INSTITUTE OF TECHNOLOGY - IUT

INTERNATIONAL SEMESTER IN ELECTRICITY, ENERGY ELECTRONICS FOR EMBEDDED SYSTEMS

Location

ANGERS
Campus de Belle-Beille

Coordinator

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The department of electrical engineering and computer science offers a fully English-taught international semester based on embedded electronic systems. The course program consists of 3 compulsory units plus a lab-work or research project and several modules to choose from.

The course offers lectures, tutorials and labwork sessions in small groups.

Contact International Relations Office

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Adresse web

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EMBEDDED ELECTRONIC SYSTEMS (COMPULSORY) -7 ECTS

Objectives : Development of small embedded systems (limited to moderately complex cases)

- Model a system within its environment
- Perform software development through its different stages (analysis, algorythm, coding, testing)
- Integrate hardware and software together
- Understand the architecture of a microcontroller system
- Master the use of the peripherals of a microcontroller
- Understand the mechanisms of interruption

Content : Approach for developing an embedded computer application

- Understand the hardware architecture of the target
- Understand the management functions of typical devices (digital inputs / outputs, analog digital and digital analog converters, timer, serial communication, PWM ...)
- Analysis of the specification, identification of the components required and the mechanisms for their implementation (scan or interruption)
- Model the embedded application
- Code in an advanced language
- Use a predefined validation method
- Use a debugging tool (debugger type)
- Use the language of material description of circuits
- Documentation of the source files

SOFTWARE AND MATHEMATICAL TOOLS (COMPULSORY)-4 ECTS

The module will present the theory and some applications of various mathematical tools used in many fields, such as control or signal processing. It should be seen as a "toolbox" available to each student.
The module is based on theoretical aspects and on the use of software, visualisation and representation tools, digital or formal calculation, simulation, programming, etc.
Lectures and exercises are completed with practical implementations using Python during labwork sessions.

Content:

- Complex numbers
- Fractions
- Integrals
- Second-order differential equations
- Laplace transform
- Fourier series

ELECTRICITY AND ENERGY (COMPULSORY)- 6 ECTS

Students will learn about the various forms of electrical energy and the appliances used to transform it, through the study of power electronics devices and electric machines, with an emphasis on power and efficiency calculations.

Content:

- DC-DC converter
- Single-phase rectifier
- Single-phase transformer
- DC motor and its control

Objectives:

- Identify the devices needed to vary the speed of a Direct Current Machine
- Design a simple system with controller and DCM
- Identify the components of a chopper and a rectifier
- Establish a power balance for a DC machine
- Choose a transformer
- Calculate the power, losses and efficiency of a transformer
- Check the quantities (inputs, outputs, efficiency,...) of DCMs and transformers as well as choppers and rectifiers.

LAB PROJECT (COMPULSORY) -7 ECTS

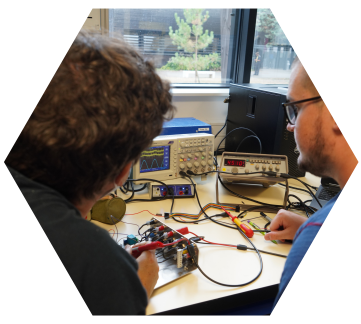
2 possibilities

A. Project in electronics:

- Completing a functional analysis of the Audio Amplifier
- Analysing the preamplifier frequency behaviour through a SPICE simulation (Bode diagram)
- Designing a PCB (Printed Components Board) and computing values of components, most of the components have to be SMC technology
- Organising and achieving structural and functional tests of the two boards
- Programming the microcontroller ATMEGA32: this microcontroller makes the link between the IHM and the different subsystems of the audio amplifier

B. Project topic chosen by the student and the IUT project supervisor:

- Topic chosen within the scope of the supervisor's research area and the student's interests
- 8 to 10 weeks



RESEARCH PROJECT - 7 ECTS

The main objective of a research project is to make students gain insight into the organization, analysis, and communication of research.
Upon completing this research project, the students will be able to:

- carry out a literature review and place their project in the context of the existing literature;
- gain the ability to identify a research question and to collect and manipulate data to answer that question.
- analyze results and place them in the context of the existing literature.
- demonstrate general learning and study skills; be reflective and collaborative in their approach to learning.
- demonstrate critical and analytical skills.
- demonstrate enhanced skills in presentation, report writing, time management.

Areas of research are related to the local economic environment and the student's field of specialization:

- information theory-based project for the biomedical field
- machine-learning project for the biomedical field
- bibliographic search on feature learning and application to the biomedical field

ELECTIVES

Physics
- 3 ECTS -

- Electric and magnetic field for basic components (capacitor and coil)
- Ability to qualitatively draw lines of the electric field (positive charges towards negative charges) and the magnetic field (corkscrew rule)
- Induction phenomenon
- Use of the appropriate units of vocabulary for measurements adapted to sensors
- Electronic systems and their respective interests used to interface sensors

English language
-3 ECTS-

Content: speaking, reading, writing and listening practice
Activities: design presentations, newscast, role-plays
Level: B1-B2

French language
- 6 ECTS-

Course: speaking, reading, writing and listening practice (level A1 to B2)
Weekly conversation workshop

Applied Statistics
- 2 ECTS-

Students will apply basic knowledge of statistics to understand some problems in the fields of management, science, industry and daily life.
The course aims at:

- Discovering random variables & usual probability distributions, summarizing quantitative data, bivariate numerical data, Sampling distributions & significance tests.
- Using basic probability, discrete probability, normal and sampling distributions, linear and non-linear regression models ... to analyse some case studies.

Learning outcomes:

- *What risk do airlines take when overbooking? (Discrete probability)*
- *How to explain some paradoxes thanks to probability. (basic probability)*
- *How to implement an effective quality control procedure for goods reception in a factory? (discrete probability)*
- *Why does the statistical process control method guarantee the quality of production? (normal and sampling distributions)*
- *How to use correlation studies to make predictions? (linear and nonlinear regression models)*
- *What mistakes should be avoided when comparing 2 or more proportions (or mean values)? (Hypothesis tests, ANOVA, multiple regression, Khi2)*