Efrei Graduate Programs Catalogue 2019-20
Cycle M – FISE[1]

Version 2020.05.05

[1] Graduate Courses for Registered Students

30-32 avenue de la République
94815 Villejuif cedex • France

Tél. 01 46 77 46 77
Fax 01 46 77 46 78

Efrei Paris
association loi 1901

Table of Contents

Introduction

This catalogue offers a detailed overview of the EFREI Engineering Curriculum at the Graduate Level (cycle M): semester 7 and semester 8 (Master 1), semester 9 and semester 10 (Master 2). It incorporates the latest changes proposed by the major committees, in accordance with the training strategy developed by the Scientific Council and implemented by the Efrei Paris Programs Committee for the academic year 2019/2020.

Courses are delivered in two broad tracks: the Scientific and Technical Training track (FST) and the General Education program track (FGI). Professional training, in the form of two long internships, completes the academic program.

Scientific and Technical Training (FST)

The Scientific and Technical Training courses cover the foundational scientific and technical competencies as well as the cross-disciplinary project skills of the future engineer. Ten majors are available to students in the academic year 2019-20, and an additional 11 electives are offered in the second year of the Master's program (M2).

Efrei Paris' ten majors are as follows:

1. ***Digital Transformation & Cloud Services*** (DTCS) – In English
2. ***Business Intelligence & Analytics*** (BIA) – In English
3. ***Big Data & Machine Learning*** (BDML)- In English
4. ***Software Engineering*** (SE) - In English
5. Imaging and Virtual Reality (IRV) - In French
6. ***IT for Finance*** (IFM) - In English
7. Cybersecurity - In French
8. Robotic Systems & Drones (SRD) - In French
9. ***Networks & Cloud Infrastructure*** (NCI) - In English
10. Avionics and Space (AE)- In French

The eleven elective modules are:

1. Artificial Intelligence, Deep Learning and Applications (OUVAIDL)
2. Blockchain: Challenges and Opportunities (OUVBCO)
3. Introduction to Internet of Things (OUVIOT)
4. Security Management (OUVMSEC)
5. Web and 3D (OUVW3D)
6. Business Process Management (OUVBPM)
7. Knowledge Based Company (OUVKBC)
8. Design Thinking (OUVDT)
9. Introduction to Bioinformatics (OUVIBI)
10. Mobile Development (OUVMD)
11. Functional Programming with Scala (OUVFPS)

All students are automatically enrolled in the following interdisciplinary project modules regardless of their declared major: the Innovation Project in Master 1 and the Capstone Project in Master 2.

General Education Program (FGI)

The General Education Program includes non-scientific and technical modules, which prepare students to become successful managers, communicators, and citizens, in France or abroad. The courses cover such topics as IT careers, sectors of activity, competencies, culture, communication, and foreign languages, as well as the e-Novation seminars.

I. Scientific and Technical Training

Major: Digital Transformation and Cloud Services – DTCS

Coordinator: Jean-Charles HUET (jean-charles.huet@efrei.fr)

Program Description

The "Digital Transformation and Cloud Services" major trains engineers capable of working on the information system of any company, regardless of its sector of activity. Information systems are at the heart of companies, and they are made up of all of the computer applications that are used by company employees to do their jobs.

The Information Systems Engineer knows how to analyze an existing system, understand it, propose solutions to improve it and drive the implementation of these solutions. The IS Engineer proposes solutions in line with his/her customers' sector of activity and with the current advances in technology, such as cloud computing. They will work closely with the upper management of the company, who dictates the strategy to be put in place. The IS Engineer is then responsible for ensuring that this strategy is compatible with the company's IT systems. For large projects, he/she may be part of the project management. In this case, he/she acts as a liaison between the company, its management, its employees, and the project manager, who, as an IT specialist, determines the best solution to be applied to the company.

All DTCS major courses are offered in English.

Learning Objectives

- Design an information system while ensuring the layout of its architectural components in a harmonious and coherent way.
- Ensure the integration of the various components of the architecture and design modular and reusable components
- Bring the network and system infrastructures to a level which ensures the quality of service.
- Define operational performance indicators and ensure that the data generated by the various components are analyzed in order to steer the organization's strategy.

Career Paths

- General Contractor (IS)
- Project Manager
- Information System Architect
- Information Systems Security Consultant

Typical business that recruit: Service Industry, Large Retailers, Banks, IT service companies, Business Software Development Publishers

Key Words

Information Systems; Corporate Computing; Business Process Management (BPM); Computerized Business Operations (CBO); Cloud Computing; Information System Security

Program Details: Digital Transformation and Cloud Services

SEMESTER 7	Code	FFP[2]	ECTS[3]
Information Systems Fundamentals	**UE71ISCE**	**110,25**	**9**
Information System Modeling	ST2MOD	36,75	3
Operational Decision Making Systems	ST2ODS	36,75	3
Information System Technologies and Cloud Computing	ST2TSI	36,75	3
Communication and Interoperability	**UE73ISCE**	**108,5**	**9**
Advanced Databases	ST2BDA	36,75	3
Internet of Things	ST2IOT	35	3
Web Services	ST2WBS	36,75	3

SEMESTER 8	Code	FFP	ECTS
From Data to Knowledge	**UE81ISCE**	**110,25**	**9**
Enterprise Resource Planning	ST2ERP	35	3
Introduction to Big Data	ST2IBD	36,75	3
Knowledge Management and Semantic Web	ST2KM	36,75	3
Information Systems Applications	**UE83ISCE**	**73,5**	**6**
Collaborative Tools	ST2CT	36,75	3
Machine Learning for IT Engineers	ST2MLI	36,75	3

SEMESTER 9	Code	FFP	ECTS
Digital Transformation	**UE91ISCE**	**110,25**	**9**
Business Process Management	ST2BPM	36,75	3
Information System Security	ST2ISS	36,75	3
Architecture and IS Governance	ST2ISG	36,75	3
Cloud Services and Electives	**UE95ISCE**	**110,25**	**9**
Advanced Cloud Computing	ST2CCO	36,75	3
Cloud Integration	ST2DCCC	36,75	3
Optional Scientific Module (Elective chosen from Modules on p.3)	OUV*	36,75	3

[2] Volume of face-to-face teaching (excluding evaluations) expressed in terms of number of hours.
[3] Number of ECTS credits per module and in total for each block

Major: Business Intelligence and Analytics – BIA

Coordinator: Hanen Ochi (hanen.ochi@efrei.fr), Salim Nahle until May 2020 (salim.nahle@efrei.fr)

Program Description

The major in "Business Intelligence" trains engineers capable of designing and implementing the means, tools and methods to collect, consolidate, model and reproduce a company's data in order to assist in decision-making or in defining a strategy. Business Intelligence allows a decision-maker to have an overview of current activity while having visibility on the future and potential market developments. In sum, Business Intelligence is computer science at the service of decision-makers and business executives. Consequently, BI is embedded into the wider architecture of the information system in any company.

All BIA major courses are offered in English.

