



## **Training: Computer Engineering**

### **Private Higher International School Polytechnic of Sousse (EPI)**

Computer engineering training has an orientation or development council:

- Total number of members: 12
- Number of representatives from the economic world: 4
- Frequency of meetings: 2 to 4 meetings per semester

#### **1. Presentation of the sector: Training objectives**

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The aim of the Computer Engineering training at the École Internationale Supérieure Privée Polytechnique de Sousse (EPI) is to train future engineers capable of taking responsibility for large-scale projects in the areas of “software development”, “software development”. Internet of Things and Robotics”, “Virtual Reality and Game Development”, “Cyber Security and Cryptography”, “Artificial Intelligence and Data Sciences” and “Cloud Computing and Networks”.

The student thus begins his training at the EPI with two semesters of common core, at the end of which he has the possibility of choosing between 6 areas of specialization. The specialty training thus lasts 4 semesters, the last semester being reserved for the end-of-studies project.

The areas of specialization are as follows:

- Software Engineering: Software engineering is a field that encompasses the principles, techniques and methods used to develop reliable, efficient and scalable software. It concerns the entire software development process, from defining requirements to continuous maintenance and improvement, including programming, project management and testing.

It is essential to emphasize that the applications of software engineering are varied and virtually unlimited. They can be designed specifically for the information system of a specific company (web,

mobile and desktop), image and video processing, games, applications linked to artificial intelligence, health, or yet to the Internet of Things (IoT). In addition, the development of such applications requires the mastery of multiple skills by the software engineer, such as modeling and object-oriented programming, web development, native mobile development, hybrid development, design patterns, virtualization and cloud services, software testing, DevOps processes, business intelligence, Machine Learning, Deep Learning, as well as soft skills and interpersonal communication.

- Artificial Intelligence: The Artificial Intelligence and Data Science course offers an in-depth exploration of the concepts, tools and applications of AI and data science. It combines theoretical courses with practical training, emphasizing the acquisition of technical skills and solving real-world problems. Students work on concrete projects throughout the course to apply their knowledge in real-world contexts.

This course aims to provide students with a complete immersion in the fields of Artificial Intelligence (AI) and Data Science. To achieve this, the program is designed to balance theory and practice. Theoretical courses provide a solid foundation in fundamental concepts, while hands-on training allows students to implement these concepts in real-world projects.

Theoretical courses cover a wide range of topics, from the basics of AI and data science to advanced techniques such as machine learning and natural language processing. This provides students with an in-depth understanding of the principles underlying these technologies, as well as the skills needed to apply them effectively.

The practical component of the course is essential to allow students to develop their skills and put them into practice. They are regularly confronted with concrete projects which reflect the challenges encountered in the professional world. This allows them to develop their ability to solve real-world problems using AI and data science techniques, while developing their skills in programming, data analysis and solution design.

By working on these projects, students gain valuable experience that prepares them to enter the workforce with the skills and confidence to succeed in roles related to AI and data science.

The Artificial Intelligence and Data Science pathway offers a balanced combination of theory and practice, allowing students to gain an in-depth understanding of AI and data science concepts and tools, while developing their practical skills at through concrete projects

- Cybersecurity: The Cybersecurity course offers an in-depth exploration of the concepts, tools and applications of IT and network security. It combines theoretical courses with practical training,

emphasizing the acquisition of technical skills and solving real-world problems. Students work on concrete projects throughout the course to apply their knowledge in real-world contexts.

This course aims to provide students with a complete immersion in the areas of digital attacks and intrusions as well as information protection techniques, mechanisms and approaches. To achieve this, the program is designed to balance theory and practice. Theoretical courses provide a solid foundation in fundamental concepts, while hands-on training allows students to implement these concepts in real-world projects.

Theoretical courses cover a wide range of topics, from the basics of security to advanced techniques such as firewall administration and intrusion detection systems. Students gain an in-depth understanding of the principles underlying these technologies, as well as the skills needed to apply them effectively.

The practical component of the course is essential to allow students to develop their skills and put them into practice. They are regularly confronted with concrete projects which reflect the challenges encountered in the professional world. This allows them to develop their ability to solve real-world problems using network and systems security techniques, while developing their skills in advanced networking and systems administration on physical servers or in the Cloud.

By working on these projects, students gain valuable experience that prepares them to enter the job market with the skills and confidence needed to succeed in Security Expert, Information Systems Manager (CISO) roles. or Information Systems Directors (DSI).

The Cybersecurity track offers a balanced combination of theory and practice, allowing students to gain an in-depth understanding of concepts and tools related to advanced network administration, and the administration of information security solutions, while developing their practical skills through concrete projects.

- Cloud computing and networks: The cloud is a collection of hardware, network connections and software that provides sophisticated services that individuals and communities can exploit at will from anywhere in the world

Cloud computing is a changing trend: instead of obtaining computing power by purchasing hardware and software, the consumer uses power made available by one or more providers via the Internet.

The Cloud and Network Engineer is in charge of the deployment, storage, management and migration of data on virtual solutions. A specialist in programming and data centers, he supports companies in their dematerialized digital transformation.

This specialization therefore aims to train engineers specialized in the design, implementation and management of infrastructure and IT solutions based on the Cloud. This results in varied missions: analysis of the data storage system and audit, selection of the most appropriate Cloud services, creation of scalable architectures, etc. All this by relying on technologies like AWS, Microsoft Azure, Google Cloud Platform, etc.

Thanks to training where theoretical aspects are combined with the practical aspects of the profession, students will be able to understand the fundamental concepts of cloud computing, master cloud computing technologies, develop skills in cloud design and architecture, acquire skills in cloud development and deployment, become familiar with security and compliance in the cloud, learn to manage and optimize cloud resources...

- IoT and Robotic Programming: The computer engineer track specializing in Internet of Things (IoT) and robotics programming, is a deep dive into technological areas that are rapidly changing the way we interact with the physical world. This specialized work goes beyond basic computer science concepts and focuses specifically on the design and development of connected systems and smart materials for robotics.

