MANIPAL
ACADEMY of HIGHER EDUCATION
(Deemed to be University under Section 3 of the UGC Act, 1956)
MANIPAL SCHOOL OF INFORMATION SCIENCES
MANIPAL ACADEMY OF HIGHER EDUCATION, INDIA

ESIGELEC
SCHOOL OF ENGINEERING
SMART AND CONNECTED SYSTEMS

# JOINT MSc.
# IN
# CONNECTED EMBEDDED INTELLIGENT SYSTEMS
## (2022-2023)

Master of Science - MSc. in Connected Embedded Intelligent Systems
ESIGELEC, Graduate School of Engineering, France

Accredited by

CONFÉRENCE DES GRANDES ÉCOLES

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# GENERAL INFORMATION & PROGRAMME STRUCTURE

# GENERAL INFORMATION

## ELIGIBILITY

A 4 year bachelor's degree in Electronics & Communication, Electrical & Electronics, Telecommunication, Computer Science or any other relevant branches in Engineering, with a minimum aggregate of 50%.

## PROGRAMME OBJECTIVES

The Master's Programme in Connected Embedded Intelligent Systems, seeks to equip students with the relevant knowledge, professional skills, practical experience and basic management skills, for industry or for research. They will learn how to design, develop systems and equipment in the aeronautic, space, automobile and electronics sectors.

The mandatory internship gives students hands-on experience, in an international setting. Our graduates find job opportunities as developers, project managers, consultants or researchers.

The multicultural environment at ESIGELEC allows students to discover new cultures and languages.

## DURATION

The programme comprises two semesters of study, one semester each at MSIS-MAHE, India and one at ESIGELEC, France. In semester 3, students are required to complete a mandatory internship in a company or in a laboratory (Ref. sections *semester 3*).

The maximum permissible duration to complete the programme and obtain the degree is of 3 years.

# PROGRAMME STRUCTURE

## SEMESTER 1 ( JULY-DECEMBER 2022)

Location: MANIPAL ACADEMY OF HIGHER EDUCATION – MANIPAL SCHOOL OF INFORMATION SCIENCES (MSIS-MAHE), India

Course delivery: lectures, tutorials, practical work, projects and seminars.

Evaluation: tests, quizzes, oral & written exams, etc. conducted on a regular basis

Faculty: MSIS-MAHE

The rules and regulations for this semester are prescribed by MSIS-MAHE (approved by ESIGELEC).

## SEMESTER 2 (FEBRUARY 2023-JULY 2023)

Location: ESIGELEC, France

Course delivery: lectures, tutorials, practical work, projects.

Evaluation: tests, quizzes, oral & written exams, etc. conducted on a regular basis

Faculty: ESIGELEC, partner universities, industry captains from France and / or abroad.

The rules and regulations for this semester are prescribed by ESIGELEC (approved by MSIS-MAHE).

## SEMESTER 3: INDUSTRIAL / RESEARCH INTERNSHIP(S)

In the third semester, students must do a mandatory internship in a laboratory or in industry, for a period of 4 months (min.) to 6 months (max.).

***While ESIGELEC and / or MSIS-MAHE provide assistance to find internships, students are expected to play an active part, as internships are not provided automatically.***

# SEMESTER ONE

## MANIPAL SCHOOL OF INFORMATION SCIENCES INDIA

## Module Summary

| SEMESTER 1 – MSIS-MAHE, MANIPAL, INDIA: JULY 2022 - DECEMBER 2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Module Name | Hrs / Week | | | | Exam Duration (hrs) | Maximum Marks | | |
| | Lecture | Tutorial | Practical | Credits | | Internal Assessment | Final Exam | Total |
| Data Structures & Algorithms | 3 | | | 3 | 3 | 50 | 50 | **100** |
| Fundamentals of Machine Learning | 3 | | | 3 | 3 | 50 | 50 | **100** |
| Embedded Systems | 3 | | | 3 | 3 | 50 | 50 | **100** |
| Elective 1 | 3 | | | 3 | 3 | 50 | 50 | **100** |
| Microcontrollers & its Applications | 3 | | | 3 | 3 | 50 | 50 | **100** |
| Data Structures & Algorithms - Lab | | | 3 | 1 | 3 | 50 | 50 | **100** |
| Microcontrollers & its Applications - Lab | | | 3 | 1 | 3 | 50 | 50 | **100** |
| Fundamentals of Machine Learning -Lab | | | 3 | 1 | 3 | 50 | 50 | **100** |
| Embedded Systems - Lab | | | 3 | 1 | 3 | 50 | 50 | **100** |
| Elective 1 - Lab | | | 3 | 1 | 3 | 50 | 50 | **100** |
| Minor Project 1 | | | | 4 | | 100 | | **100** |
| Seminar 1 | | | | 1 | | 100 | | **100** |
| French Language - 1* | 5 | | | | 3 | 100 | | **100** |
| **TOTAL** | **475 HOURS / 25 CREDITS** | | | | | | | |