Learning Objectives

By the end of this program, the new BI Engineer will have the following skills:

- Design, configure and deploy systems which assist in decision-making and knowledge management;
- Process, exploit and leverage a company's data;
- Propose a decision-making strategy

Career Paths

- Data Scientist, Data Analyst
- Business Intelligence Consultant
- Project Manager for Decision-Making Systems
- Doctoral Studies

Key Words

Decision-Making, Data Analysis, Big Data, Knowledge Management, BI Project Management, Business Intelligence, Business Information Systems

Program Details: Business Intelligence and Analytics

SEMESTER 7	Code	FFP	ECTS
BI Fundamentals	**UE71BI**	**110,25**	**9**
Information System Modeling	ST2MOD	36,75	3
Operational Decision Making Systems	ST2ODS	36,75	3
Information System Technologies and Cloud Computing	ST2TSI	36,75	3
BI Applications	**UE73BI**	**110,25**	**9**
Advanced Databases	ST2BDA	36,75	3
Introduction to Business Intelligence	ST2IBI	36,75	3
Programming for BI	ST2PBI	36,75	3

SEMESTER 8	Code	FFP	ECTS
From Data to Knowledge	**UE81BI**	**108,5**	**9**
Enterprise Resource Planning	ST2ERP	35	3
Introduction to Big Data	ST2IBD	36,75	3
Knowledge Management and Semantic Web	ST2KM	36,75	3
Decision Process	**UE83BI**	**71,75**	**6**
Data Storage for BI	ST2DSBI	36,75	3
Advanced Business Intelligence	ST2ABI	35	3

SEMESTER 9	Code	FFP	ECTS
BI Fundamentals II	**UE91BI**	**110,25**	**9**
Advanced Machine Learning	ST2AML	36,75	3
Big Data Analytics	ST2BIG	36,75	3
Data Mining	ST2DMI	36,75	3
AI Applications and Electives	**UE95BI**	**110,25**	**9**
Artificial Intelligence for Knowledge Discovery	ST2AIK	36,75	3
Big Data Processing and Visualization: Tools and Platforms	ST2BDPV	36,75	3
Optional Scientific Module (Elective chosen from Modules on p.3)	OUV*	36,75	3

Major: Software Engineering – SE

Coordinator: Jacques André Augustin (jacques.augustin@efrei.fr)

Program Description

Software Engineering covers the full range of services related to the integration of software components and specialized application products within a larger comprehensive project. The aim is to design, develop, deploy and maintain the online components of the company's Information systems within the context of their strategic needs and/or to design, develop and maintain applications for the "general public" such as Web sites or web portals, e-commerce and so forth.

Software Engineers often have the following professional responsibilities:

- Analyzing and specifying the needs and requirements for the development of a software product or software system;
- Designing software based on the client's needs and specifications while ensuring the interest of the public and of the customers;
- Developing new software or systems based on existing software in accordance with appropriate technical and professional standards;
- Deploying adequate testing measures to guarantee that the software conforms to the stated specifications;
- Where necessary, ensuring the appropriate certification of software.

All of these activities must be carried out with a view to cost-planning and resource management.

The Software Engineer is a General Engineer with a solid Computer Science background. He/She is able to analyze a client's needs, develop functional and technical software solutions, develop, and implement them. Due to ever-increasing security and reliability concerns, these steps must be rigorously carried out in a tried and true methodological framework.

All SE major courses are offered in English.

Learning Objectives

By the end of this program, the new Software Engineer will have the following skills:

- An understanding of the fundamentals of computer science;
- Versatility and mastery of a body of knowledge;
- An understanding and mastery of standardized models and techniques;
- An ability to solve often complex technological problems;
- An ability to work in teams and to plan and manage projects;
- Openness, creativity and critical thinking.

Career Paths

The Software Engineering program opens the door to a wide variety of career paths:

- Software Designer, App Designer ;
- Development Engineer (integration or study);
- Software System Architect;
- Expert specialist in the Internet of Things, Data Management, Real-time, or Software Quality Assurance;
- Doctoral Studies.

The Software Engineer is most often a member of large project teams. The experience gained over the course of these projects will often allow the Software Engineer to move up to a Project Manager position.

Key Words

Systems and applications design, information systems architecture, specifications, modelling, development, algorithms, security, real-time, Object Technology, Web technologies.

Program Details: Software Engineering

SEMESTER 7	Code	FFP	ECTS
Software Factory I	**UE71SE**	**108,5**	**9**
C# and .NET environment	ST2CSH	35	3
Java Enterprise Edition (JEE)	ST2JEE	36,75	3
DevOps and Continuous Delivery	ST2DCD	36,75	3
System and Interoperability I	**UE73SE**	**110,25**	**9**
Application Interoperability with Web Services	ST2AIWS	36,75	3
Real-Time Systems	ST2RTS	36,75	3
U/X Design	ST2UXD	36,75	3

SEMESTER 8	Code	FFP	ECTS
Software Factory II	**UE81SE**	**108,5**	**9**
Functional Data Programming	ST2FDP	36,75	3
Front-end Web Development	ST2FWD	36,75	3
Mobile Development	ST2MOB	36,75	3
System and Interoperability II	**UE83SE**	**73,5**	**6**
Machine Learning for IT Engineers	ST2MLI	36,75	3
Advanced Databases	ST2BDA	36,75	3

SEMESTER 9	Code	FFP	ECTS
Software Factory III	**UE91SE**	**110,25**	**9**
Event-driven Asynchrone Programming	ST2EAP	36,75	3
Software Engineering for the Cloud	ST2SCL	36,75	3
Secure Coding	ST2SCO	36,75	3
Software Quality and Electives	**UE95SE**	**110,25**	**9**
Formal Modeling and Verification of Critical Systems	ST2SCV	36,75	3
Testing	ST2TST	36,75	3
Optional Scientific Module (Elective chosen from Modules on p.3)	OUV*	36,75	3

Major: Big Data and Machine Learning – BDML

Coordinator: Salim Nahle (salim.nahle@efrei.fr)

Program Description

The major in "Big Data" prepares engineers capable of helping companies "extract value" from their data. The courses include theoretical components (e.g. Statistics, Machine Learning) and practical elements (e.g. data-centric programming, distributed systems for Big Data, data visualization). Multiple case studies are included in the program. They help to understand the potential role of these techniques in the value chain of companies as well as the proposal of Big Data solutions based on the needs of different fields.

All BDML major courses are offered in English.

Learning Objectives

By the end of this program, the Big Data engineer will know how to:

- Apply machine learning methods to business data;
- Implement solutions for processing and analyzing Big Data;
- Navigate the choice of Big Data solutions based on a company's strategic needs;
- Capitalize on and leverage data to the benefit of the business.

Career Paths

- Data Scientist
- Big Data Architect
- Data Engineer
- Big Data Consultant

Key Words

Data Analysis, Machine Learning , Data science, Data engineering, Big Data, Python, Scala, Hadoop, Spark, R, Deep learning, Artificial intelligence

Program Details: Big Data and Machine Learning

SEMESTER 7	Code	FFP	ECTS
Big Data Fundamentals I	**UE71BD**	**110,25**	**9**
Machine Learning	ST2ML1	36,75	3
Applied Statistics	ST2APS	36,75	3
Distributed Algorithms	ST2DISC	36,75	3
Big Data Applications I	**UE73BD**	**110,25**	**9**
Data structuring and NoSQL databases	ST2DST	36,75	3
Hadoop stack - Hive	ST2HSH	36,75	3
Python for Data Science	ST2PDS	36,75	3

SEMESTER 8	Code	FFP	ECTS
Big Data Fundamentals II	**UE81BD**	**108,5**	**9**
Convex Optimisation	ST2CXO	36,75	3
Functional Data Programming	ST2FDP	36,75	3
Advanced Machine Learning and Text Mining	ST2ML2	36,75	3
Big Data Applications II	**UE83BD**	**73,5**	**6**
Data Visualisation and Applications	ST2DVA	36,75	3
Applications of Big Data for IoT	ST2BDIT	36,75	3

SEMESTER 9	Code	FFP	ECTS
Big Data Fundamentals III	**UE91BD**	**110,25**	**9**
Advanced Big Data Systems	ST2ABDS	36,75	3
Advanced Learning and Predictive Analytics	ST2ALPA	36,75	3
Deep Learning for AI	ST2DLAI	36,75	3
Big Data Applications III	**UE95BD**	**110,25**	**9**
Applications of Big Data	ST2APD	36,75	3
Data management	ST2DMG	36,75	3
Optional Scientific Module (Elective chosen from Modules on p.3)	OUV*		3

Major: Imaging and Virtual Reality - IRV

Coordinator: Nicolas Flasque (nicolas.flasque@efrei.fr)

Program Description

The "Imaging and Virtual Reality" major trains IT engineers capable of working on complex systems based on digital imaging, whether to process existing images, to create virtual scenes, and/or to combine the real and the virtual to generate an augmented reality. Digital image processing is a rapidly developing field. Students will learn the techniques and gain experience working with the tools used in digital simulation and animation. Likewise, they will gain an understanding of and be able to create immersive digital environments.

Learning Objectives

By the end of this program, the IRV Engineer will know how to:

- Implement image processing and synthesis tools;
- Identify and integrate the elements of an immersive environment;
- Use 3D tools and technologies;
- Demonstrate in-depth knowledge of the applications and the market for virtual and augmented reality;
- Master the mathematical foundations of Digital Imaging and 3D simulations.