The computer engineer course specializing in IoT & Robotic Programming offers comprehensive training that prepares students to meet the technical and conceptual challenges associated with building intelligent and interconnected computer systems. Through a combination of theoretical learning, practical work and real-world projects, students develop the skills needed to succeed in this ever-changing industry.

This program aims to train versatile and competent IT engineers, capable of responding to the technological challenges arising from the omnipresence of connectivity and increasing automation. Students are prepared to design and deploy innovative solutions suitable for diverse sectors such as manufacturing, healthcare, smart cities and agriculture. Emphasis is placed on developing practical skills, solving complex problems and the ability to quickly adapt to changing technologies.

This course aims to provide students with the knowledge and skills necessary to navigate a world where IoT devices and robots are increasingly present. Engineers from this program will be able to design interconnected computer systems and intelligent robots that meet the specific needs of various industries. They will be able to identify opportunities for innovation and develop appropriate technological solutions, while taking into account performance, security and sustainability requirements.

With a focus on developing practical skills, this path provides students with real-world experience in the design, development and deployment of IoT and robotics solutions. Hands-on projects and laboratory work allow students to develop a deep understanding of emerging technologies and improve their ability to solve real-world problems. Additionally, by encouraging adaptability and the

ability to adjust to rapid changes in the field, this program prepares students to succeed in an ever-changing professional environment.

In summary, this course aims to train highly qualified IT engineers, ready to take on the technological challenges of tomorrow in the fields of IoT and robotics, with an emphasis on practice, innovation and 'adaptability.

- Virtual reality and game engineering: The Computer Engineer course, specializing in Virtual Reality and Game Engineering, aims to train computer engineers specialized in the design, development and management of innovative systems and applications in the fields of reality virtual (VR), augmented reality (AR) and video games.

The Virtual Reality and Game Engineering engineer plays a key role in the development of innovative and immersive solutions. His responsibilities include designing and modeling 3D environments, developing interactive features, programming game mechanics, performance optimization, testing, and troubleshooting technical issues. He works closely with designers, artists and other team members to create exceptional user experiences.

With this in mind, this course offers students complete and in-depth training in IT, with a particular focus on technologies related to virtual reality and video games. Technical skills acquired include proficiency in programming languages such as C++, C#, Python and Java, as well as gaming frameworks and engines such as Unity, Unreal Engine and Three.js. Students also develop skills in 3D design, animation, artificial intelligence, data processing, IT security and project management.

In the landscape of "IT Engineer" training in Tunisia, the EPI offer stands out by:

- Its suitability for business needs;
- Its marked orientation towards professional practice;
- The high supervision rate from which students benefit.

## **2. Professions Reference**

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One of the objectives of engineering training at EPI is to prepare future engineers capable of immediately entering the job market, both nationally and internationally. Our training combines both theoretical and practical aspects, in order to enable graduates to be immediately competitive in a market increasingly demanding advanced and specialized skills.

The different specialties of computer engineering training at EPI allow our graduates to integrate various professions, of which we will cite as examples, depending on the specialty:

**Software engineering:** The professions that an IT engineer specializing in software engineering can apply for: Software developer, Programmer analyst, Software architect, Software quality assurance (QA) engineer, IT security engineer, IT project manager, Technology consultant, Data analyst, Trainer in information technology,...

**Artificial intelligence:** The professions to which a computer engineer specializing in artificial intelligence can apply: Data Analyst, Big Data Engineer, Statistician, Machine Learning Engineer, AI Consultant, Data Science Project Manager, Data Scientist, Freelance AI Engineer, AI Teacher-Researcher, etc.

**Cybersecurity:** The professions to which an IT engineer specializing in cybersecurity can apply: System Administrator, Network Administrator, IT Manager, Information Systems Manager, Information System Director, Project Manager developer of secure solutions, Cybersecurity Consultant, Project Manager, Engineer in freelance Cybersecurity, Teacher-researcher in Cybersecurity...

**Cloud computing:**The IT engineer specializing in cloud and network can work within the IT department of a large company. He must find providers who offer cloud data storage services, based on the needs of the company he works for. It is he who manages the customer/supplier relationship and who liaises with general management. It validates all technical aspects of storage and then supports all stakeholders in the appropriation of the new systems (training, documentation, etc.). After a few years of experience, the cloud and network engineer can become an expert in storage or virtualization solutions, cloud services manager, cloud infrastructure architect, or they can choose to progress towards positions with managerial responsibilities. Thus, he can become cloud service manager, infrastructure and network manager or even DSI.

**IoT and Robotic Programming:**The IT engineer specializing in IoT and Robotic Programming can be recruited by development companies (web, mobile, etc.), IT service and consulting companies, companies in many fields (consumption, health, home automation, transport, components, aerospace companies ...), Design offices. Research and innovation centers, Startups and innovative companies.

Jobs he can do include: Application Developer, IoT System Integration Engineer, IoT Solutions Architect, IoT Security Engineer, IoT Data Analyst, IoT Consultant, IoT Hardware Developer, IoT Project Management Engineer...

**VR and Game Engineering:** A computer engineer specializing in virtual reality and game engineering can be recruited by video game development companies, software development companies, VR/AR solution design and development companies, professional training companies, research centers, Tech startups...

The professions he can pursue are generally those that involve the design, development and integration of interactive and immersive technologies: Video game developer, Mobile application developer, User experience designer (UX), 3D web developer , 3D moduler, Computer graphics engineer, Augmented reality developer, VR/AR solutions architect, Serious game designer, Responsible for the quality of VR/AR experiences, Responsible for research and development in technology companies...

### 3. Skills repository

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The training offered at the EPI allows engineering students to understand the complex problems that will constitute their future missions. This training is characterized by the combination of basic scientific training, specialty training in the fields of computer engineering and transversal training. The training offered is very widely open to the company by including modules oriented towards project management, visits and conferences, two two-month internships in companies in the 3rd and 4th year and an end-of-study project in 5th year from 4 to 6 months.

