

**RF Engineering**  
**ENSEA - ESC 3<sup>rd</sup> Year Academic Track**

**ESC\_1 RF Communication Systems (6 ECTS)**

**ESC\_3961 Wireless Communication Systems** (Lectures: 10h / Tutorial classes: 10h / Lab: 12h)

This course introduces the basics of formatting signals (modulation, coding), and the RF front-end structures. The knowledge provided by this course allows the student to analyze the functioning of a real system and to evaluate its performance. Experiments in labs give a first training with measuring and simulation methods.

**ESC\_3940 Antennas** (Lectures: 14h / Tutorial classes: 10h / Lab: 16h)

This course introduces the general concept of antennas, and studies key antennas from main technologies. This course has an interest in different methods of modeling antennas, especially the plane wave spectrum decomposition. Simulation models are presented. Practices in lab illustrate the theory by measuring specific antennas (quarter wave antennas ...), in anechoic chamber or in free space, and it uses 2.5D electromagnetic simulations.

**ESC\_3910 Guided Waves** (Lectures: 10h / Tutorial classes: 10h / Lab: -h)

This course gives the basics of guided waves propagation, in order to prepare for the generalized concept of power waves. The electromagnetic functioning of waveguides is studied, millimeter-wave integrated circuits in particular. Then it explains dispersion and parasitic modes.

**ESC\_2 Optical and High-Speed Communication (5 ECTS)**

**ESC\_3950 High-Speed Electronics** (Lectures: 10h / Tutorial classes: 10h / Lab: 16h)

This course studies different modules of electronic interfaces (SFI-4) for optical communications at 10 Gb/s (SONET OC 192, SDH STM-64). The course also focuses on analog / digital interfaces for high speed electronics and measuring techniques. There is also practical work on CAD workstations, allowing students to design typical circuits using Cadence software.

**ESC\_3960 Optical Fiber Transmission** (Lectures: 10h / Tutorial classes: 10h / Lab: 4h)

This course is divided into 3 parts. The first part is about optical fiber as a mean of transmission, the second part focuses on the components and the third part is about the systems. This course presents the current technologies and it introduces methods for designing connections and networks, with attention being brought to current research.

**ESC\_3 RF components and design (5 ECTS)**

**ESC\_3920 RF Components** (Lectures: 14h / Tutorial classes: -h / Lab: 16h)

This course gives a qualitative presentation on how the components work, in order to suggest models and characterization techniques, together with equivalent circuits, linear or not, and of noise. These models and equivalent circuits are useful for the design of microwave circuits.

**ESC\_3930 RF Design** (Lectures: 16h / Tutorial classes: 10h / Lab: 16h)

This course presents the general methods for analyzing circuits (S parameters, multipoles). It also presents the main methods to design passive circuits (filters, couplers) and active circuits (amplifiers, oscillators).

There are some exercises using Computer-Aided Design (CAD). The tutorials use CAD to consider parameters and phenomena too complicated to handle without CAD.

### **ESC\_4 RF Project (4 ECTS)**

**ESC\_3901 Circuit Project** (Lectures: -h / Tutorial classes: 6h / Lab: 32h)

It is about designing a simple circuit of a communication system such as antennas and amplifiers for radio frequency applications. The study is preceded by a bibliographic research related to the subject. The circuit is then designed, made, and measured. A project defense presents the results.

### **ESC\_5 Acquisition Systems (5 ECTS)**

**ESC\_3900 System Project** (Lectures: -h / Tutorial classes: -h / Lab: 40h)

This project develops the skills necessary to implement a system or part of an acquisition or instrumentation system as well as a wireless communication system. Students will use acquisition and transmission cards (use of programming software such as LabVIEW).

**ESC\_3902 CAD and Measuring Tools** (Lectures: 4h / Tutorial classes: -h / Lab: 24h)

This module presents the tools necessary for the use of specific measuring equipment and software for simulation commonly used in this field.

- Line theory. Reduced impedance, Smith chart, impedance matching
- Microwave measurements. Network analysis, correction of errors, noise factor measurement
- Presentation of CAD software, methods of analysis and optimization

**ESC\_3970 Conferences** (Lectures: 10h / Tutorial classes: -h / Lab: -h)

The lectures are delivered by professionals from the field. The subjects covered may vary from one year to the next. The following topics are only a sample of possible themes.

MMIC technology and applications. Evolutions and recent developments in the field of video. Radar. Wireless applications: GSM, DECT, Wifi, Bluetooth, RFID, Satellite telecommunications...

### **SH\_3EME Humanities (5 ECTS)**

**DSH\_3000 Human Resources Management and International Management** (Lectures: 16h / Tutorial classes: 6h / Lab: -h)

This transversal training offers:

- an awareness of labor law specifically for the engineer: employment contract, expatriation, working environment in the company
- managerial aspects dealt within a multicultural context such as team management, corporate culture, professional projects...
- accounting aspects: employee cost versus human capital.

**DSH\_3060 English** (Lectures: -h / Tutorial classes: 24h / Lab: -h)

The objective of the third-year courses is to make the students able to work in English and have a good command of the language.

The goal is achieving a professional use and to reach, at least, a B2 level requested to obtain the degree.

Two third-year options are grouped together for English courses. Level groups can be formed. The students will be able to work on different aspects of life professional (communication in different settings, in the office, abroad, in seminars, through writing, orally, case studies...), by carrying out work groups and putting in practice the knowledge they have acquired throughout their training.

**DSH\_3061 FLE (French for foreigners)** (Lectures: -h / Tutorial classes: 24h / Lab: -h)

The main goal of this class is training the foreign students through communication fundamentals for everyday life, proposing them an introduction to French culture and civilization and more advanced knowledge in order to work in a French company during the final internship period.