Career Paths

The "Imaging and Virtual Reality" major prepares students for various technical fields and career paths such as:

- Project Leader for 3D Simulation Tools;
- Dassault Systèmes, Thalès, Total Immersion, VSM, General Electric, Car manufacturers, EDF.

The IRV Engineer is most often a member of large project teams. The experience gained over the course of these projects will often allow the IRV Engineer to move up to a Project Manager position.

Key Words

Image Processing, Computer Vision, Virtual and Augmented Reality, Computer Graphics, Real Time Systems, 3D Animation, Unity 3D, Ogre3D, 3DS Max

Program Details: Imaging and Virtual Reality

SEMESTER 7	Code	FFP	ECTS
Fundamentals of Imaging and Virtual Reality	**UE71IRV**	**110,25**	**9**
Introduction to Virtual Reality	ST2IRV	36,75	3
Mathematics for Geometry	ST2MPG	36,75	3
Introduction to Image Processing	ST2ITI	36,75	3
Technologies	**UE73IRV**	**108,5**	**9**
Application Interoperability with Web Services	ST2AIWS	36,75	3
C# and .NET Environment	ST2CSH	35	3
3D Graphics	ST2G3D	36,75	3

SEMESTER 8	Code	FFP	ECTS
Fundamentals of Imaging and Virtual Reality II	**UE81IRV**	**110,25**	**9**
Advanced Image Processing	ST2TIA	36,75	3
Big Data for Images	ST2BDI	36,75	3
Artificial Intelligence for Images	ST2IAI	36,75	3
Applications	**UE83IRV**	**73,5**	**6**
Digital Simulation for Business	ST2SNE	36,75	3
Virtual Reality & Interactions between Man and Machine	ST2IHM	36,75	3

SEMESTER 9	Code	FFP	ECTS
Fundamentals of Imaging and Virtual Reality III	**UE91IRV**	**110,25**	**9**
Computer Vision & Scene Analysis	ST2VAAS	36,75	3
Augmented Reality and 3D Registration	ST2RA3D	36,75	3
Data Visualization and Collaboration	ST2VCD	36,75	3
Additional Courses & Elective	**UE95IRV**	**110,25**	**9**
Event-driven Asynchronous Programming	ST2EAP2	36,75	3
Virtual and Augmented Reality Applications	ST2ARVA	36,75	3
Optional Scientific Module (Elective chosen from Modules on p.3)	OUV*	36,75	3

Major: IT for Finance – ITF

Coordinator: Johannes Gomolka (johannes.gomolka@efrei.fr)

Program Description

The IT for Finance major trains engineers capable of mathematically modeling real systems, constructing these models on a computer, and analyzing the results obtained in order to better understand the modeled systems. The systems that are dealt with in this program are financial markets.

The Financial Engineer seeks to understand how these markets function in order to implement investment strategies. More broadly, students in this major will learn the mathematical and computing methods that make it possible to understand, calculate the size of, and put in place complex systems, which act inside of financial markets. The Financial Engineer should also be able to easily learn how to perform mathematical modeling and computer implementation, and how to analyze results within the framework of other real systems (networks, transportation, energy, civil engineering, etc.)

All ITF major courses are offered in English.

Learning Objectives

- Mathematical modeling of real systems
- IT Implementation (programming and analysis of results on different platforms)
- Ability to analyze real systems and mathematical models
- Understanding how financial markets function
- Ability to adapt to different contexts, other than the financial sector

Career Paths

- Banks and Insurance
- Quantitative Consultant in Market Finance
- Doctoral Studies

Key Words

Mathematical modeling, optimization, statistics, numerical analysis, market finance, numerical simulation, high performance computing.

Program Details: IT for Finance

SEMESTER 7	Code	FFP	ECTS
Fundamentals of Information Technology for Finance	**UE71ITF**	**110,25**	**9**
Literature for Financial Topics	ST2EFF	36,75	3
Infrastructure Exchanges and Institutions	ST2IEI	36,75	3
Introduction to Financial Markets	ST2IFM	36,75	3
ITF Programming Skills I	**UE73ITF**	**108,5**	**9**
Application Interoperability with Web Services	ST2AIWS	36,75	3
C# and .NET environment	ST2CSH	35	3
Scientific Programming Languages	ST2SPL	36,75	3

SEMESTER 8	Code	FFP	ECTS
ITF Quantitative Skills	**UE81ITF**	**110,25**	**9**
Financial Risk	ST2FIR	36,75	3
Numerical Optimization Methods	ST2NOM	36,75	3
Numerical Analysis Applied to Finance	ST2NAF	36,75	3
ITF Programming Skills II	**UE83ITF**	**73,5**	**6**
Advanced Databases	ST2BDA	36,75	3
Advanced C++	ST2CPP	36,75	3

SEMESTER 9	Code	FFP	ECTS
Information Technology for Finance Applications	**UE91ITF**	**110,25**	**9**
Business Analytics and Big Data	ST2BAN	36,75	3
Pricing of Derivatives: Models and Algorithms	ST2PMA	36,75	3
Portfolio Management	ST2POM	36,75	3
ITF Implementation Skills and Electives	**UE95ITF**	**110,25**	**9**
Digital Finance	ST2DFI	36,75	3
Trading	ST2TRD	36,75	3
Optional Scientific Module (Elective chosen from Modules on p.3)	OUV*	36,75	3

Major: Cybersecurity - SSI

Coordinator: Nadjib Ait Saadi (nadjib.ait.saadi@intervenants.efrei.fr)

Program Description

Monitoring the security of a company's information systems on a day-to-day basis is a challenging, vast and complex undertaking. Whenever information technology is used to improve a service or provide new services, this same technology gives potential attackers, motivated by various goals, new opportunities to access, modify, or damage sensitive information. The cost to a company from such malicious attacks can be devastating and include not only reputational damage and/or a tarnished image but also possibly losing the competitive edge on important R&D projects, or worse, a complete shutdown of its operations.

In this constantly evolving context, the goal of the Cybersecurity major is to give students the theoretical knowledge and applied tools to understand the various aspects of cybersecurity in all its dimensions. The objective of this program is to produce engineers who possess a global vision of information systems security, and who are capable of designing and implementing solutions to mitigate risk and prevent hostile attacks aimed at compromising sensitive data, assets and, consequently, the daily operations of a company.

Learning Objectives

- Design, implement, and maintain software systems to support the objectives of the company's security policy.
- Assess the IT security risks faced by an organization
- Evaluate the tools, material and human resources available to reduce risk and mitigate the effects of hostile action both internally and externally.
- Securely manage the development and evolution of information systems.

Career Paths

The Cybersecurity curriculum prepares majors for multiple career options such as:

- Security Systems Development Engineer,
- Engineer/Consultant in Information Security,
- IT / IS Security Consultant,
- IT Security Expert - Pentest,
- IS Security Project Manager,
- Security and Clearances Architect,
- Security Auditor,
- CISO
- Network Engineer / System Engineer
- Doctoral Studies

Program Details: Cybersecurity

SEMESTER 7	Code	FFP	ECTS
Fundamentals of Cybersecurity I	**UE71SSI**	**110,25**	**9**
Advanced Operating Systems	ST2AOS	36,75	3
Network services, Industrialization of Security, Orchestration and IAM	ST2SER	36,75	3
Switched and Routed Networks	ST2SRN	36,75	3
Cybersecurity Applications I	**UE73SSI**	**108,5**	**9**
Introduction to Cloud Computing and Virtualization	ST2CVR	36,75	3
Ethical Hacking I	ST2ETHA1	36,75	3
Computer Security	ST2SEI	36,75	3

SEMESTER 8	Code	FFP	ECTS
Fundamentals of Cybersecurity II	**UE81SSI**	**110,25**	**9**
Big Data, Networks and Security	ST2BDNS	36,75	3
Mathematics and Applied Cryptography	ST2MAC	36,75	3
Network security	ST2NSSI	36,75	3
Cybersecurity Applications II	**UE83SSI**	**73,5**	**6**
Ethical Hacking II	ST2ETHA2	36,75	3
Wireless Networks Security	ST2SRSF	36,75	3

