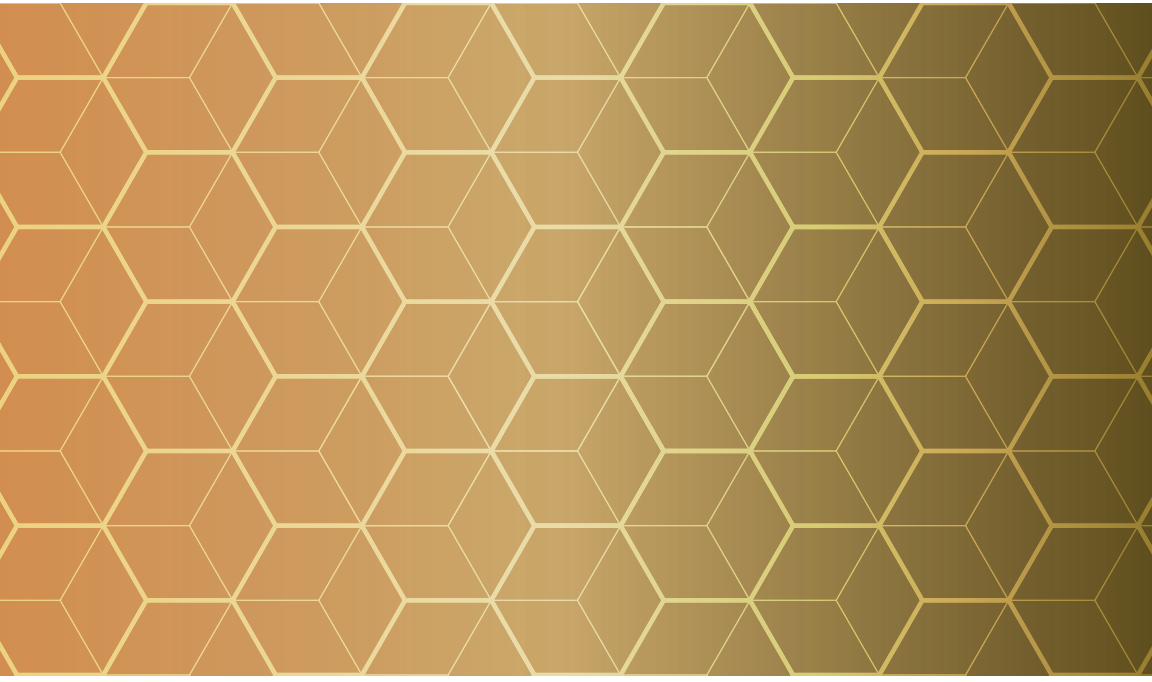
ESIGELEC



MASTER IN SCIENCES AND TECHNOLOGY

ELECTRONIC EMBEDDED SYSTEMS

COURSE OUTLINE 2020 - 2022

In partnership with

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES ROUEN

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A

COURSE STRUCTURE

The Master's Programme comprises:
For students with a 4-year Bachelor's Degree minimum and with a specialisation in Electronics / Instrumentation / Automation / Electrical Engineering -

- Semester 2 – Academic (on campus)
- Semester 3 – Academic (on campus)
- Semester 4 – Internship (company/laboratory)

For students with a 3-year Bachelor's Degree OR a 4-year Bachelor's Degree in another engineering stream OR choosing to join the first semester -

- Semester 1 – Academic (on campus)
- Semester 2 – Academic (on campus)
- Semester 3 – Academic (on campus)
- Semester 4 – Internship (company/laboratory)

The first three academic semesters* are offered between September 2020 and January 2022.

Lectures, tutorials, lab work, practical work, projects, conferences and / or seminars make up the academic semesters. Evaluation, in the form of tests, quizzes, exams, etc. is conducted on a regular basis. Faculty members are from ESIGELEC and/or INSA Rouen, from partner companies and from partner universities in France or abroad.

The final semester is devoted to industrial or research experience, during which students must do a mandatory internship in a company or laboratory for a period of 4 months (min.) to 6 months (max.). While ESIGELEC and/or INSA Rouen provide assistance to find internships, students are expected to play an active part, as internships are not offered automatically.

* 2 academic semesters in the case of students granted direct entry into the second semester, beginning February 2021

The students have up to a maximum of two years, after the final academic semester:

- to find and complete the internship,
- to submit a professional thesis and make an oral presentation before a convened jury,
- and to clear all the ECTS credits of the Master's Programme.

Failure to meet these requirements may result in the degree not being awarded.

The Student Status

After completion of the academic semesters at ESIGELEC, students have a maximum of two years to find and finish the internship, submit the professional thesis, complete the oral presentation, and clear all the ECTS credits of the Master's Programme, failing which they will not be awarded the degree from ESIGELEC and INSA Rouen, except in some exceptional cases, approved both by ESIGELEC and INSA Rouen.
Students will retain the Registered Student status till the end of the academic year 2021/2022.