#### a. Basic skills:

- The ability to mobilize resources from a broad field of fundamental sciences.
- Knowledge and understanding of a specialized scientific and technical field.
- Mastery of engineering methods and tools: identification and resolution of problems, even unfamiliar and undefined ones, collection and interpretation of data, use of computer tools, analysis and design of complex systems, experimentation.
- The ability to integrate into an organization, commitment and leadership, project management.
- Taking into account industrial, economic and professional issues: competitiveness and productivity, innovation, intellectual and industrial property, compliance with quality procedures, safety.
- Ability to work in an international context: mastery of several foreign languages, economic training, cultural openness.

#### b. The skills of the Software Engineering specialty

- Design and Development: Software engineers design and implement software solutions taking into account user needs and technical constraints.
- Requirements Analysis: Software engineers work closely with customers and end users to understand their software needs and requirements.
- Testing and Debugging: Software engineers are responsible for testing software to ensure that it functions properly and meets specifications.
- Maintenance and Updates: Once software is deployed, software engineers are responsible for its ongoing maintenance. This may include fixing bugs, optimizing performance, adding new features, and supporting software updates.



- **Project Management:** Software engineers may also be involved in project management, overseeing development teams, establishing schedules and budgets, and providing communication with project stakeholders.
- **Training and User Support:** They can also provide technical assistance to end users, train users on how to use the software, and respond to their questions and concerns.
- **Soft and interpersonal skills:** Software engineers must be able to manage their time effectively, prioritize tasks, collaborate, and communicate clearly and effectively with other team members, including developers, testers, and managers of project.

### **c. The skills of the Artificial Intelligence specialty**

- **Proficiency in Programming Languages:** Students gain a strong command of relevant programming languages such as Python, which is widely used in the field of AI and data science. They learn to use Python for data analysis, using libraries like Pandas and NumPy, for machine learning with libraries like Scikit-Learn and TensorFlow, and for data visualization with tools like Matplotlib and Seaborn .
- **Understanding of software architectures and design patterns:** Students gain an in-depth understanding of software architecture principles and design patterns. This allows them to design and develop software systems that are robust, scalable, and easy to maintain, using design principles such as MVC (Model-View-Controller) and design patterns like Singleton, Factory, and Observer.
- **Expertise in Cloud Computing:** Students learn how to effectively use cloud computing services such as AWS (Amazon Web Services), Azure, and Google Cloud Platform. They learn skills in storing, processing and deploying data in the cloud, using services such as Amazon S3, Azure Blob Storage and Google Cloud Storage, as well as compute services such as Amazon EC2, Azure Virtual Machines and Google Compute Engine.
- **Manipulating Large Amounts of Data:** Students learn how to efficiently manipulate large amounts of data using NoSQL databases such as MongoDB, relational data warehouses, and Big Data technologies such as Hadoop and Spark. They gain skills in ingesting, storing, processing, and analyzing large-scale data.
- **Application of advanced data analysis techniques:** Students learn to apply advanced data analysis techniques such as data mining, statistical modeling, and machine learning to extract insights from data. They acquire skills in selecting and applying appropriate algorithms based on the specific needs of the problem.

- **Developing and Deploying Machine Learning and Deep Learning Models:** Students learn to develop and deploy machine learning and deep learning models for tasks such as classification, prediction, and recognition. They gain skills in selecting, training, and evaluating models, as well as deploying models into production.
- **Using Business Intelligence Tools:** Students learn how to use Business Intelligence tools such as Power BI for data visualization, analysis, and reporting. They gain skills in creating interactive dashboards, custom reports and data analysis to make informed decisions in a business context.
- **Soft skills:** Communication and collaboration, Critical thinking and problem solving, Creativity and innovation, Ability to learn and adapt, Rigor and attention to detail.

#### **d. The skills of the cybersecurity specialty**

- **Mastery of programming languages:** Students acquire a solid mastery of programming languages allowing them to develop secure solutions and to audit the code of existing solutions in order to identify possible security vulnerabilities and correct them.
- **Mastery of network security solutions:** Students will have the ability to design adequate security strategies according to the needs of businesses. This design integrates the choice of security entities necessary to protect networks against threats and guarantees the optimal level of security for the company.
- **Application of advanced information system protection techniques:** This skill gives the student the opportunity to master information protection solutions in computer systems using crypto systems to be deployed or the implementation of applications and platforms to protect the exchange of data in the company.
- **Mastery of information systems audit approaches:** students will have the necessary qualities to follow information systems audit approaches in accordance with current approaches. Advanced techniques will also be studied in order to carry out technical audits on all entities of the information system, whether at system level or network level.
- **Cloud Computing Expertise:** Students learn how to effectively use cloud computing services such as AWS (Amazon Web Services), Azure and Google Cloud Platform. They learn skills in storing, processing and deploying data in the cloud, using services such as Amazon S3, Azure Blob Storage and Google Cloud Storage, as well as compute services such as Amazon EC2, Azure Virtual Machines and Google Computer Engine.
- **Big Data Manipulation:** Students learn to efficiently manage large amounts of data using NoSQL databases such as MongoDB, relational data warehouses, and Big Data technologies such as

Hadoop and Spark. They acquire skills in the ingestion, storage, processing and analysis of large-scale data, allowing them to offer adequate security solutions that take into consideration the constraints of massive data.

- Application of advanced data analysis techniques: Students learn to apply advanced data analysis techniques. They acquire skills in selecting and applying appropriate algorithms based on the specific needs of the problem.
- Using Business Intelligence Tools: Students learn how to use Business Intelligence tools such as Power BI for data visualization, analysis, and reporting. They acquire skills in creating interactive dashboards and personalized reports.
- Soft skills: Wisdom, Communication and collaboration, Critical thinking and problem solving, Creativity and innovation, Ability to learn and adapt, Rigor and attention to detail

#### **e. The skills of the Cloud Computing and networks specialty**

- In-depth knowledge of operating systems and networks.
- Understanding of agile development methodologies and DevOps practices.
- Ability to effectively manage cloud computing environments.
- Ability to quickly resolve technical issues and make informed decisions
- Frameworks allowing you to go further in terms of innovation and applications
- The financial and human challenges of Cloud Computing
- A specific focus on security issues.
- Development and automation
- Infrastructure management
- Security and control
- Managing DevOps tools
- Soft skills: Wisdom, Communication and collaboration, Critical thinking and problem solving, Creativity and innovation, Ability to learn and adapt, Rigor and attention to detail.