SEMESTER 9	Code	FFP	ECTS
Fundamentals of Cybersecurity III	**UE91SSI**	**110,25**	**9**
Advanced Defenses	ST2DEFA	36,75	3
Penetration Testing	ST2INT	36,75	3
Forensics Investigation	ST2HFI	36,75	3
Addition Courses & Optional Scientific Module	**UE95SSI**	**110,25**	**9**
Software Analysis and Vulnerability	ST2AVL	36,75	3
Security Seminar	ST2SEM	36,75	3
Optional Scientific Module (Elective chosen from Modules on p.3)	OUV*	36,75	3

Major: Avionics and Space - AE

Coordinator: Max Agueh (max.agueh@efrei.fr)

Program Description

The "Avionics and Space" major is an interdisciplinary program covering the range of "digital intelligence and services" that affect flying objects (civil and military aircraft, large drones and satellites).
Courses cover the following themes:

- Sensors
- Dedicated networks,
- Calculators
- Storage and transmission (telecommunications) of large volumes of data (Big data) in an authenticated and secure way (IOT safety)
- HMI (head high, augmented reality)
- Pilot decision support (BI)
- Predictive maintenance (digital twinning)
- Multi-physics modeling of critical systems
- Re-configurable cabin services
- Aviation standards
- Project management in the aerospace industry

All AE major courses are offered in French.

Learning Objectives

By the end of this program, the new Avionics and Space engineer will have the following skills:

- Design, Size and Deploy services dedicated to the aircraft of the future
- Develop the architecture of embedded systems compliant with aeronautics standards
- Implement secure storage and transmission architectures for large volumes of data
- Deploy pilot assistance services
- Model complex and critical systems

Career options for recent graduates

- R & D Engineer
- Aerospace software engineer
- Avionics architect
- Embedded networks and systems architect
- Embedded Systems Validation Engineer

For graduates with 3-5 years' experience

- Quality Engineer
- Operational Safety Engineer
- Security Engineer

For graduates with 6 or more years' experience

- Senior Embedded Systems Architect
- Tools and Methods Manager

Key Words

Critical systems, multi-physics modeling, real-time embedded systems, Dedicated networks, Decision-Making Assistance, Data Analysis, Big Data, Digital twinning, Spatial Telecommunications, Transmission Security, Remote Sensing, Future Cockpit, Augmented Reality.

Program Details: Avionics and Space

SEMESTER 7	Code	FFP	ECTS
Embedded Systems and Real Time	**UE71AE**	**110,25**	**9**
Digital Signal Processing and Processors	ST2DSP	36,75	3
Real-time Systems	ST2STR2	36,75	3
Hardware Architecture	ST2AMA	36,75	3
Autopilot Systems	**UE73AE**	**108,5**	**9**
Sensors and Flight Mechanics	ST2CMV	36,75	3
Labview	ST2LBV	36,75	3
Aircrafts of the Future	ST2AVF	36,75	3

SEMESTER 8	Code	FFP	ECTS
Operational Safety and Security	**UE81AE**	**110,25**	**9**
Critical Systems and Modeling	ST2SCM	36,75	3
Hardware and Data Protection	ST2PDM	36,75	3
Virtual Dashboard and access techniques	ST2TBTA	36,75	3
Data Intelligence	**UE83AE**	**73,5**	**6**
Big Data and Predictive Maintenance	ST2BDMP	36,75	3
Estimation and Decision Making	ST2ESD	36,75	3

SEMESTER 9	Code	FFP	ECTS
Avionics Architecture	**UE91AE**	**110,25**	**9**
Modular Avionics and Advanced Calculators	ST2AMCA	36,75	3
Flight Management	ST2GV	36,75	3
Quality System, Software and Product	ST2QSLP	36,75	3
Space and Electives	**UE95AE**	**103,25**	**9**
Satellite Architecture and Reconfigurable Load	ST2ASCR	36,75	3
Multi-Physics Simulation	ST2SMP	29,75	3
Optional Scientific Module (Elective chosen from Modules on p.3)	OUV*	36,75	3

Major: Robotic Systems and Drones - SRD

Coordinator: Elizabeth Colin (elizabeth.colin@efrei.fr)

Program Description

The "Robotic Systems and Drones" major trains engineers capable of designing humanoid robots and drones, in particular, autonomous systems with their intelligence embedded onboard. This multidisciplinary program combines electronics (in terms of hardware and software), robotics, signal processing (in terms of image/speech), communication processes and their security, ambient intelligence and artificial intelligence.
These systems are intended for both consumer and industrial use with multiple applications in areas such as the e-health sector (including in-home and care services,) security, civilian and military surveillance, defense, transportation, commerce, etc.

Learning Objectives

- Analyze and process images, signals, in order to perform a diagnostic test (location) and control the system (navigation).
- Model, estimate and control complex dynamic systems and integrate real-time requirements embedded into their processing algorithms.
- Implement navigation and positioning strategies.
- Develop broadband communications solutions and secure connections.
- Integrate control systems on connected objects (land-based or airborne).
- Design embedded and distributed applications for connected objects (mobile or not)
- Implement learning and reasoning methods (supervised or not) to solve complex problems

Career Paths

- Monitoring and Control Engineer
- Interaction Developer
- Robotics Engineer
- Electronic Simulation and Design Engineer
- Drone Video Engineer
- Embedded Systems Development Engineer

Program Details: Robotic Systems and Drones

SEMESTER 7	Code	FFP	ECTS
Embedded Systems and Real Time	**UE71DD**	**110,25**	**9**
Digital Signal Processing and Processors	ST2DSP	36,75	3
Real-time systems	ST2STR2	36,75	3
Hardware architecture	ST2AMA	36,75	3
Signals and control	**UE73DD**	**110,25**	**9**
Control and Energy	ST2CEN	36,75	3
Sensors and flight mechanics	ST2CMV	36,75	3
Robotic Vision	ST2VROB	36,75	3

SEMESTER 8	Code	FFP	ECTS
Robotic Systems	**UE81DD**	**110,25**	**9**
Control and Observation	ST2CEO	36,75	3
Robotics	ST2ROB	36,75	3
Vision and Scene Analysis	ST2VAS	36,75	3
Data Intelligence	**UE83DD**	**73,5**	**6**
Big Data and Embedded Technologies	ST2BDTE	36,75	3
Estimation and Decision Making	ST2ESD	36,75	3

SEMESTER 9	Code	FFP	ECTS
Advanced and Interactive Robotics	**UE91DD**	**110,25**	**9**
Artificial Intelligence for Robotics	ST2IAR	36.75	3
Autonomous Navigation and Fleet Control	ST2NC	36.75	3
AI and ROS	ST2IR	36.75	3
Telecommunication Systems	**UE95DD**	**110,25**	**9**
Vision and EMC	ST2VIC	36.75	3
RF Systems and Secure Transmissions	ST2RFS	36.75	3
Optional Scientific Module (Elective chosen from Modules on p.3)	OUV*	36,75	3

Major: Networks and Cloud Infrastructure - NCI

Coordinator: Yessin Neggaz (yessin.neggaz@efrei.fr)

Program Description

The "Networks and Cloud Infrastructure" major allows students to have a broad theoretical and practical understanding of corporate network environments including network architecture, production, daily monitoring, security, and infrastructures within the context of recent developments in Cloud Computing.

The program begins with an in-depth study of the architecture of corporate networks and their implementation in accordance with a) the technological constraints of quality of service and b) the constraints of access and data security. It then addresses the fundamental elements of current server storage and virtualization technologies as well as advanced concepts of storage virtualization and networks. The program then moves on to Cloud computing platforms in both proprietary (VMware, VCloud Suite) and Open Source (OpenStack, CloudStack) models. This part will focus on both the theoretical and practical aspects of implementation (in particular, private cloud and hybrid options with Amazon AWS). The issues of performance, diagnostics, security of virtual infrastructures and cloud will also be studied.

Learning Outcomes

By the end of this program, students will know how to

- Develop and implement secure corporate networks
- Design and deploy virtual Infrastructure
- Analyze the performance of virtual infrastructure
- Detect, diagnose and monitor technical problems of virtual platform
- Plan the migration and transition process to virtual infrastructure platforms
- Implement Cloud Computing solutions.