Students who, at the end of the academic year 2021/2022 (likewise for 2022/2023), have already started but have not yet: completed the internship / submitted the professional thesis / completed the oral presentation and have cleared all the ECTS credits of the academic semesters will retain the Registered Student status for the academic year 2022/2023 (likewise for 2023/2024), without having to pay the applicable fees.

Students who, at the end of the academic year 2021/2022 (likewise for 2022/2023), have not started the internship or obtained the required ECTS credits for the academic semesters, must re-register for the academic year 2022/2023 (likewise for 2023/2024), by paying the applicable fees, failing which, they will be struck off the rolls of ESIGELEC and will cease to be students of the school.

The validity of the Registered Student status will end automatically and immediately after the student will be presented to the official jury of ESIGELEC and INSA Rouen OR after a maximum duration of two years after completion of the academic semesters, whichever is earlier, except in some very specific cases approved both by ESIGELEC and INSA Rouen.

B PROGRAMME OBJECTIVES

The Master's Programme seeks to equip the students with the relevant knowledge, professional skills and practical experience in electronic embedded systems for industry or for research. They will learn how to design, develop and implement electronic embedded systems in different sectors. Students will also acquire basic managerial skills.

The international environment at ESIGELEC allows students to discover new cultures and languages. Students must appear for the TCF / TEF certification exams in French (or TOEIC for French speaking students). The mandatory internship gives the students a hands-on experience in the work environment. Our graduates find job opportunities as developers, project managers, consultants or researchers in the field of electronic embedded systems.

C ATTENDANCE POLICY

ESIGELEC views class attendance as the student's individual responsibility. Students are expected to comply with ESIGELEC's attendance policy throughout their study period. All lectures, tutorials, practical work, projects, conferences and seminars are mandatory. Attendance will be monitored by the faculty members at the beginning of each class and the attendance sheet will be maintained by the Studies Office of ESIGELEC.

Late entry into class:

If a student is late by 10 or more minutes, he/she will be refused entry into the classroom and the faculty member will make a note in the attendance register. Such cases will be considered as unjustified absence. If a student is late less than 10 minutes, he / she will be accepted into the classroom and the faculty will make a note in the attendance register.

3 late entries of less than 10 minutes will be considered as 1 case of unjustified absence.

Absence from class:

A student who is absent for medical reasons must submit a medical certificate within 3 working days, in order for the absence to be excused. Leave letters in the case of other accepted anticipated absences must be signed at least 3 days prior to the absence, by the Academic Coordinator of the Master's Programme, in order for the absence to be excused. No other justifications of absence will be excused by ESIGELEC.

Penalty:

Students will receive an oral warning after 5 occurrences (unjustified absence). A stern oral warning will be given after 10 instances. 20 such cases may lead to the student's dismissal from ESIGELEC.

Absence from examination:

Only students whose absence from an examination has been excused will be allowed to re-take the examination.
Students whose absence from an examination has not been excused will be marked 0/20 in the said examination and will not be authorized to retake the examination.

D

EVALUATION

Evaluation may include tests, quizzes, presentations or other formats as decided by the faculty members, who may also authorise the use of reference documents or calculators, if they deem it necessary. Each such test will be graded on a maximum mark of 20.

Scores & ECTS credits (European Credit Transfer System)

- The Master's Programme is divided into several weighted courses, all of which include one or more weighted modules. Each course represents a certain number of credits.
- The score of a module is the average of the weighted scores of the different evaluation processes conducted within the same module.
- The score of a course is the result of the weighted averages of all modules of the course.
- The final overall score of the student is the result of the weighted averages of all courses of the Master's Programme.
- The total number of ECTS credits of the Master's Programme is equal to the total of all the ECTS credits of its courses.
- One ECTS credit corresponds to about 25 hours of course work (lectures, tutorials, lab work, projects, practical work, evaluation, individual work).
- Students who are granted entry directly to the second semester, beginning February 2020, will automatically be awarded 30 ECTS credits, equivalent to the first semester of the Master's Programme.
- A statement of marks is sent to the students at the end of each academic semester and also after they are evaluated by the Jury of ESIGELEC and INSA Rouen.

E FRAUD AND CHEATING

Students indulging in fraudulent practices / cheating during an exam / oral presentation / project / practical work / internship report will be marked 0/20 for that piece of course work, evaluation exercise, report or exam. Examples of plagiarism, fraud or cheating, include, but are not limited to:

- Duplication of another student's work during a written assignment / exam.
- Use of a reference document or calculator not authorized by the faculty member during an evaluation exercise.
- Plagiarism (>20%) of reports, presentations, or computing programs, obtained by any means (book, magazine, other students, electronic files, Internet, work previously submitted in another course).

F AWARDING THE MASTER'S DEGREE

Each academic semester at ESIGELEC carries a total of 30 ECTS credits. The internship, professional thesis and oral presentation also carry a total of 30 ECTS credits. A student must obtain a minimum score of 10/20 in a course to be awarded the allocated ECTS credits of the course.