#### **f. The skills of the IoT and Robotic Programming specialty**

This course allows students to develop a wide range of technical and professional skills, including:

- **Software development and programming:** This skill brings together expertise in software development and design. It includes knowledge of programming languages such as Java and Python, as well as the development of mobile applications and web services. Skills in advanced microcontroller-based programming and computer vision are also included, allowing students to develop software for various platforms, including embedded systems and visual recognition applications.
- **Hardware Design and Integration:** This skill focuses on the design and integration of hardware components into IoT and robotics systems. It includes printed circuit board (PCB) design, creation of smart sensors and actuators, and embedded programming to control these components. Robotics and cobotics are also covered, allowing students to design, program and deploy autonomous or collaborative robots for various applications.
- **Security and Infrastructure:** This skill group focuses on securing IoT systems and establishing the infrastructure necessary for their deployment and operation. It includes skills in data security, IoT communication protocols and cloud computing to ensure the confidentiality, integrity and availability of data exchanged between connected devices. IoT data analysis and the use of long-range communication technologies round out this group, allowing students to efficiently collect, process and analyze IoT data.
- **Project Management and Interpersonal Skills:** Project management emphasizes the practical skills needed to deliver IoT and robotics projects, as well as managing these projects using agile methodologies. Students learn to design and integrate IoT solutions into real-world projects, such as applications for healthcare, agriculture, smart cities, and more. Project management is also covered, allowing students to work collaboratively and manage resources and deadlines effectively.
- **Language and ethics skills:** Language skills encompass soft skills essential for professional success, such as communication in French and English, as well as awareness of the ethics and governance of IoT technologies. Digital marketing and finance skills are also covered, allowing students to understand the business and ethical aspects associated with the development and deployment of IoT and robotics solutions.
- These skills enable students to be versatile and competitive in the job market in varied fields such as IoT, robotics, IT security, web and mobile development, AI, etc.

#### **g. The skills of the VR and Game Engineering specialty**

This course offers students in-depth training in computer science, with a particular focus on virtual reality and video game technologies. Technical skills acquired include proficiency in programming

languages such as C++, C#, Python and Java, as well as gaming frameworks and engines such as Unity, Unreal Engine and Three.js. Students also develop skills in 3D design, animation, artificial intelligence, data processing, IT security and project management.

- Basic skills :

- Good math and programming skills.
- The ability to work in a team.
- Creativity and ability to innovate.
- Excellent communication skills.

- Specific skills :

- Mastery of programming languages (C++, C#, Python, Java).
- Knowledge of game engines (Unity, Unreal Engine).
- 3D design and animation skills.
- Knowledge of artificial intelligence applied to video games.
- Ability to manage video game and virtual reality development projects.

#### **h. Scientific research skills**

- Be able to provide a state of the art of research work linked to a theme and
- Equip yourself with critical thinking and literature analysis
- Successfully complete an applied research project.
- Work in groups

**Objective Module Matrix:****Computer Science – Common Core (S5 and S6)**

<b>Skill families</b>	<b>SKILLS</b>	<b>Materials involved</b>
Language skills	- Communications in French and English	- English - French
Mathematics	- Master the basic mathematical concepts of problem solving	- Engineering mathematics
Advanced Systems and Architectures	- Understand the basic notions of operating systems Master the architectures of computer systems	- Advanced operating systems - Architecture of microprocessor systems and microcontrollers - Systems architecture, embedded systems and IoT
Software engineering	- Master the life cycles of information systems (IS) Master the design of IS	- Object Modeling Language (UML)
Algorithmic development and programming	- Master the fundamentals of algorithms - Problem solving and combinatorial optimization - Master object-oriented programming languages	- Algorithmic - Advanced algorithmic - Advanced C Programming - Object Oriented Programming
Database administration	- Design and implementation of databases - Master and administer DBMS	- Data base - Database Management Systems
<b>Skill families</b>	<b>SKILLS</b>	<b>Materials involved</b>

Skill families	SKILLS	Materials involved
Web Design and Development	<ul style="list-style-type: none"> <li>- Design and development of sites, applications and WEB portals</li> <li>- Master front-office and back-office development</li> <li>- Become familiar with recent web development frameworks</li> </ul>	<ul style="list-style-type: none"> <li>- Web development</li> <li>- Advanced web development</li> </ul>
Signal processing, networks and IT security	<ul style="list-style-type: none"> <li>- Master the basic notions and foundations of protocols and network technologies</li> <li>- Learn skills to obtain CCNA certification.</li> <li>- Introduction to the principles, equipment and protocols used in networking.</li> <li>- Address the different computer attacks and security techniques deployed for strengthening security</li> </ul>	<ul style="list-style-type: none"> <li>- CCNA Preparation Part 1</li> <li>- CCNA Preparation Part 2</li> <li>- Computer network security</li> <li>- Digital signal acquisition and processing</li> </ul>
Image processing and AI	<ul style="list-style-type: none"> <li>- Discover and learn the basic concepts of artificial intelligence.</li> <li>- Manipulate the Python programming language and discover its libraries used in data analysis, AI, etc.</li> <li>- Discover the basic notions of signal processing</li> </ul>	<ul style="list-style-type: none"> <li>- Introduction to Artificial Intelligence</li> <li>- Image processing</li> <li>- Python Programming</li> </ul>