Career Paths

Systems and Networks Engineer, Operations Engineer, Presales Virtualization Engineer, Virtualization Infrastructure Engineer, Network Administration and System Engineer, Network Security Engineer, Vmware Engineer, Citrix Engineer, Hyper-V Engineer, Capacity Planning Engineer, Storage Engineer, Data Center Engineer, R & D Engineer, Doctoral Studies

Program Details: Networks and Cloud Infrastructure

SEMESTER 7	Code	FFP	ECTS
Networks	**UE71NV**	**110,25**	**9**
Cross-Technology Convergent Networks	ST2ACN	36,75	3
Scripting and Monitoring	ST2SMO	36,75	3
Switched and Routed Networks	ST2SRN	36,75	3
Security and Virtualization	**UE73NV**	**110,25**	**9**
Cryptography and Network Security	ST2CNS	36,75	3
Introduction to Cloud Computing and Virtualization	ST2CVR	36,75	3
Advanced Operating Systems	ST2AOS	36,75	3

SEMESTER 8	Code	FFP	ECTS
Modern Networks	**UE81NV**	**110,25**	**9**
Quality of Service	ST2QSV	36,75	3
Cloud Foundations (AWS Certification)	ST2CF	36,75	3
Big Data & Artificial Intelligence for Network and Security	ST2BDNS	36,75	3
Network and System Administration	**UE83NV**	**73,5**	**6**
Windows Administration	ST2WINA	36,75	3
Linux Administration and Network Services	ST2LINA	36,75	3

SEMESTER 9	Code	FFP	ECTS
Cloud Infrastructure	**UE91NV**	**110,25**	**9**
Infrastructure as a Service (IaaS)	ST2IAAS	36,75	3
PaaS and IaaS: Performance and diagnostics	ST2PERF	36,75	3
Virtualization Automation and Scripting	ST2VAS	36,75	3
Cloud Security and Network Virtualization	**UE95NV**	**110,25**	**9**
Cloud Security and White Hacking	ST2CSWH	36,75	3
Software-Defined Networks & Network-Function Virtualization	ST2AVC	36,75	3
Optional Scientific Module (Elective chosen from Modules on p.3)	OUV*	36,75	3

Major: Renewable Energies and Smart Grids

Coordinator: Catherine Maréchal (catherine.marechal@efrei.fr)

Program Description

The challenges of climate change and the recent directives of the European Commission to encourage the development of renewable energy sources will have a significant impact on transportation and distribution networks (particularly for electricity, gas and heating). Tomorrow's energy management will increasingly be carried out at the city, regional, country, and the continental level. Smart electrical and gas networks, as well as heating networks, must integrate new information technologies (data processing from intelligent sensors). This digital integration makes it possible to ensure, in real time, the balance between supply and demand in energy requirements, while ensuring the stability and safety of the distribution network.

The goal of this major is to train engineers who will be able to work in the field of renewable energies. Thanks to the skills they have acquired in Artificial Intelligence and real-time computing, and their knowledge of renewable energies and Smart Grids, students in this major will collaborate with energy specialists to develop software to control Smart Grids. They will also provide the specialists with recommendations on how to improve energy networks. In addition, students will work with energy providers to develop services for customers (private individuals, towns, and businesses).

All courses in this major are conducted in French.

Learning Outcomes

By the end of this program, students will know how to

- Develop solutions for processing energy data and analyze the results to propose recommendations to energy specialists
- Construct algorithms in appropriate programming languages, while making good use of existing software building blocks
- Deploy the software designed on the company's IT platforms and supervise the change in software
- Participate in the roll-out of new energy networks
- Ensure quality by securing the installations of sensors and actuators and securing the data collected (GDPR)

Career Paths

- Smart Grids Project Manager
- Research Engineer
- Data Analyst
- IT Developer
- Consultant for the digital transformation of the energy sector

Program Details: Renewable Energies and Smart Grids

(Program is currently being developed and course details may be modified)

SEMESTER 7	Code	FFP	ECTS
Energy I			
Physics For the Energy Sector			
Energy in the World I			
Electric Smart Grids			
Digital Technology I			
Mathematics for Data Scientists			
Digital Communications			
Data Science for Smart Grids			

SEMESTER 8	Code	FFP	ECTS
Digital Technology II			
Digital Networks			
Advanced Databases			
Machine Learning			
Energy II			
Energy in the World II			
Smart Building, Smart Home			

SEMESTER 9	Code	FFP	ECTS
Energy Applications and Cybersecurity			
Smart Cities and Electric Mobility			
Cybersecurity			
TBA			
Digital Technology III			
Deep Learning			
Business Intelligence for the Energy Sector			
Optional Scientific Module – *Blockchain recommended* (Elective chosen from Modules on p.3)			

Major: Bio-Informatics

Coordinator: Mano Mathew (mano.mathew@efrei.fr)

Program Description

The field of Bio-Informatics has rapidly developed over the course of the last several years, due to the need to process data from new biotechnologies (multiomics data). Given the diversity of these new technologies and the mass of data to be processed, Bio-Informatics has become a field in its own right, at the crossroads of Information Technology, statistics (Big Data), biology, and medicine. At the industrial level, the field will continue to grow in order to respond to advances in the health sector (personalized medicine at the diagnostic and therapeutic level). With these changes, the Bio-Informatics field will need new experts who understand the data, tools, and current challenges of the field, and who are capable of developing new software adapted to the technological advances in biomedicine and computer science.

Large companies such as Google, Illumina, IQVIA, and IBM Watson have already positioned themselves in this field, as they understand that it is a major issue today.

Courses in this major are conducted in English and French.

Learning Outcomes

By the end of this program, students will know how to

- Apply machine learning methods to medical data
- Implement NGS data processing, storage and analysis solutions
- Create data visualizations to communicate the results of data analysis
- Understand the different steps of Bio-Informatics projects and the added value of such projects

Career Paths

- Bioinformatician
- Biostatistician
- Data Scientist/Computational Biologist
- Bioinformatics Project Manager
- R&D Engineer

Program Details: Bio-Informatics

(Program is currently being developed and full details will be announced shortly)

SEMESTER 7	Code	FFP	ECTS
Fundamentals of Bio-Informatics I	**UE71BIO**		
Biostatistics and Epidemiology	ST2BEP		
Programming for Bioinformaticians	ST2PGB		
Cloud Computing and DevOps	ST2DOC		
Applications for Bio-Informatics I	**UE73BIO**		
Genomics, Epigenetics, and Application	ST2GEA		
Big Data Framework for Health	ST2HBD		
Medical Terminology and Coding	ST2MTC		

SEMESTER 8	Code	FFP	ECTS
Fundamentals of Bio-Informatics II	**UE81BIO**		
Metagenomics, Population Genetics, and Phylogenomics			
High-Performance Computing (HPC) and Algorithms for Bioinformaticians			
AI for the Health Sector			
Applications for Bio-Informatics II			
IoMT and Applications			
Medical Image Analysis and Data Visualization			

SEMESTER 9	Code	FFP	ECTS
Optional Scientific Module (Elective chosen from Modules on p.3)			

Optional Scientific Modules

Coordinator: Dario Vieira (dario.vieira@efrei.fr)

Program Description

The optional Scientific Modules are a group of theme-based scientific and technical electives open to all students in semester 9A, regardless of their declared major. Each thematic course explores the primary issues related to the area of focus in 35 hours of face-to-face class time. There are no prerequisites required.