The Master's Degree is awarded if the student has obtained a minimum average score of 10/20 in each course, thereby obtaining the total number of 120 credits.

The jury of ESIGELEC and INSA Rouen for the Master's Degree comprises the President, faculty members of ESIGELEC and/or INSA Rouen, and representatives of the managing staff of ESIGELEC and/or INSA Rouen. This jury, chosen by the General Director of ESIGELEC, convenes up to a maximum of four times per year, i.e. April, July, September and December.

The Master in Sciences and Technology - Electronic Embedded Systems, awarded by ESIGELEC and INSA Rouen to students who have successfully cleared all requirements, is accredited by the French Ministry of Higher Education and Research.

G RETAKING EXAMS

If a student has obtained less than 10/20 in one or more courses in the academic semesters at ESIGELEC, the student will be asked to retake one or more exams in one or more modules of the courses concerned, as advised by the Academic Coordinator of the Master's Programme (even if the final overall score of the student in the Master's Programme is greater than 10/20).

Retaken exams will be conducted by the Office of Graduate Student Affairs:

- in July, for courses completed in semester 1,
- in August / September, for courses completed in semester 2,
- in February after completion of semester 3, for courses completed in semester 3.

The score(s) obtained from exam(s) retaken replace the previous score(s) obtained by the student in the module(s) concerned and a new average score will be calculated for the course(s) concerned.

If the student does not retake an exam as advised by the Academic Coordinator, the student will be marked 0/20 for the module.

The new average(s) of the course(s) must be greater than 10/20 to obtain the requisite credits.

REQUIREMENT FOR ACADEMIC PROGRESS

H UPON COMPLETION OF ACADEMIC YEAR 1 AND RETAKEN EXAMS

- A student who obtains 60 ECTS credits will gain entry into academic year 2.
- A student who obtains between 42 and 59 ECTS credits will be allowed to continue with academic year 2, but will have to retake, in academic year 2, all or some of the exams in all or some of the modules of all the courses of academic year 1, for which the student has not yet obtained the requisite credits, and as advised by the Academic Coordinator of the Master's Programme.
- A student who obtains between 18 and 41 ECTS credits will have to redo academic year 1 (but only the courses for which the requisite ECTS credits have not yet been obtained), the following academic year. Failure to clear the 60 required ECTS credits of academic year 1 after redoing academic year 1 may result the entry into academic year 2 refused and the degree not being awarded.
- A student who does not obtain a minimum of 18 ECTS credits will be disqualified from the programme and will not be awarded the degree.

UPON COMPLETION OF ACADEMIC YEAR 2 AND RETAKEN EXAMS

- A student must obtain a total number of 120 ECTS credits for academic years 1 & 2 to be awarded the Master's Degree.
- A student who fails to clear all the ECTS credits for academic year 1 before the end of academic year 2 will be required to redo academic year 1 (but only the courses of academic year 1 for which the requisite ECTS credits have not yet been obtained), the following academic year, or will be disqualified from the programme and will not be awarded the degree, if the student would also be required to redo one or two semesters of academic year 2 due to his/her scores obtained in academic year 2. Failure to clear the 60 required ECTS credits after redoing academic year 1 the following academic year, may result the degree not being awarded.
- A student who obtains between 21 and 29 ECTS credits for semester 3 will have to retake, during the following academic year, all or some of the exams in all or some of the modules, of all or some of the courses of semester 3, for which the student has not yet obtained the requisite credits and as advised by the Academic Coordinator of the Master's Programme. If the student fails to obtain the 30 ECTS credits of semester 3 during the next academic year, he/she will be required to redo semester 3 (but only the courses for which the requisite ECTS credits of semester 3 have not yet been obtained), the following academic year, or will be disqualified from the programme and will not be awarded the degree, if academic year 1 was already repeated. Failure to obtain the 30 ECTS credits of semester 3 after redoing semester 3 the following academic year, may result the degree not being awarded.
- A student who obtains between 10 and 20 ECTS credits for semester 3 will be:
  - Disqualified from the programme if academic year 1 was

already repeated or if academic year 1 will have to be repeated,

OR

- Be required to redo semester 3 (but only the courses of semester 3 for which the requisite ECTS credits have not yet been obtained) the following academic year, if academic year 1 was not already repeated and if academic year 1 will not have to be repeated. Failure to clear the 30 ECTS credits of semester 3 after redoing semester 3 the following academic year, may result the degree not being awarded.

- A student who obtains less than 10 ECTS credits in semester 3 will be disqualified from the Master's programme and will not be awarded the degree.
- If a student doesn't obtain the 30 ECTS credits of semester 4 (Internship), the Academic Coordinator of the Master's Programme may:
  - Instruct the student to submit a fresh professional thesis and/or redo the oral presentation, within a maximum period of 2 years, after the final academic semester,.

  OR

  - Instruct the student to redo a fresh internship, including submission of a professional thesis and an oral presentation, within a maximum period of 2 years, after the final academic semester.