**Computer Science – Software Engineering (S7, S8, S9 and S10)**

Skill families	SKILLS	Materials involved
Language skills	<ul style="list-style-type: none"> <li>- Communications in French and English</li> </ul>	<ul style="list-style-type: none"> <li>- French</li> <li>- English</li> </ul>
Soft Skills & Interpersonal skills	<ul style="list-style-type: none"> <li>- Problem management, Leadership</li> <li>- The ability to work in a team</li> <li>- Manage time effectively and prioritize tasks</li> <li>- Clear and effective communication</li> <li>- Openness, Creativity and critical thinking</li> <li>- Knowledge sharing and transfer</li> </ul>	<ul style="list-style-type: none"> <li>- GL Seminar (Design thinking, Public speaking, Leadership, Interpersonal communication, etc.)</li> <li>- Integration project</li> <li>- PFA, Summer internship &amp; PFE</li> </ul>
Application design and development	<ul style="list-style-type: none"> <li>- Identification of functional and non-functional requirements.</li> <li>- Implementation of specifications.</li> <li>- Modeling of a computer application using an entirely object approach (UML)</li> <li>- Excellent knowledge of agile development principles.</li> <li>- Study of the technological feasibility of applications.</li> <li>- Have a good knowledge of the fundamentals of UI/UX Design</li> <li>- Good knowledge of programming languages.</li> <li>- Solid knowledge in web development (front-end and back-end)</li> <li>- Development of mobile applications for iOS and Android.</li> <li>- Solid knowledge in hybrid development (cross-platform).</li> </ul>	<ul style="list-style-type: none"> <li>- Advanced OOP (Java)</li> <li>- Advanced object modeling</li> <li>- Agile and hybrid methodologies</li> <li>- UI/UX Design</li> <li>- .Net development (C#)</li> <li>- Native mobile development 1</li> <li>- Native mobile development 2</li> <li>- Cross-Platform Framework</li> <li>- Java EE &amp; Springboot</li> </ul>



Skill families	SKILLS	Materials involved
Skill families	SKILLS	Materials involved
Computer science decision-making	<ul style="list-style-type: none"> <li>- Analyze data using Python language</li> <li>- Put the ETL process into practice</li> <li>- Develop a Business Intelligence project</li> </ul>	<ul style="list-style-type: none"> <li>- Data analysis</li> <li>- Business Intelligence</li> </ul>
DevOps	<ul style="list-style-type: none"> <li>- Accelerate the software development process using automation skills</li> <li>- Have knowledge of automation tools</li> <li>- Putting design patterns into practice</li> <li>- Implement a suitable software architecture</li> <li>- Design and implement unit tests and integration tests</li> <li>- Implement the CI/CD approach (continuous integration and deployment)</li> <li>- Have in-depth knowledge of IT security</li> </ul>	<ul style="list-style-type: none"> <li>- DevOps 1 and DevOps 2</li> <li>- Software architecture</li> <li>- Design patterns</li> <li>- Virtualization &amp; Cloud Services</li> <li>- Agile and hybrid methodologies</li> <li>- Software testing</li> <li>- GL Seminar (information systems security, secure deployment)</li> </ul>

Skill families	SKILLS	Materials involved
Data management	<ul style="list-style-type: none"> <li>- Managing complex data in the context of object-relational DBMS</li> <li>- Have knowledge of the foundations of multidimensional databases</li> <li>- Choose the right data storage format (relational and NoSQL).</li> <li>- Discover and apply the advantages of the SQL3 language.</li> <li>- Manage massive and varied data of document, column, graph and key-value types</li> <li>- Use Big Data tools and technologies.</li> </ul>	<ul style="list-style-type: none"> <li>- Advanced databases</li> <li>- Big Data (NoSQL Database)</li> </ul>
Skill families	SKILLS	Materials involved
Artificial intelligence	<ul style="list-style-type: none"> <li>- Apply machine learning</li> <li>- Apply deep learning.</li> <li>- Practice natural language processing (NLP)</li> <li>- Distinguish the main methods used in NLP</li> </ul>	<ul style="list-style-type: none"> <li>- Machine Learning</li> <li>- Deep Learning 1</li> <li>- Deep Learning 2 (NLP)</li> </ul>

Skill families	SKILLS	Materials involved
Entrepreneurship	<ul style="list-style-type: none"> <li>- Master the entrepreneurial skills of small businesses and understand its different functions.</li> <li>- Understand fundamental concepts in finance and business financing</li> <li>- Have a good knowledge of procedures and standards relating to intellectual property and its legal protection, as well as computer criminal law.</li> <li>- Define and implement a digital marketing strategy</li> </ul>	<ul style="list-style-type: none"> <li>- ESB: Entrepreneurship and Small Business</li> <li>- IT law</li> <li>- Finance for Engineers</li> <li>- Digital Marketing</li> </ul>
Applied research	<ul style="list-style-type: none"> <li>- Solve concrete problems or meet specific needs in various areas</li> <li>- Exploit technological advances that can lead to the development of new products, processes or services</li> <li>- Create innovative and effective solutions that have a positive impact on society and industry</li> <li>- Acquire critical thinking and the ability to analyze literature</li> <li>- Effectively complete an applied research project</li> </ul>	<ul style="list-style-type: none"> <li>- GL Seminar (Technology monitoring, IoT, Gaming &amp; Virtual reality, Cybersecurity, Design thinking, etc.)</li> <li>- PFA &amp; PFE</li> </ul>

**Computer science – Artificial Intelligence (S7, S8, S9 and S10)**

Skill families	SKILLS	Materials involved
Professional Communication	- Written and oral communication, technical writing, effective presentations	- French, - English
Software Design and Architecture	- Design of software architectures, use of Design Patterns, Cloud Infrastructure	- Software Architecture & Design Patterns, - Cloud infrastructure
Systems Administration	- Cloud infrastructure management and administration, NoSQL database administration	- Cloud infrastructure, - NoSQL databases
Data Analysis and Exploration	- Data mining, Exploratory data analysis, insight extraction, Data warehouse	- Data mining, Data analysis, - Data warehouses
Software development	- Object-oriented programming in Python, Data science-oriented programming in Python, development of machine learning models	- Python OO, - Data Science oriented Python, - Machine learning
Certification and Continuing Education	- Preparing and obtaining certifications in artificial intelligence, Amazon cloud, Azure cloud, Business Intelligence: Microsoft certification (EXAM PL300 Power BI), Entrepreneurship and Small Business	- Preparation for HCAI certification, - Cloud computing, - Azure Certificate, - Business Intelligence, - BSE
Ethics and Law	- Artificial intelligence ethics, engineering and data law	- Engineering Law and Ethics
Artificial Intelligence and Machine Learning	- Foundations of artificial intelligence, - Automatic learning (Machine Learning), - Deep learning, - Shape recognition (image recognition),	- Foundations of artificial intelligence, - Machine Learning, - Deep Learning,