Program Details: Scientific Modules

SEMESTER 9	Code	FFP	ECTS
Artificial Intelligence, Deep Learning and Applications	OUVAIDL	36,75	3
Blockchain: Challenges and Opportunities	OUVBCO	36,75	3
Business Process Management	OUVBPM	36,75	3
DevOps and Continuous Delivery	OUVDCD	36,75	3
Design Thinking	OUVDT	35	3
High Performance Computing	OUVHPC	36,75	3
Introduction to Big Data Bioinformatics	OUVIBI	36,75	3
Internet of Things	OUVIOT	36,75	3
Knowledge Based Company	OUVKBC	36,75	3
Mobile Development	OUVMOB	36,75	3
Security Management	OUVMSEC	36,75	3
Functional Programming with Scala	OUVPFS	36,75	3
Critical Systems, Reliability of Systems	OUVSCFS	36,75	3
Web and 3D	OUVW3D	36,75	3

II. Interdisciplinary Training and Projects

Innovation Projet

Coordinators: Benoît Charroux (benoit.charroux@efrei.fr) / Andreas Topp (andreas.topp@efrei.fr)

As part of the Innovation project, students work in teams throughout the first year of the Masters program (M1). The year-long project provides students with the opportunity to experience:

- The entire lifecycle of a project (from the needs analysis to market research and up to the development of a prototype)
- The practical usage of a project management method (Scrum, an agile software development framework)
- The process of preparing a business plan
- The management of a project's human resources
- The application of quality management and testing methods
- The preparation of documents related to the project
- The presentation and defense of a project

This project includes the following three-fold supervision and guidance framework:

- Business support to help the project team launch a market study, imagine and develop a product or a service adapted to the market and establish a complete business plan (finance, marketing ...)
- Technical support for project management as well as assistance in developing a prototype
- Coaching workshops, and team support

Monitoring and Project Evaluation:

- Regular meetings with coaches and supervisors during the different stages of the project
- Continuous evaluation throughout the project's lifecycle (at each meeting and during the submission of deliverables)
- A contest for the best project of the year is held during the school's annual *Innovation Day* where selected projects are judged by a jury composed of representatives from the business community

Program Details: Innovation Project

SEMESTER 7	Code	FFP	ECTS
Innovation Project	**UE76**	**54,25**	**4**
Coaching : Team Support	FT2AEQ	5,25	0
Business Plan	FT2BPL	10,5	0
Methodology and Technical Monitoring	FT2MTD	10,5	0
Innovation Project Monitoring	FT2PJT	10.5	2
Project Management	FT2GPJ	17,5	1

SEMESTER 8	Code	FFP	ECTS
Modern Networks	**UE86**	**36,5**	**2**
Coaching: Team Support	FT2AE2	15,5	1
Business Plan II	FT2BP2	3.5	0
Innovation Day	FT2INNO	3.5	0
Methodology and Technical Monitoring II	FT2MT2	7	0
Innovation Project Monitoring	FT2PJ2	7	3

Capstone Project - Technology Innovation and Intelligence

Coordinator: Benoît Charroux (benoit.charroux@efrei.fr)

Project Description

The Capstone Project (PFE) takes place in the second year of the graduate engineering program (M2). As part of this project, students must demonstrate their ability to carry out a project conducted by a team of engineers. This project must contain two essential components common to all types of professional projects: management skills and technical aspects. The management component includes team management, project planning, and monitoring. This component must be carried out in accordance with the lifecycle of the product, which includes three classic steps: identifying needs, specifications, and analysis. The nature of the technical component depends upon the type of project that the students choose to carry out and may include programming, administrative services and comparative research tools. Students may choose to undertake projects related to a variety of professional domains. Besides the project work, the Capstone Project includes a course on "Managing an R&D Project."

Learning Outcomes

The Capstone Project aims to develop engineers who will be able to:

- Demonstrate an ability to characterize an innovation and identify technological barriers
- Secure financing for a project
- Direct and lead an R&D project by defining its phases and sourcing its teams

Program Details

SEMESTER 9	Code	FFP	ECTS
Capstone Project: Technology Innovation and Intelligence I	**UE96A**	**24,5**	**2**
Capstone Project: Technology Innovation and Intelligence I	ST2PFE1	24.5	1
Capstone Project: Technology Innovation and Intelligence II	**UE96B**	**7**	**2**
Capstone Project: Technology Innovation and Intelligence II	ST2PFE2	7	1

III. General Education Program

IT Careers

Coordinator: Agnès Béhar (agnes.behar@efrei.fr)

Program Description

In a constantly evolving world that is full of dynamic challenges such as the globalization of financial markets and the ever-increasing pace of technological advances, companies are looking for young graduates who are able to understand today's issues, not only through a technical lens, but also on an economic and human level. Therefore, it is essential that all Efrei Paris students combine their technical expertise with professional skills.

The career courses help students become quickly operational in their professional field and ready them for a career path aimed at gaining positions of responsibility.

Learning Outcomes

By the end of this program, students will be able to:

- Develop the managerial skills that will allow them to lead projects in a complex environment
- Manage difficulties and priorities
- Summarize and analyze various types of information
- Construct their professional future
- Become proactive and forward thinking
- Develop their creativity

Key Words

Innovation Challenges, Development of a Commercial Proposal, Management Simulation, the Foundations of Entrepreneurship, Strategic audit, Marketing and Innovation, Risk Management, IT Marketing, Financial Risk Management, Leading change in a changing world, Business Case Studies, e-business, Customer Relations

1. Business Engineer Track

Students who have chosen this path will move towards careers aimed at developing lasting commercial relationships with clients. This involves anticipating a client's needs, drawing up a proposal in accordance with these needs, and supporting the sales teams.

Career Opportunities

- Customer Services Manager
- Sales Representative
- Sales Application Engineer
- Client-Side Project Manager
- Large Account Manager
- Market Research Manager

Key Strengths

- Active learning: students complete the design and implementation of a scope of work provided by one of Efrei's business partners. This project is supervised by Efrei teachers. Student teams present their proposals to the school's business partners who select the best project.

- An internship in the Marketing or Commercial Sales sector is an excellent complement to the coursework in this track.

2. Entrepreneurship Track

Given that the creation of a business is often linked to technological innovation, many students decide to take courses exploring entrepreneurship. The courses offered under this theme allow students to acquire management skills tailored to the specific context of entrepreneurship.

Career Opportunities

- Entrepreneur
- Profit Center Manager
- Business Unit Manager
- Subsidiary Manager

Key Strengths

- For students who create their own start-up, the Engineering Internship can be fulfilled by the development of the start-up
- Active learning: students complete the design and implementation of a scope of work provided by one of Efrei's business partners. Efrei teachers supervise this project. Student teams present their proposals to the school's business partners who select the best project.
- Students can earn a double master's degree in entrepreneurship from EM Grenoble
- Long-term support: as the first years of starting a new business are always difficult, Efrei accompanies and assists entrepreneurs after graduation through several actions:
  - Coaching for Alumni Entrepreneurs. They also have the possibility of obtaining a scholarship which offers them free space in Efrei's business incubator
  - *Access to Efrei's partnership with the technology incubator IncubAlliance*

3. International Project Manager Track (en)

The goal of the International Project Manager track is to make students aware of the challenges and implications of working in a globalized world. The track will prepare students to become "business developers" who are ready to carry out actions on an international and global scale.

Career Opportunities

- Profit Center Manager
- Business Unit Manager
- Subsidiary Manager

Key Strengths

- Instructors have experience in consulting, management, project coordination, and creating subsidiaries at the international level
- All courses are taught in English
- Student diversity: more than 50% of the students enrolled in this track are international students

4. Consultant Track

New information and communication technologies (NICTs) are the central nervous system of all companies and the economic world in general. Due to the constant evolution of these new technologies, companies must often work with consulting firms in order to stand out from their competitors, adapt to market fluctuations and to be able to better anticipate such changes. Students who choose to pursue this track will develop the methodologies and skills that will allow them to design

and implement organizationally transformative projects, based on a new way of envisioning the flow of information.

Career Opportunities

- Consultant
- Research Engineer
- Methods Engineer

Key Strengths

Active learning: students complete the design and implementation of a scope of work provided by one of Efrei's business partners. Efrei teachers supervise this project. Student teams present their proposals to the school's business partners who select the best project.

5. Innovation and Strategy Track (en)

In a globalized world, innovation and research are at the heart of corporate growth strategies. The research and innovation manager must be able to meet the strategic challenges facing the company and ensure the practical implementation of projects. The objectives of this course are a) to acquire the skills necessary to manage the innovation process and b) to elaborate strategies to master the challenges related to technological management.