  OR

  - Deny the award of 30 ECTS, on the grounds of misconduct during the internship.

A student can only redo courses of one academic year (academic year 1 or academic year 2), and can redo only once a course or the internship, during the Master's Programme.

In the event that the curriculum is revised and if some modules are replaced by newer ones, students who are required to redo modules, i.e. attend classes and appear for the exams, must do so for the new modules.

COURSES & ECTS CREDITS

Courses	Modules	Duration (hours)	Weight	ECTS Credits
Semester 1: 30 Credits / 354 hours				
Computer Science 1	Introduction to Object Oriented Programming with Java	40	3	8
	Fundamentals of Data Communication and Networking	24	2	
	Fundamentals of Web-Centric Development	30	3	
Digital Electronics	Binary Logic & Digital Functions	30	3	9
	LabView	30	3	
	C Programming	30	3	
Communication & Language	Cross Cultural Awareness and Working in a Team	36	3	6
	French as a Foreign Language OR English as a Foreign Language	60	3	
Specialized Courses for EES	Bibliographical Study	12	1	7
	Digital Electronics Project	32	3	
	Fundamentals of Electronics	30	3	
Total Credits				**30**

Courses	Modules	Duration (hours)	Weight	ECTS Credits
Semester 2: 30 Credits / 392 hours				
Digital Systems	Microprocessors	60	4	8
	VHDL & Logic Synthesis	30	2	
	Communication Busses	30	2	
Embedded Operating Systems	Real Time Operating Systems	30	3	6
	Embedded Linux	30	3	
Embedded Software	Embedded C programming	30	2	6
	Analysis & Design with UML	32	2	
	Embedded Java	30	2	
Instrumentation	Smart Sensors	30	3	6
	Specific Instrumentation	30	3	
Communication & Language 2	French as a Foreign Language OR English as a Foreign Language	60	4	4
Total Credits				**30**

Courses	Modules	Duration (hours)	Weight	ECTS Credits
Semester 3: 30 Credits / 330 hours				
Embedded Communication	MtoM Communication	30	4	10
	Python Programming & Image Treatments	30	3	
	Android Programming	30	3	
Embedded Electronics	System on Chip	20	2	6
	DSP Processors	20	2	
	Safety Systems	20	2	
Communication & Language 3	Oral Communication & Presentation Skills	14	1	5
	French as a Foreign Language OR English as a Foreign Language	60	4	
Project Development & Management	Project Management	26	2	9
	R&D Project	80	7	
Total Credits				**30**
Semester 4: Internship of 4 to 6 months				

All modules are delivered face-to-face, on campus, with all required safety measures. However, modules may be delivered partially or totally online and/or through distance mode, in keeping with possible changes in the health crisis or any other circumstances beyond our control and as advised by the relevant French Government authorities.

J

COURSE CURRICULUM & SYLLABUS

Introduction to Object-Oriented Programming with JAVA

Module Code: MSTSI12 **Duration: 40h**

Objectives

At the end of this module students will be able to:

- Write, test and set up a Java programme and documentation from a given situation
- Use vocabulary relating to OO languages within the framework of Java
- Explain the design and set up for the life-cycle of a Java programme / explain the design
- Process and working of a Java program (define bytecode and explain the role of a JVM)
- Document code and create the Javadoc
- Respect Java writing code structures
- Use existing classes and packages
- Use basic Eclipse functions: editing, compiling, operating, importing and debugging

List of topics

- Storing information, communicating information, making choices, creating repetitions
- Initiation to Object-Oriented programming
- From algorithms to writing functions, classes and objects, UML classes
- Collecting objects (a fixed amount and undetermined amount), using UML

Fundamentals of Data Communication & Networking

Module Code: MSTSI13 **Duration: 24h**

Objectives

At the end of this module students will be able to:

- Understand the very basic operation of communication networks
- Distinguish between different communication technologies
- Distinguish between different communication services
- Choose communication technologies and services appropriate for given requirements
- Get a better understanding of the Internet communication services they use in everyday life

List of topics

- Basics of information transmission
- Classical telecommunications services
- Integration of telecommunication services
- Principles of networking and protocols
- TCP/IP communication architecture
- LAN/WLAN technologies
- MobilityFundamentals of Web-centric Development

Fundamentals of Web-centric Development

Module Code: MSTSI14 **Duration: 30h**

Objectives

At the end of this module students will be able to explain:

- How the web relates to the Internet
- What HTTP is
- The notions of web server and web client
- The role of PHP, HTML,CSS, Javascript languages
- The major steps of a web project implementation
- The value of validation for web site security

The student will also be able to create a Web site which:

- Is dynamic
- Follows the separation of content and presentation principle
- Is in keeping with HTML5 and CSS standards
- Is secured against SQL injections and defacement attacks
- Is in project mode, using especially the Git version control system

