

# EMBEDDED SYSTEMS



## OBJECTIVES

The embedded systems are the heart of automatic devices in our daily life. The design of embedded systems represents an economical stake for manufacturers: it increases the value of equipments and improves the competitiveness of companies. France has several worldwide industries in aerospace, in military and space industry, in energy, in rail, in telecommunications, automotive etc. which have been users of embedded systems for decades: EADS, Thales, Airbus, Renault, etc.

The embedded systems major addresses the design, the implementation and the management of complex systems (aircraft, cars, trains...). The competences involved are the design of standardized and reliable functioning hardware and software devices/objects. The acquired knowledges cover the fields of electronics and software engineering at system level design.

## JOB PROSPECTS

Equipement manager, system expert, project manager, embedded platform architect, embedded technologies expert/support manager, embedded applications architect, Software Development expert, Qualification/validation Expert, Test expert, integration expert/manager, process & methods/quality/certification expert.



# COURSE CONTENT

## SEMESTER 1

### PROJECT-BASED LEARNING IN ELECTRONIC AND SIGNAL

- Analog electronics: signal conditioning, analog filter, power management
- Digital electronics: microcontroller based sensor management, bluetooth link
- Fourier series and transform, Sampling, digital filtering

### NETWORK FUNDAMENTALS

- Network communication, communication channel
- Layer approach, OSI model, TCP/IP model
- Network devices, network addressing models

### DATA ACQUISITION AND PROCESSING

- Data types: qualitative, quantitative
- Deterministic data processing: Data transforms, filtering, linear prediction
- Random data processing: distributions, estimation, measure errors, correlation...

### MANAGEMENT TRAINING

- Economics principles, intercultural relations
- Corporate organization, international sales

### ENGLISH LANGUAGE COURSE

### FRENCH LANGUAGE COURSE

## SEMESTER 2

### RADIOFREQUENCY SYSTEMS

- Radio wave transmission and propagation
- Design of RF systems
- Advanced topics in RF systems

### ELECTRONIC MICROSYSTEMS

- Instruction set architecture
- Logic design, computer arithmetic
- CPU design, memory hierarchy
- Multicore and GPU models

### COMPUTER MICROSYSTEMS

- C language programming: memory allocation, pointer and API
- Operating system description: process/thread/memory/supervision, shell & system programming

### ELECTRONICS FOR IoT

- Deepening on microcontroller
- Battery management, low power design, power conversion
- Wireless link, protocols and capabilities low power
- Green communication design, system implementation

### INTERNATIONAL BUSINESS INNOVATION PROJECT

- Build real business model in a multicultural team
- Create innovative idea with marketing & business strategies
- Present final business model to professionals

### FRENCH LANGUAGE COURSE

## SEMESTER 3

### SAFETY AND RISK ANALYSIS

- Failure trees – failure density, failure rate
- Reliability of components, of boards, of systems, life duration, physical failure analysis – methods and tests
- Redundant systems, serial, parallel, vote, triplication
- Coded systems
- Standards on quality, standards on safety
- Electromagnetic compatibility of systems

### SYSTEM CONSTRAINTS AND IMPLEMENTATION

- Methodology development cycles and systems
- Life cycle of software, of hardware
- System simulation, tools for formal proof
- Real-time UML

### PROJECT

- The project is composed of an advanced case study. The students will be called upon to use the knowledge, design techniques and tools that they learnt through their courses

### FRENCH LANGUAGE COURSE

### CHOICE OF 2 ELECTIVE COURSES AMONG:

#### AUTOMATIC CONTROL/REAL TIME

- System model, state space, optimum command theory
- States representation
- Reliability of components & cards

#### CONNECTED AND AUTONOMOUS VEHICLES

- Connected cars and urban equipment
- Deep learning and automatic car driving
- Sensor, Vehicular Ad-hoc Network, security

#### MEDICAL ROBOTICS

- Kinematics of medical robots
- Imaging guided medical robots
- Tracking and surgical navigation

#### PROGRAMMING LANGUAGES AND COMPILERS/FORMAL APPROACHES

- Abstract syntax trees
- Compilation algorithms
- Proof of program properties, model-checking
- Typed programming languages, lambda calculus

## SEMESTER 4

### INTERNSHIP

The internship with an international company will enable students to display valuable professional skills and attitudes developed during the three academic semesters. ISEP will provide you with assistance in your search for an internship. Companies usually give a stipend to the trainees.