Career Options

- Innovation Project Manager
- New Market Development Manager
- Marketing Representative
- Business Development Representative
- Profit Center Manager

Key Strengths

- Active learning: students complete the design and implementation of a scope of work provided by one of Efrei's business partners. Efrei teachers supervise this project. Student teams present their proposals to the school's business partners who select the best project.
- There is the possibility for students to earn a double master's degree in technology and innovation management from EM Grenoble.

6. Expert Track

The expert helps clients choose and implement new tools, which requires sharp skills. He/she advises the client on the choice of solutions to be implemented to improve the business process. Depending on his/her specialization, the expert directs the client towards product lines or methods that correspond to the company's needs. Expertise in infrastructure or virtualization, for example, requires highly specialized knowledge that is often the result of intense personal effort and which will allow the engineer to become a reference in his/her field. Expert status can also be acquired through experience in the implementation of specific projects or solutions, as well as via certification programs offered by publishers and manufacturers in specific areas such as software or infrastructure development.

Key Strengths

Case studies done in teams and led by professionals

7. Research and Development Track (en)

This course will help students become familiar with research methods and understand the constraints and conditions associated with such methods. The content focuses on developing documentary research skills, refining the capacity to evaluate, synthesize and present research findings, recognizing the stakes and issues related to research projects, and integrating concepts dealing with intellectual property rights and scientific ethics.

Career Opportunities

- R&D Engineer
- Innovation Management Consultant
- R&D Project Manager
- Doctoral Studies

Key Strengths

Current issues in direct connection with Efrei's research laboratory

Culture and Communication

Coordinator: Jean Soma (jean.soma@groupe-efrei.fr)

Program Description

At the intersection of the art of communication and the art of management (projects and people), the courses in the Culture and Communication Department focus on the human dimension of an IT engineer's education. This is perhaps a more complex aspect for students to grasp than the technical dimensions of their training.

In this sense, the courses at the graduate level have two primary objectives: the first is to raise students' awareness of communication issues that arise in corporate culture; the second is to open students up to the world outside of their usual frames of reference through the exploration of philosophy, psychoanalysis, literature, etc.

These two educational objectives rely on various materials, tools and methods that promote the assimilation of both content (e.g. theories) and practice (e.g. behavior).

Therefore, the courses, most notably the seminars (18 hours), are primarily comprised of applied studies, such as simulations, games, case studies, project-based learning, coaching workshops, personalized monitoring of the "Development Project" teams, etc.

Learning Outcomes

By the end of this program, students will be able to

- Master the expression, the structuring and the formulation of ideas
- Demonstrate intellectual flexibility and an ability to interpret information from different angles
- Master public speaking
- Work effectively in a team, including multicultural groups: autonomy, adaptability, and an ability to integrate oneself into the group
- Effectively analyze and summarize information
- Lead or facilitate meetings
- Function as an educator while taking the lead on proposals and innovation
- Demonstrate social, cultural and emotional intelligence (mastery of social codes, openness, ability to listen, etc.)

Key Words

General culture, corporate culture, tools and methods of communication, interpersonal communication, project stakeholders, conflict management, communication and consulting, organizations, team building, leading meetings, economics, epistemology, philosophy, psychology, psychoanalysis and management, sociology, job interview, soft skills, writing professional documents, public speaking, rhetoric

International Relations and Languages

Coordinator: Christiane Michel (christiane.michel@efrei.fr)

Foreign Language 1 English

At the Master's level, the English foreign language program aims to improve the oral communication and writing skills of our engineering students and to promote a greater degree of autonomy and sophistication in their expression. Students who have already attained an advanced level of English have the opportunity to select thematic seminars where English language is no longer the object of the study but the vehicle through which to explore the proposed course topic. The seminars offered address the following themes: English Business Communication, Development in Asian countries, technological innovation and creativity, introduction to finance, social networks, and media, among others. For students who have not yet reached a sufficient level in English, a general English course is offered to help reinforce their oral and written skills and prepare them for the TOEIC exam.

Foreign Language 2

The study of a second foreign language is optional for graduate students but is strongly encouraged. Learning a second language enhances students' general culture, allowing them to develop a broader worldview and opening up study and work opportunities for them in non-English speaking countries. The languages taught are Spanish, German, Chinese and Japanese.

The courses are taught to groups of students with the same linguistic level. Classes are taught in the "target" language via a communicative approach that best replicates the process of acquiring one's native language.

French As A Foreign Language (FLE)

The French as a Foreign Language (FLE) Program is offered to Efrei's international students. The international student population at Efrei can be divided into two categories: 1) students who speak French at an advanced level and are doing their studies in French, and 2) students who are doing their studies in English and need to improve their French for everyday life and/or professional reasons. The content of this program is specifically tailored to the needs of these two different groups of students. However, in both cases, emphasis is placed on the development of cultural, academic and professional skills to better facilitate academic and professional integration.

Participation in Student Life (PAVE)

Coordinators: Roxane Chevallier (roxane.chevallier@efrei.fr), Annick Fitoussi (annick.fitoussi@efrei.fr), Stéphanie Soetemondt (stephanie.soetemondt@efrei.fr)

Program Details

Participation in student life, or the PAVE, is an integral part of the curriculum because it helps students to:

- Expand student worldview
- Network with and integrate into the corporate world
- Build their professional and personal profiles
    - The PAVE program provides students the opportunity to learn about and effectively exploit social and professional registers while enhancing their social, cultural and emotional intelligence.

In terms of skills to acquire and develop, the PAVE experience is fully consistent with the following:

- General Education Engineer Training program
- Working in Project models
- The evolution of the company's expectations in terms of recruitment in France and internationally

You can contribute the following 4 activities:

- Be active in Group communication
- Participate in student life activities
- Be a student representative
- Participate in activities with the Cultural and Equality Diversity Department

You will develop intercultural skills including, but not limited to, the following:

- Rigor and organizational skills
- Be proactive and take the initiative
- Teamwork
- Interpersonal skills, listening and respecting others

Program Details

SEMESTER 7	Code	FFP	ECTS
General Education Options	**UE77**		**8**

PARTICIPATION IN STUDENT LIFE			
PAVE Semester 7	PAVE		1

SEMESTER 8	Code	FFP	ECTS
General Education Options	**UE87**		**3**

PARTICIPATION IN STUDENT LIFE			
PAVE Semester 8	PAVE		1

Program Details Recap

SEMESTER 7	Code	FFP	ECTS
General Education Options	**UE77**	**98**	**8**
Law and Ethics			
Information Society Law	FE2DE1	19,25	1
IT Law and Ethics	FE2DE2	19,25	1
Professional Project			
Professional Project I	FE2PP1	15,75	1
Human and Social Sciences			
Communication with Professional Stakeholders	FH2CAP1	17,5	1
Effectively Lead Meetings	FH2RAE	17,5	1
Anglais et FLE (Electives)			
English 7 - Capacity Building	FL2CB7	19,25	1
English 7 - Trends in the Corporate World	FL2CW7	19,25	1
English 7 - Developing World and Emerging Economies	FL2DW7	19,25	1
English 7 - Issues in Global Finance	FL2GF7	19,25	1
English 7 - Preparation for Graduate Studies Overseas	FL2GS7	19,25	1
English 7 - Media Studies and Democracy	FL2MS7	19,25	1
English 7 - Critical Thinking and Public Speaking	FL2PS7	19,25	1
English 7 - Technology and Arts	FL2TA7	19,25	1
English 7 - Technology in the Cinema	FL2TC7	19,25	1
English 7 - Technology and Society	FL2TS7	19,25	1
French Foreign Language 7A	FL2FLE7A	19,25	1
French Foreign Language 7B	FL2FLE7B	19,25	1

Management : IT Careers (Electives)			
Business Consultant	METCON1	19,25	1
Project Manager – Quality in Project Management	METCP1	19,25	1
Entrepreneurship: The Basics of Starting Your Own Business	METENT1	19,25	1
Expert in Technology Intelligence	METEXP1	19,25	1
Business Engineer: Business Case Study	METIA1	19,25	1
Innovation: Marketing and Innovation	METINN1	19,25	1
International Project Manager: International Marketing	METIPM1	19,25	1
PAVE			
Participation in Student Life	PAVE	0	1