List of topics

- Introduction to the internet and World Wide Web
- HTML (Hypertext Markup Language)
- Editing and viewing HTML
- Headers, titles, meta-tags
- Special characters
- Lists
- Tables
- Basic forms
- Metatags
- Cascading Style Sheets
- Embedded Anchors, Images, Links, Objects
- Dynamic web pages with PHP
- Introduction to javascript

Binary Logic & Digital Functions

Module Code: MSTEE11 **Duration: 30h**

Objectives

At the end of this module, students will be able to: analyse and design digital functions

List of topics

- Basic concepts of probability:
- Number representation
- Fundamentals of Boolean algebra
- Construction of elementary gates

- Circuits developed from combinatory logic (comparator, decoder and demultiplexer)
- Introduction to sequential logic and its basic components (D, RS, RSH, and JK flip flop circuits)
- Registers and counters
- Designing and creating a sequential system

LabView

Module Code: MSTEE15 **Duration: 30h**

Objectives

- Design a program with LabVIEW for an electrocardiogram that monitors real and "noisy" data. This program must:
- respect design standards
- use standard programming and signal processing tools seen in the 2nd year
- The application must respect standard LabVIEW practices (taken from the Certified LabVIEW Developer (CLD) test) and use a modular and evolving architecture

List of topics

- Fundamental programming notions in LabVIEW
- LabVIEW programming
- Creating an interface
- Learning good LabVIEW practices for form and structure in programming

C Programming

Module Code: MSTEE10 **Duration: 30h**

Objectives

At the end of this module, students will be able to write and develop a programme in C language, using:

- Functions: definitions, interests, prototypes
- 1 & 2 D arrays: syntax, use, parameters
- String functions: manipulating chains of characters
- Pointers: syntax, manipulation, using them correctly
- Structures: syntax, manipulation, establishing parameters
- Binary and text files: manipulation and relation to structures
- Dynamic allocation

List of topics

- Algorithms, processors, fundamentals, environment and variables
- Simplified architecture of a computer
- C Language: programming structure, declarations, control structures (if, switch, while, do while, for), entries / exits (printf, scanf, fflush role)
- Environment for development
- 1D arrays
- Review of general notions for arrays, functions, character chains, structures, pointers, dynamic allocation, files

Cross Cultural Awareness and Working in a Team

Module Code: MSTCCAWT **Duration: 36h**

Objective

At the end of this module students will be able to:

- Recognise the different elements that make up culture
- Demonstrate the role culture plays on general and professional communication and behaviour
- Suggest ways to begin respecting and reconciling the cultural differences that make a difference
- Analyse the cultural elements inherent in different situations
- Evaluate the relative importance of different cultural elements in different communication situations
- Apply different cultural orientations to correctly analyse different situations
- Interact more sensitively within international teams
- Develop a capacity for culturally sensitive critical analysis
- Sensitively interpret different elements of verbal and non-verbal communication
- Sensitively analyse critical incidents
- Clearly distinguish between objective and subjective culture
- Integrate a new team from an initial team

List of topics

- Modern leadership models and their application
- The influence of national cultures on leadership
- The building and management of international, multi-discipline, remote and virtual teams

Bibliographical Study

Module Code: MSTEE40 Duration: 12h

Objectives

At the end of the module, students will be able to :

- Learn to create and conduct a short oral presentation on a technical topic given to them at the beginning of the semester
- Acquire basic skills and methods on searching for information and oral presentations
- Enhance their skills to search for information and conduct oral presentations
- Learn to deliver an effective oral presentation in order demonstrate their understanding of the subject

List of topics

- Team working
- Information searching
- Oral presentation

Digital Electronics Project

Module Code: MSTEE41 Duration: 32h

Objecives

At the end of the module, students will be able to:

- Acquire basic practical skills in Digital Electronics
- Familiarise themselves with a real-world situation similar to that of future professional environments
- Acquire skills to exercise their initiative and independence
- Improve their organizational, interpersonal and communication skills
- Acquire time management skills

Fundamentals of Electronics

Module Code: MSTEE13 **Duration: 30h**

Objectives

At the end of this module, students will be able to:

- Put together an electrical circuit in the form of a four-terminal network (transmit gain, input / output impedance)
- Transcribe a situation into a simulation diagram
- Choose the type of analysis (polarisation or time-frequency analysis)
- Identify function block diagrams
- Design a cabling schema from a given electric schema (using BNC connectors correctly)
- Measure voltage using oscilloscopes, multimeters and dB meters
- Create various wave forms, recognize them using an oscilloscope and change settings
- Measure input/output impedance
- Measure frequency response
- Interpret results of the aforementioned measurements
- Use Excel to plot graphs and schemas

List of topics

- Electrical circuits
- Simulation schema
- Block diagrams
- Cabling and electric schema
- Measurement
- Generation of various signals
- Generation of plot graphs

Microprocessors

Module Code: MSTSEE21 **Duration: 60h**

Objectives

At the end of this module, students will be able to:

- Understand the architecture of microprocessors
- Program microprocessors
- Study the evolution of their architecture