Skill families	SKILLS	Materials involved
	- Natural Language Processing (NLP)	- Shape recognition (image recognition), - Natural Language Processing (NLP)
Project management	- Planning, management and execution of AI integration and deployment projects	- Integration project (AI project), - PFA Project
Finance and Market Analysis	- Financial analysis, digital marketing, AI applications in finance and markets	- Finance for the Engineer, - Digital Marketing, - Blockchain
Data Visualization and Communication	- Interactive visualization, visual communication of insights, creation of dashboards	- Data visualization
Big data processing	- Using Hadoop/MapReduce, Spark for processing and analyzing large datasets	- Big Data 1 (Hadoop/Mapreduce) - Big Data 2 (Spark)
Probabilistic Modeling	- Using and applying stochastic models for data analysis	- Stochastic models
Technical Operations Management	- Integration of DevOps practices with machine learning, deployment and maintenance of AI models	- Devops/MLops
Robotics Engineering	- Design, programming and deployment of intelligent robotic systems	- Robotics

**IT – Cybersecurity (S7, S8, S9 and S10)**

Skill families	SKILLS	Materials involved
Professional Communication	- Written and oral communication, technical writing, effective presentations	- French, - English

Skill families	SKILLS	Materials involved
Systems Administration	- Cloud infrastructure management and administration, NoSQL database administration	- Advanced databases, - Systems Administration 1, - Systems Administration 2
Data Analysis and Exploration	- Data mining, Exploratory data analysis, insight extraction, Data warehouse	- Data analysis
Software development	- Mobile Programming with Android, Web Development, Mobile Programming with iOS	- Native mobile development 1, - Full stack development, - Native mobile development 2
Certification and Continuing Education	- Preparing and obtaining certifications in Security, Amazon cloud, Azure cloud, Entrepreneurship and Small Business	- BSE certification, CyberOps I, - Network Security I (CISCO Certification), - Linux Services Security (CEH), - CyberOps II (CISCO Certification), - Network Security II (CISCO Certification), - Cloud Computing Services (Azure Certification)
Cloud computing	- Cloud Infrastructure, Cloud Computing Services,	- Cloud Computing Services (Azure Certification), - Cloud Computing and virtualization, - Cloud Computing Security
Artificial Intelligence and Machine Learning	- Foundations of artificial intelligence, Machine Learning,	- Artificial intelligence 1, - Artificial Intelligence 2
Project management	- Planning, management and execution of security integration and deployment projects	- Integration project (applied to security), - PFA project (applied to security)
Finance and Market Analysis	- Financial analysis, digital marketing, applications of Cybersecurity in finance and markets	- Finance for the Engineer, - Digital Marketing

Skill families	SKILLS	Materials involved
Network security	<ul style="list-style-type: none"> <li>- Network protection, Network attack detection, creation of network monitoring dashboards</li> </ul>	<ul style="list-style-type: none"> <li>- CyberOps I,</li> <li>- Network Security I (CISCO Certification),</li> <li>- Linux Services Security (CEH),</li> <li>- CyberOps II (CISCO Certification),</li> <li>- Network Security II (CISCO Certification),</li> <li>- Intrusion Detection Systems (IDS),</li> <li>- Virtual Private Network (VPN),</li> <li>- Firewall administration,</li> </ul>
IT security	<ul style="list-style-type: none"> <li>- Security foundations, integration of cryptographic tools, deployment of secure objects,</li> </ul>	<ul style="list-style-type: none"> <li>- Foundations of Cybersecurity (CISCO Certification),</li> <li>- Applied cryptography,</li> <li>- Security of Connected Objects (IoT)</li> </ul>
Technical Operations Management	<ul style="list-style-type: none"> <li>- Integration of DevSecOps practices, deployment and maintenance of security models</li> </ul>	<ul style="list-style-type: none"> <li>- Information Systems Security Audit,</li> <li>- Digital investigation (forensic),</li> <li>- Pentesting,</li> <li>- Technology Monitoring (DevSecOps, etc.)</li> </ul>

**IT – Cloud computing and networks (S7, S8, S9 and S10)**

Skill families	SKILLS	Materials involved
Language skills	- Communications in French and English	<ul style="list-style-type: none"> <li>- English</li> <li>- French</li> </ul>
General skills	- Openness to the socio-economic environment, international openness, creativity, initiative, autonomy, spirit of self-training, personal development	<ul style="list-style-type: none"> <li>- Entrepreneurship; Personal development, Team building and leadership</li> <li>- Finance for engineers</li> <li>- Labor law and ethics of HR engineers; Summer internship ; PFA; PFE</li> </ul>
Mathematics and optimization	- Master the basic mathematical concepts of problem solving	<ul style="list-style-type: none"> <li>- Engineering mathematics 1</li> <li>- Image processing</li> </ul>
Computer Networks	- Master the basic notions and foundations of protocols and network technologies	<ul style="list-style-type: none"> <li>- Computer networks certification preparation 1</li> <li>- IT security</li> <li>- Computer networks certification preparation 2</li> <li>- Network protocol engineering</li> </ul>
Network and Systems Administration	- Master the basic notions and foundations of network performance, communications security and network systems audit	<ul style="list-style-type: none"> <li>- Computer networks certification preparation 1</li> <li>- Computer networks certification preparation 2</li> <li>- Firewall administration</li> <li>- Server administration</li> <li>- Advanced server administration</li> <li>- System administration</li> </ul>
IS Governance (Information System)	- Implement an information system management system (anticipation and management of load, monitoring of dashboards, etc.)	<ul style="list-style-type: none"> <li>- Management of a data center</li> <li>- Management of cloud computing infrastructures</li> </ul>