Semester 8	Code	FFP	ECTS
General Education Options	**UE87**		**3**
Professional Project			
Professional Project II	FE2PP2	8,75	1
Human and Social Sciences			
Science History and Techniques	FH2HST	7	1
Anglais et FLE (Electives)			
English 8 - Capacity Building	FL2CB8	19,25	1
English 8 - Trends in the Corporate World	FL2CW8	19,25	1
English 8 - Developing World and Emerging Economies	FL2DW8	19,25	1
English 8 - Issues in Global Finance	FL2GF8	19,25	1
English 8 - Preparation for Graduate Studies Overseas	FL2GS8	19,25	1
English 8 - Media Studies and Democracy	FL2MS8	19,25	1
English 8 - Critical Thinking and Public Speaking	FL2PS8	19,25	1
English 8 - Technology and Arts	FL2TA8	19,25	1
English 8 - Technology in the Cinema	FL2TC8	19,25	1
English 8 - Technology and Society	FL2TS8	19,25	1
French Foreign Language	FL2FLE8A	19,25	1
French Foreign Language 8B	FL2FLE8B	19,25	1
Trades II & III (Electives)			
Consultant: Management Simulation USPTRAT-FI	METCO2	19,25	1
Consultant: Strategic Audit	METCO3	19,25	1
Entrepreneurship: Management Simulation UPSTRAT-INOBIKE	METENT2	19,25	1
Entrepreneurship: Entrepreneurial Leadership	METENT3	19,25	1
Expert: Management Simulation USPTRAT-FI	METEXP2	19,25	1
Expert: Change Management	METEXP3	19,25	1

Business Engineer – Business Managament Simulation UPSTRAT-INOBIKE	METIA2	19,25	1
Business Engineer – Development of a Business Proposal	METIA3	19,25	1
Innovation - Business Simulation Winexpert (English)	METINN2	19,25	1
Innovation - Managing Innovation	METINN3	19,25	1
International Project Management - Business Simulation Winexpert (English)	METIPM2	19,25	1
International Project Management - International Project Management	METIPM3	19,25	1
Project Manager – Management Simulation UPSTRAT-INOBIKE	METCP2	19,25	1
Project Manager – Creativity and Agility	METCP3	19,25	1
PAVE			
Participation in Student Life	PAVE		1

Semester 9	Code	TOTAL	ECTS
General Education Options	**UE97A**		**4**
Professional Project			
Professional Project III	FE2PP3	14	
Culture and Communication Electives			
Communication for Impact	FH2CIM	17,5	1
Interpersonal Communication	FH2CIP	17,5	1
Corporate Social Responsibility	FH2CSR	17,5	1
Stress Management and Non-Violent Communication	FH2GSC	17,5	1
Humanity in Engineering : Ethical Issues	FH2HEE	17,5	1
Efficient Communication Process	FH2PCE	17,5	1
Being Active in Your Own Hiring	FH2REC	17,5	1
Seminars : Management and Development			
Customer Relation Management	ME5CO	19,25	1
Leading Change in a Changing World (En)	ME5IA	19,25	1
Risk Management	ME5IN	19,25	1
Financial Product	ME5MA	19,25	1
Data Protection : Principals and Law	ME5PDP	19,25	1
Quality Management	ME5QM	19,25	1
Workplace Risks : Challenges and Prevention	ME5RTEP	23,25	1
Management : From a Start-Up to an Established Business	ME5SEM	19,25	1
English (Reinforcement) and French (optional)			
English 9 - Capacity Building	FL2CB9	17,5	1
French Foreign Language 9	FL2FLE9A	17,5	1

General Education Options	UE97B		4
Seminars : « E-novation »			
E-novation - Digital Strategy	FE2EN1	19,25	1
E-novation - E-reputation	FE2EN2	19,25	1
E-novation - E-reputation	FE2EN13	19,25	1
E-novation – Digital Strategy	FE2EN3	19,25	1
E-novation – Web Technology Trends and Developments	FE2EN6	19,25	1
E-novation - E-Marketing	FE2EN12	19,25	1
E-novation - Data Storytelling	FE2EN10	19,25	1
E-novation - Innovation challenges (En)	FE2EN14	19,25	1
E-novation – Management Digitalisation	FE2EN11	19,25	1
E-novation - UX Design et web ergonomics	FE2EN15	19,25	1
E-novation - Data Driven Marketing	FE2EN9	19,25	1
Seminars : Globalized World			
Globalized World: International Entrepreuneurship Management	ME4CO	19,25	1
International Business Strategy	ME4E	19,25	1
Geopolitics and Strategy	ME4GS	19,25	1
Geopolitics and Strategy	ME4IA	19,25	1
Economic Intelligence and Technology Intelligence	ME4IN	19,25	1
International Financial Markets	ME4MA	19,25	1
Intercultural Management	ME4MI	19,25	1
Cross-Cultural Management	ME4PM	19,25	1
Technology and Market Projection	ME4PTM	19,25	1
Artificial Intelligence and Transhumanism	ME4AIT	19,25	1
Seminars : Human and Social Sciences			
Communicating with Project Stakeholders	FH2CAP2	17,5	1
Editorial Communication	FH2CED	17,5	1
Interpersonal communication	FH2CIP	17,5	1
Tools for a Public Relations Consultant	FH2COC	17,5	1
Economics Terminology	FH2ECO	17,5	1
Conflict Management	FH2GCF	17,5	1
Relational Intelligence	FH2IR	17,5	1
Discovering Behavioral Preferences (MBTI)	FH2MBTI	17,5	1
Psychoanalysis and Management	FH2PSM	17,5	1
La revanche de l'analogique – The Revenge of the Analogue ?	FH2RA	17,5	1
Being Active in Your Own Hiring	FH2REC	17,5	1
French Foreign Language 9B	FL2FLE9B	17,5	1

Corporate Social Responsability			
Corporate Social Responsibility (French)	FG2RSE	5,25	1
Corporate Responsibility (English)	FG2CSR	5,25	1
Research Methods			
Research Methods (French)	FG2MR	19,25	1
Research Methods (English)	FG2RM	19,25	1

Professional Training

Coordinators: Laurence Jouitteau (laurence.jouitteau@efrei.fr), Isabelle Manchin (isabelle.manchin@efrei.fr)

Program Description

Professional training consists of the following two obligatory internships:

- M1 students: technical internship in semester 8 (a minimum of 20 weeks)

- M2 students: final-year internship during semester 10 (a minimum of 26 weeks)

Program Details

SEMESTER 8	Code	FFP	ECTS
Technical Training M1	**UE108**		**10**
Technical Internship	ST104		1

SEMESTER 10	Code	FFP	ECTS
Professional Training M2	**UE109**		**30**
Final-year Internship	ST105		1

Sectors

Coordinator: Agnès Béhar (agnes.behar@efrei.fr)

Program Description

Information and communication technologies are an integral component of the management of a company's activities and are widely applied across various sectors of economic activity. These electives were developed with the aim of giving students in-depth knowledge of the technical, scientific and economic aspects that make up the character of the area of activity under study. Courses cover three major elements:

1. The fundamental engineering techniques and business expertise of business relating to each sector and the current state of play.
2. The role of ICT (information and communications technology) in the different business processes of the particular sector.
3. The economic, geopolitical, organizational and managerial environment of the particular sector.

Learning Outcomes

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

- Apply fundamental theoretical knowledge and practical techniques pertinent to the area of activity under study;
- Display a deep understanding of economic, geopolitical, organizational and administrative environments of the area of activity under study;
- Recognize the impact and place of the information technologies essential to the activity of various companies found within the area of activity under study.

Key Words

Sustainability, Energy, Transport, New Media and video games, Internet and Telecommunications, Finance and Bank Insurance

Program Details

SEMESTER 9B	Code	FFP	ECTS
Economy and Sectors (Electives)	**UE97B**		**4**
Sectors: Corporate Social Responsibility	SECDD6	19.25	1
Sectors: Finance and Bank Insurance	SECFB6	19.25	1
Sectors: New Media and Video Games	SECMJ6	19.25	1
Sectors: Healthcare	SECSA6	19.25	1
Sectors: Telecommunication & the Internet	SECTI6	19.25	1
Sectors: Transportation	SECTR6	19.25	1