List of topics

- Microprocessor architecture (ALU, control unit, registers, buses)
- Data and processors (address decoding, synchronization)
- Vital signals of processors (clocks, power supply, reset)
- Microprocessor programming (languages, registers, addresses, instructions)
- Execution time, routines, passing parameters
- Principles and how exceptions/interruptions work
- Inputs/outputs
- Case study (MSP430)

VHDL & Logic Synthesis

Module Code: MSTSEE22 **Duration: 30h**

Objectives

At the end of this module, students will be able to:

- Program logic devices (PLD)
- Develop programs using VHDL language

List of topics

- Review of combinatory and sequential logic
- The different families of programmable logic devices
- Practice with synthesis tools (Xilinx or Altera targets, Quartus or ISE tools, Modelsim)

Communication Busses

Module Code: MSTSEE23 **Duration: 30h**

Objectives

At the end of this module, students will be able to:

- Use the most widely used communication busses in the field of embedded processors
- Understand technical specifications

List of topics

- RS-485
- I2C BUS, SPI BUS
- CAN BUS
- ARINC bus

Real Time Operating Systems

Module Code: MSTSEE24 **Duration: 30h**

Objectives

At the end of this module, the students will be able to:

- Understand why real-time executive is used in embedded systems
- Describe the four major categories of services provided by an executive
- Describe the necessary required materials to implement an executive in real-time
- Learn the various commercial aspects of executive suppliers
- Describe the role of scheduling, how it works and the major variations
- Calculate task times for simple situations
- List attribution rules for task priority
- Describe how the principle elements for synchronization are presented in executives
- Describe the characteristics and how an email inbox works
- Design and develop a simple multitasking application with MicroC / OSI

List of topics

- Fundamentals of multitasking and real-time
- A scheduler: its role and how it works
- Why real-time executives are used in embedded systems
- Necessary materials
- Categories of executives and their markets
- A real-time kernel: MicroC/OSII (Micro-Controller Operating Systems Version 2)
- Memory management
- Intertask communication and synchronization tools
- Using MicroC/OSII and microcontrollers

Embedded Linux

Module Code: MSTSEE25 **Duration: 30h**

Objectives

At the end of the module, the students will be able to:

- Understand the possibilities and uses of the Linux kernel for an embedded IT project.
- Learn the principle software tools used in the Linux/Unix world and how to use them to develop.
- Write a device driver for specific Linux run material
- Combine tools to create advanced functions with a minimum of programming

List of topics

- Introduction to Linux.
- How an OS fits in an embedded system.
- History of Linux and Unix systems.
- Linux compared to other embedded operating systems.
- Fundamental tools: command lines, shell scripts.
- Linux development tools.
- C programming with embedded systems.
- Linux drivers.
- Web connections and Remote Administration Tools (RATs).t

Embedded C Programming

Module Code: MSTSEE26 **Duration: 30h**

Objectives

At the end of this module, students will:

- Be familiar with the C coding practices for embedded systems
- Be familiar with the elements and tools for embedded software validation
- Develop, write and test a C language program (as per design specifications) to be used with a microprocessor with respect of good practices like MISRA-C rules
- Analyse and enumerate the various phases of development for a software project: the V cycle

List of topics

- Specificities of C Language for embedded systems (variables, memory organization, physical address access, etc.)
- Programming methods
- Software analysis and validation tools and principles for embedded systems

Analysis & Design with UML

Module Code: MSTISI2A **Duration: 32h**

Objectives

At the end of this module students will be able to:

- Be familiar with the process for designing software applications, with a special focus on the Unified Modelling Language (UML) and Java as design tools
- Be familiar with the major steps in software design, including the development of user requirements, specifications, data bases, user interfaces, and software models

List of topics

- Overview of software design: challenges, accomplishments, and failures
- Overview of software lifecycle model and its variants
- Overview of object oriented design – Java classes, objects, inheritance, associations
- Requirements analysis and use case design – UML use case and sequence diagrams
- Class design – UML class diagrams
- Modeling activities and interactions – UML activity and state diagrams

Embedded Java

Module Code: MSTSEE27 **Duration: 30h**

Objectives

At the end of this module, students will:

- Be familiar with a computer language which can be used to develop graphic applications under Windows for personal embedded systems like Pocket PCs

List of topics

- Java ME environment: interface and syntax
- Basics of programming in the Java ME environment

Smart Sensors

Module Code: MSTSEE32 **Duration: 30h**

Objectives

At the end of this module, students will:

- Be familiar with the principles and the advantages of smart sensors through different applications

List of topics

- Sensors and interfacing circuits
- Applications of smart sensors
- Architecture and components of smart sensors
- Practice with smart sensors

Specific Instrumentation

Module Code: MSTSEE29 **Duration: 30h**

Objectives

At the end of this module, students will be able to:

- Manage the entire information sampling chain in an instrumentation-type embedded system

List of topics

- The measurement chain: physical signal to digital processing
- Sensors: types, technology
- Signal conditioning: transport, filtering, amplification
- Sampling: period, response time
- Information security: accuracy, lifetime, redundancy

MtoM Communication

Module Code: MSTSEE31 **Duration: 30h**

Objectives

At the end of this module, students will:

- Be familiar with the principles of communication between machines, needing no human action

List of topics

- Sensors and servers
- Cellular networks
- Applications
- Protocols of MtoM communication

Python Programming & Image Treatments

Module Code: MSTSEE36 **Duration: 30h**

Objectives

The Python language is today, one of the most useful programming tool for engineers and is used in several applicative areas including embedded systems. The objective of this elective is to understand the environment, the tools and the scope of this language.