Skill families	SKILLS	Materials involved
Assistance to Project Management in project framing	<ul style="list-style-type: none"> <li>- Analyze the functional, environmental and technical characteristics relating to the type of work or product to be produced (regulations, organizations, assembly, manufacturing, operating, safety constraints)</li> <li>- Analyze technical proposals and provide assistance with choice</li> </ul>	<ul style="list-style-type: none"> <li>- DevOps</li> <li>- Advanced Database</li> <li>- Introduction to data analysis</li> <li>- Agile Methods adapted to Cloud applications</li> <li>- Data Analysis and BI</li> <li>- Object modeling</li> <li>-</li> </ul>
IS technical architecture	<ul style="list-style-type: none"> <li>- Analyze market players and tools (hardware or software)</li> <li>- Evaluate the solutions in relation to the need</li> <li>- Define technical orientations (methods, tools, quality, etc.)</li> <li>- Conduct technical performance audits</li> </ul>	<ul style="list-style-type: none"> <li>- Development of Distributed Applications</li> <li>- The fundamentals of Cloud Computing</li> <li>- Development of web services applications on cloud platforms</li> <li>- SaaS and PaaS operational solutions</li> <li>- Administration of Cloud platforms and Web services.</li> <li>- Hybrid mobile development of Cloud applications</li> <li>- Integration project</li> </ul>
Advanced Systems and Architectures	<ul style="list-style-type: none"> <li>- Understand the basics of operating systems</li> <li>- Master the architectures of computer systems Strengthening security within information systems</li> </ul>	<ul style="list-style-type: none"> <li>- Advanced operating systems</li> <li>- Information Systems Security</li> <li>- Digital signal acquisition and processing</li> <li>- Architecture of microprocessor systems and microcontrollers</li> </ul>

Skill families	SKILLS	Materials involved
Algorithmic development and programming	<ul style="list-style-type: none"> <li>- Master the fundamentals of algorithms</li> <li>- Problem solving and combinatorial optimization</li> </ul>	<ul style="list-style-type: none"> <li>- Advanced algorithmic</li> <li>- Complexity of algorithms and graphs</li> <li>- Advanced C Programming Workshop</li> <li>- Advanced algorithmic</li> <li>- Object Oriented Programming</li> <li>- Complexity and optimization of algorithms</li> <li>- Web development</li> <li>- Python Programming</li> <li>- Advanced web development</li> </ul>
Database administration	<ul style="list-style-type: none"> <li>- Design and implementation of databases</li> <li>- Master and administer DBMS</li> </ul>	<ul style="list-style-type: none"> <li>- Data base</li> <li>- DBMS workshop</li> <li>- Advanced databases</li> <li>- Big data</li> </ul>
IT Operations Management	<ul style="list-style-type: none"> <li>- Manage changes to IT infrastructures (system, network, etc.)</li> </ul>	<ul style="list-style-type: none"> <li>- Cloud Computing Security and Network Auditing</li> <li>- Management of cloud computing infrastructures</li> <li>- Management of a Data Center</li> </ul>
Technology watch	<ul style="list-style-type: none"> <li>- Identify new tools, software, communication technologies, products, services and methods and techniques and assess their relevance and the value of their potential in business development, cost/performance improvement or business sustainability.</li> </ul>	<ul style="list-style-type: none"> <li>- Cloud for IoT</li> <li>- Preparation for MOS certification</li> <li>- Introduction to Artificial Intelligence</li> <li>- Big data</li> <li>- Digital Marketing</li> </ul>

Skill families	SKILLS	Materials involved
	<ul style="list-style-type: none"> <li>- Raise employee and management awareness of emerging technologies</li> </ul>	
Scientific Research	<ul style="list-style-type: none"> <li>- Be able to provide a state of the art of research work linked to a theme</li> <li>- Equip yourself with critical thinking and literature analysis to successfully complete an applied research project.</li> </ul>	<ul style="list-style-type: none"> <li>- Scientific subjects Mathematics</li> <li>- LANGUAGES</li> <li>- PFA &amp; PFE</li> </ul>

**Computer science –IoT and Robotoc Programming (S7, S8, S9 and S10)**

Skill groups	SKILLS	Materials involved
Programming and software development	<ul style="list-style-type: none"> <li>- Ability to design and implement computer programs using object-oriented programming principles to organize and structure code in a modular and reusable manner.</li> <li>- Skill in creating web and mobile applications, using specific programming languages and technologies adapted to each platform.</li> <li>- Proficient in advanced features of the Python programming language, including advanced aspects of syntax, complex data structures, and specialized libraries.</li> <li>- Ability to develop embedded software for microcontrollers using low-level languages and specific development environments.</li> <li>- Skill in designing and programming smart sensors and actuators to collect data and control devices in IoT systems.</li> </ul>	<ul style="list-style-type: none"> <li>- Advanced OOP</li> <li>- Advanced python programming</li> <li>- Advanced web development (Framework)</li> <li>- Mobile Development and Web Services (React Native)</li> <li>- Advanced Microcontroller-Based Programming</li> </ul>
Data management and analysis	<ul style="list-style-type: none"> <li>- Ability to design, create and manage relational or non-relational databases to store and organize data efficiently.</li> <li>- Skill in implementing secure, scalable and efficient data storage solutions, adapted to the specific needs of IoT applications.</li> <li>- Ability to extract meaningful insights from large amounts of data generated by IoT devices, using statistical analysis, data mining and machine learning techniques.</li> </ul>	<ul style="list-style-type: none"> <li>- Databases and Data Storage for IoT</li> <li>- IoT Data Analysis</li> </ul>

Skill groups	SKILLS	Materials involved
Artificial Intelligence and Machine Learning	<ul style="list-style-type: none"> <li>- Ability to design, develop and deploy artificial intelligence and machine learning models to solve specific problems in IoT applications.</li> <li>- Skill in developing computer systems capable of understanding, analyzing and interpreting images or videos, often used in applications such as video surveillance, object recognition, etc.</li> </ul>	<ul style="list-style-type: none"> <li>- AI and Machine Learning applied to IoT (AIoT)</li> <li>- Computer vision</li> </ul>
IoT architecture and infrastructure	<ul style="list-style-type: none"> <li>- Architecture and design of IoT systems: Ability to design and implement the software and hardware architecture of IoT systems, taking into account performance, security and connectivity constraints.</li> <li>- IoT Communication Protocols: Knowledge of the different communication protocols used in IoT applications, along with their operation and proper use.</li> <li>- IoT System Security: Skill in designing and implementing security measures to protect IoT systems from potential threats such as security attacks, hacking, and privacy violation.</li> <li>- Cloud computing and IoT services: Ability to use cloud computing services to deploy, manage and scale IoT applications, as well as to store and analyze data generated by these applications.</li> </ul>	<ul style="list-style-type: none"> <li>- IoT system architecture and design (IoT programming primer)</li> <li>- IoT communication protocols (MQTT, CoAP, LoRa, etc.)</li> <li>- Security of IoT systems and Cybersecurity</li> <li>- Cloud computing and IoT services</li> </ul>

