English 8 – Technology and Well-being
- English 8 – Technology in Cinema
- English 8 – Trends in the Corporate World
- English Project 8 – IT Job Challenges

### ➤ French as a Foreign Language

Students must choose from the following list if they want to take French classes.

- FLE8A – French as a Foreign Language
- FLE8B – French as a Foreign Language

# List of Courses for General Engineering Education

## Semester 8 \_ UE87

### ➤ Professional Development

| Code    | Course Title    | Hours | Coefficient |
|---------|-----------------|-------|-------------|
| FG2WBM1 | Welcome Back M1 | 15    | 1           |

# List of Courses for General Engineering Education

## Semester 9 – UE97

This UE97 is worth 8 ECTS. Students must pick 4 modules to totalize 8 ECTS from either Business Sciences, Language, CSR & Sustainability, Management or Humanities.

### ➤ Business Sciences

Students must choose from the following list to complete their Learning Agreement. Business Game

- Design Thinking and Entrepreneurship
- Innovation Challenges
- Digital Transformation of Organizations
- Becoming a Freelancer: Challenges of Independent Work
- Introduction to Competitive Intelligence for Digital Engineers
- Strategic Innovation and Entrepreneurship
- From Manager to Leader, From Leader to High-Performing Team
- Managing and Leading a Startup
- CSR and Management
- Product Management
- Product Manager
- B2B Prospecting and Growth Hacking

### ➤ CSR & Sustainability

| Code   | Course Title                                         |
|--------|------------------------------------------------------|
| FG2CSR | CSR – The Social and Ecological Transition Stakes    |
| FG2RSE | CSR – Social and Environmental Transition Challenges |

### ➤ Languages

| Code        | Course Title                         |
|-------------|--------------------------------------|
| FL2CB9-FISE | English 9 – Capacity Building        |
| FL2FLE9A    | FLE9A – French as a Foreign Language |
| FL2FLE9B    | FLE9B – French as a Foreign Language |

# List of Courses for General Engineering Education

## Semester 9 - UE97

### ➤ Humanities & Social Sciences

- Social and Cultural Anthropology
- Intercultural Communication
- Critical Thinking and Artificial Intelligence
- Epistemology of Big Data
- Geopolitics of Europe
- Stress Management and Nonviolent Communication
- A History of Art
- History and Cinema
- The Humanist Engineer: Ethical Challenges
- History of Public Institutions
- A History of Philosophy
- Introduction to Sustainability Ecology
- Introduction to Archaeology
- Literature and Autofiction
- Paris and Literature
- Gender, Technology and Society
- Urban Sociology
- Semiotics of Communication
- Political Science

### ➤ Management

- Management of Distributed Teams
- Interpersonal Communication for Managers and Project Leaders
- Workplace Well-being
- Conflict Management
- Negotiation
- Product Management



# Research Internship in our Laboratory

# Internships

## Overview

Develop your research skills by joining one of our laboratory teams under the supervision of an experienced faculty researcher. This internship provides Master's students with hands-on experience in cutting-edge research projects aligned with the laboratory's strategic priorities.

## Key Information

- **Eligibility** : Master's Year 1 (M1) and Master's Year 2 (M2) students
- **Duration** : 5 to 6 months
- **Supervision** : Individual mentoring by a faculty researcher
- **Selection** : Application review and, where appropriate, an interview
- **Capacity** : Up to 10 internships available each year across the laboratory
- **Research Areas**: Projects are proposed in line with the strategic research objectives of the laboratory's research teams.

This internship is an excellent opportunity for students considering a research career or wishing to strengthen their expertise through participation in innovative scientific projects.

Students may join our research Lab and obtain 30 ECTS.

Themes and subjects on the intership can be given upon request.