List of topics

- Python Development Environment
  - Python distribution and their installation
  - Python as a script language
  - Python as a programming language
  - Interactive Python (Jupiter-notebook)
  - Comparison with other programming languages
  - Installing important libraries (PIP)
- Python Basics
  - The first program
  - Docstrings
  - Blocks and indentation
  - First Control structures
- Simple data types and expressions
  - Boolean
  - Integer
  - Float
  - Complex numbers
  - Strings
  - Bytes
- More data types
  - Lists
  - Tuples
  - Sets
  - Dictionaries
  - Strings
  - Numpy
  - Arrays

- Control structures
  - Loops
  - Alternatives
  - Exceptions
- Comprehension and slicing
- Object oriented Python
  - Class definition
  - Class instantiation
  - Generators and iterators
- Files
  - Files
  - Serialization
  - Important file formats
- Specialized topics (optional)
  - Writing and installing your own libraries
  - Regular expressions

Android Programming

Module Code: MSTSEE32 **Duration: 30h**

Objectives

At the end of this module, students will be able to:

- Understand the challenges and possibilities of mobile platforms
- Use the Android development environment
- Create a user interface
- Develop communication applications
- Develop an application using persistent data
- Develop a multimedia application
- Develop an application that works with Googlemaps
- Make and publish an Android application

List of topics

- Embedded applications, possibilities, Android SDK
- Using views, creating advanced user interfaces
- Intent classes
- Persistent data
- Multimedia
- Geolocalisation
- Publishing Embedded applications, possibilities, Android SDK
- Using views, creating advanced user interfaces
- Intent classes
- Persistent data
- Multimedia
- Geolocalisation
- Publishing

System on Chip

Module Code: MSTSEE33 **Duration: 20h**

Objectives

At the end of this module, students will understand and be able to implement a complete embedded system on a chip (SoC)

List of topics

- Main components of SoC systems
- Related embedded solutions on chips
- Defining an intellectual property tool
- Integration of a solution
- Xilinx Spartan or Microsemi SmartFusion components

DSP Processors

Module Code: MSTSEE34 **Duration: 20h**

Objectives

At the end of this module, students will:

- Be familiar with the main DSP (digital signal processing) algorithms and their impact on DSP architecture

List of topics

- Sampling, convolution
- Linear filtering
- Fourier transforms
- STM32F407VG ARM based processor

Safety Systems

Module Code: MSTSEE35 **Duration: 20h**

Objectives

At the end of this module, students will:

- Understand the role EMC phenomena play in the field of embedded systems, by studying automotive examples

List of topics

- EMC (Electromagnetic Compatibility) issues for electronics
- Cause and effect
- Prevention and solutions
- The automotive field: an overview

Oral Communication & Presenting Skills

Module Code: MSTOCPS **Duration: 14h**

Objectives

At the end of this module students will:

- Have a clear model of what constitutes successful and unsuccessful presentations
- Have practiced giving formal presentations in English.
- Be more aware of their own downfalls when presenting

List of topics

- Methods for putting together an oral presentation
- Practice

Project Management

Module Code: MSTPM **Duration: 26h**

Objectives

At the end of this module students will be able to:

- Appreciate the need for project management including formal methods, as a recognised discipline
- Appreciate the need for effective planning, control and delivery mechanisms
- Understand the complexities of different types of computing projects and some of the methods used to manage them
- Apply some of the skills and knowledge learned in any future project (including during other module(s) of this course, and, in particular, documentation for development project)

List of topics

- What is a project? The need for PM, formal methods
- Managing large, complex, international projects
- Un peu de franglais (PM culture and language in English and in French)
- Management of projects, project life cycle, roles of the project manager and stakeholders
- Stakeholder management, scope, creep
- Work planning, project breakdown structures and estimating
- Resource planning, estimating, management
- Risk identification, analysis, management
- PERT and Gantt charts, their use and shortcomings
- PM planning tools (including practical sessions with MS Project)
- Change control, documentation, configuration management
- Project control, quality, documentation, delivery management
- Project closure; maintenance projects
- Types of computing projects and risks; computing PM methods
- Cost-benefit analysis and project accounting may be touched upon, but are not in the scope of this course

Research & Development Project

Module Code: MSTPRDP **Duration: 80h**

Objectives

At the end of this module students will be able to:

- Improve their organizational skills (within a team, facing deadlines) and manage their time
- Improve their communication skills
- Work in a real-world situation close to their future professional environments
- Filter and identify relevant online information according to a targeted subject
- Constitute a bibliographical study
- Develop functional specifications and success strategies
- Estimate the workload of each identified task
- Analyse their production capacity
- Design and build computer applications with current standards and new opportunities
- Integrate research approaches
- Evaluate the quality level for a developed application
- Present their work and justify the outcome

List of topics

- State of the art practices
- Technical / feasibility studies
- Research methodologies and approaches
- Information processing
- Experimental results and evaluation

French as a Foreign Language

Module Code: MSTFRE1, MSTFRE2, MSTFRE3 **Duration: 180h**

Objectives

At the end of this module students will be able to:

- Oral comprehension
  - Understand standard French used in everyday situations at work, school, etc.
- Written comprehension
  - Understand texts written in standard French used in everyday situations such at work, school, etc.
- Oral expression
  - Participate in a regular day-to-day conversation on familiar topics
  - Ask and exchange information
  - Prepare and give a short formal presentation
- Written expression
  - Write short, clear and coherent texts on familiar / everyday situations with basic grammar and vocabulary

List of topics

- Revision of grammar and vocabulary
- Preparation for the Test of French Language (TCF or TEF)

English as a Foreign Language

Module Code: MSTENG1 MSTENG2 MSTENG3 **Duration: 180h**

Objectives

At the end of this module students will be able to:

- Oral comprehension
  - Understand standard English used in everyday situations at work, school, etc.
- Written comprehension
  - Understand texts written in standard English used in everyday situations such at work, school, etc.
- Oral expression
  - Participate in a regular day-to-day conversation on familiar topics
  - Ask and exchange information
  - Prepare and give a short formal presentation
- Written expression
  - Write short, clear and coherent texts on familiar / everyday situations with basic grammar and vocabulary

List of topics

- Revision of grammar and vocabulary
- Preparation for the Test of English for International Communication (TOEIC)

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INTERNSHIP / PROFESSIONAL THESIS

The internship will take place either in a company or in a research laboratory in a university. Students are encouraged to do their internship in France or in another European country, but may choose to do so elsewhere in the world too. The duration of the internship is of 4 months (min.) to 6 months (max.). ESIGELEC and INSA Rouen provide assistance to students to find internships but they are expected to play an active part, as the internships are not offered automatically.

A professional thesis will have to be submitted upon completion of the internship and the students will have to make an oral presentation before a convened jury, at ESIGELEC or at the representative offices of ESIGELEC abroad (or remotely, upon special written request, authorised by the school).

An internship form, providing all required information must be filled and submitted to the Internship Department at ESIGELEC, as soon as the student has obtained an offer. The Head of the Internship Department and the Academic Coordinator of the Master's Programme will validate and approve the information (if relevant) by duly signing on the said form. ESIGELEC, the company / research laboratory and the student will then countersign an Internship Agreement (if required) issued at ESIGELEC. A copy of the agreement is retained by ESIGELEC, the company or research laboratory and the student.

A faculty member of ESIGELEC or INSA Rouen will be assigned the task of visiting or contacting the student at least once during the internship. In the event of questions regarding the internship, the preparation of the oral presentation and/or the professional thesis, the student may remain in contact either with the assigned faculty member or the Academic Coordinator of the Master's Programme, during the period of the internship or thereafter.

The topic of the professional thesis chosen by the student must be communicated to the Academic Coordinator of the Master's Programme for approval, within the first month of starting the internship.

The professional thesis (2 hard copies by post and 1 soft copy in Word or pdf via intranet) must be submitted to ESIGELEC at least 3 weeks before the oral presentation before a Jury comprising of a President (from ESIGELEC or INSA Rouen), one faculty member from ESIGELEC or INSA Rouen and the industrial tutor (if possible). This presentation must be done within four months, at the latest, of completion of the internship. The total duration of the oral presentation will be of 60 minutes (30 min. presentation + 15 min. Q&A + 15 min. deliberation among jury members).

These presentations are typically organized at the end of March, at the end of June, in the beginning of September and at the end of November each year.

A student has a maximum period of 2 years after the final academic semester, to find the internship, complete it, submit the professional thesis and conduct the oral presentation before a convened jury, after successful completion of the internship.

THE STUDY BOARD

The Board of Studies, whose members are representatives from industry, universities, INSA Rouen & ESIGELEC, oversees the course content and recommends changes when necessary.

The Board of Studies, which meets at least once a year, also ensures that the course content and laboratories are streamlined in keeping with the changing industry requirements. A meeting between the Academic Coordinator of the Master's Programme and all faculty members is convened at the end of each module, to assess the relevance of the content, equipment and issues which may have occurred while delivering the module.

A meeting is also convened every two months between the Academic Coordinator of the Master's Programme and the students to discuss academic and non-academic issues.

School of Engineering
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