Skill groups	SKILLS	Materials involved
Project management and work methodologies	<ul style="list-style-type: none"> <li>- Federated project management (agile method): Mastery of agile project management principles and practices, including Scrum, Kanban methodologies, and associated tools.</li> <li>- Integration Project: Ability to coordinate and integrate different software and hardware components to create complete and functional IoT solutions.</li> <li>- PFA Scientific Project: Skill in the design and implementation of research and development projects, following a rigorous scientific methodology.</li> <li>- Advanced IoT Projects: Ability to design, develop and deploy advanced IoT solutions in specific areas such as healthcare, agriculture, smart city, etc.</li> </ul>	<ul style="list-style-type: none"> <li>- Federated project (agile method)</li> <li>- Integration project</li> <li>- PFA Scientific Project (Design of a Connected IoT solution)</li> <li>- Advanced IoT Projects (Smart Healthcare, Smart Agriculture, Smart City, Smart Home, Smart Car, etc.)</li> </ul>
Transversal skills	<ul style="list-style-type: none"> <li>- Language skills: Proficiency in written and oral communication in French and English for effective communication in an international professional environment.</li> <li>- Soft Skills &amp; Interpersonal Skills: Soft skills such as communication, teamwork, problem solving, leadership, adaptability and time management, essential for success in the professional field.</li> </ul>	<ul style="list-style-type: none"> <li>- French</li> <li>- English</li> <li>- Advanced Projects</li> </ul>
Business strategy and entrepreneurship	<ul style="list-style-type: none"> <li>- Digital Marketing: Knowledge of digital marketing strategies and tools used to promote products and services in an online environment.</li> <li>- Finance for Engineers: Understanding the basic principles of finance and accounting, as well as financial concepts specific to technology companies and engineering projects.</li> </ul>	<ul style="list-style-type: none"> <li>- Digital Marketing</li> <li>- Finance for engineers</li> <li>- Entrepreneurship</li> </ul>

Skill groups	SKILLS	Materials involved
	<ul style="list-style-type: none"> <li>- Entrepreneurship: Competence in the creation, development and management of innovative technology companies, as well as in the search for financing and the development of business plans.</li> </ul>	
Applied research and innovation	<ul style="list-style-type: none"> <li>- Introduction to Industry 4.0: Knowledge of emerging technologies such as Industrial Internet of Things, 3D printing, advanced robotics, etc., and their impact on the industry.</li> <li>- Computer vision: Skill in developing computer systems capable of understanding, analyzing and interpreting images or videos, often used in applications such as video surveillance, object recognition, etc.</li> </ul>	<ul style="list-style-type: none"> <li>- Introduction to Industry 4.0</li> <li>- Computer vision</li> </ul>
Hardware and electronic design	<ul style="list-style-type: none"> <li>- PCB Design Fundamentals: Proficiency in designing printed circuit boards (PCBs) for integrating electronic components into IoT systems.</li> <li>- Designing Smart Sensors and Actuators for IoT: Ability to design smart sensors and actuators to collect data and control devices in IoT systems.</li> </ul>	<ul style="list-style-type: none"> <li>- PCB Design Fundamentals</li> <li>- Design of smart sensors and actuators for IoT</li> </ul>

**Computer science – Virtual reality and game engineering (S7, S8, S9 and S10)**

Skill groups	SKILLS	Materials involved
Language skills	- Communications in French and English	- English - French
General skills	- Openness to the socio-economic environment, international openness, creativity, initiative, autonomy, spirit of self-training, personal development	- Entrepreneurship; Personal development, Team building and leadership - Finance for engineers - Labor law and ethics of HR engineers; Summer internship ; PFA; PFE
Computer Science and Programming	- Mastery of one or more programming languages (C++, C#, Java, JavaScript, etc.)	- Advanced programming, - Algorithmic - Unity - Unreal Engine - Advanced Web Development
Video game design	- Level design, - Gameplay design, Game balancing	- Game design, Level design
Development of virtual reality	- Using Unity, Unreal Engine, - VR programming	- VR game development, - VR techniques
Graphics and 3D modeling	- 3D Modeling, Animation, Texturing	- 2D and 3D graphics, - Animation Blender
Artificial Intelligence for Gaming	- Use of AI for character behaviors, - Adaptive AI	- AI for games, - AI algorithms
User experience and user interfaces	- User interface design, - User testing	- UX/UI design, - Ergonomics



Skill groups	SKILLS	Materials involved
Sound, music and video for video games	<ul style="list-style-type: none"> <li>- Creation and integration of sounds and music</li> </ul>	<ul style="list-style-type: none"> <li>- Sound and Visual Design for VR and AR Experiences</li> </ul>
Project management	<ul style="list-style-type: none"> <li>- Project planning,</li> <li>- Team management</li> </ul>	<ul style="list-style-type: none"> <li>- Project Management and Agile Methodologies</li> <li>- Team project</li> </ul>
Problem solving and creative thinking	<ul style="list-style-type: none"> <li>- Solving technical problems,</li> <li>- creative thinking</li> </ul>	<ul style="list-style-type: none"> <li>- Team project</li> </ul>
Web development	<ul style="list-style-type: none"> <li>- Website design,</li> <li>- Front-end and back-end development, Mastery of Three.js</li> </ul>	<ul style="list-style-type: none"> <li>- 3D web development,</li> <li>- Web technologies</li> </ul>
Big Data	<ul style="list-style-type: none"> <li>- Manipulation of massive data,</li> <li>- Use of Big Data tools (Hadoop, Spark, etc.)</li> </ul>	<ul style="list-style-type: none"> <li>- Big Data</li> </ul>