## List of Electives

| MSIS-MAHE, India |
| --- |
| **Elective - 1** |
| DotNet Technologies |
| Advanced Programming Techniques |
| Linux & Scripting Languages |
| Internet of Things |

**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 Indian Government authorities**

# module description

## Data Structures & Algorithms

Module Code: ESI 601 Duration: 72h

**Objectives:**

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

- Analyze algorithms
- Analyze basic recursive programs, solve a general class of recurrence relations
- Design programs for implementation of linked lists, stack and queues
- Design programs for sorting and searching
- Explain sets and design dictionary and hash tables
- Design trees and binary search trees
- Design graphs for implementing spanning trees and shortest path algorithms
- Illustrate application of divide and conquer technique, dynamic programming, greedy technique and back tracking

**List of topics:**

- Introduction to Data structure, Algorithms and problem solving
- Elementary data structures – Linked list, Stack, Queue, Tree, Sets
- Graphs and its applications
- Sorting and Searching Techniques
- Algorithm design techniques and analysis of algorithms

This module will also help students to improve their programming skills.

## Fundamentals of Machine Learning

**Module Code: BDA 601** **Duration: 72h**

**Objectives:**

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

- Identify the software and tools for designing machine learning applications
- Apply concept learning and hypothesis space
- Apply machine learning approach to reduce the dimension
- Analyse different machine learning algorithms
- Design ensemble methods

**List of Topics**

- Introduction to Machine Learning
- Inductive Classification
- Decision Tree learning
- Computational learning theory
- Bayesian learning, Instance-based learning
- Continuous Latent Variables
- Ensemble methods (bagging and boosting)

## Embedded Systems

**Module Code: ESI 609** **Duration: 72h**

**Objectives:**

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

- Employ the knowledge of ARM Processor architecture in programming ARM Microcontrollers
- Explain the concept of Memory map, Processor Modes, Banked Registers, Interrupts and Exception Handling of ARM Processor
- Employ the knowledge of Microcontrollers to build Real Time Embedded systems
- Explain the concept of Programming ARM Microcontrollers using Assembly and Embedded C
- Design a Real Time Embedded Systems by interfacing Sensors and Actuators and porting Real time operating systems

**List of topics:**

- Introduction to Embedded Systems
- ARM Cortex processor
- Instruction Set Architecture
- LPC13/17xx Microcontroller
- Data Acquisition System: ADC, DAC
- Serial Communication: UART – I2C – SPI
- USB, CAN Bus
- Multitasking in Microcontrollers
- Designing a Digital Camera

## Dot Net Technologies

**Module code: ESI 615.3 Duration: 72h**

**Objectives:**

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

- Understand the working principles of dot net framework
- Use Object-oriented programming features offered by C#
- Design and implement desktop application using ADO.Net
- Design and build web application using ASP.Net

**List of topics:**

- Introducing C# and the .NET Platform:
  - The philosophy of .NET, Building C# Applications.
- The C# Programming language:
  - Fundamentals, Object-Oriented Programming with C# 2.0,
  - Understanding Object Lifetime, Understanding Structured Exception Handling,
  - Interfaces and Collections, Callback Interfaces, Delegates, and Events.
- Programming with the .NET Libraries:
  - The System.IO Namespace, Understanding Object Serialization,
  - Building Better Window with System Window Forms,
  - Rendering Graphical Data with GDI, Programming with Window Forms Controls,
  - Database Access with ADO.NET.
- Web Applications and XML Web Services:
  - ASP.NET 2.0 Web Pages and Web Controls, ASP.NET 2.0 Web Applications

## Advanced Programming Techniques

**Module code: MIS 506** **Duration: 72h**

**Objectives:**

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

- Explain major principles of object-oriented programming concepts and apply it in an application using java programming language
- Discuss the basic structures of a java application and Develop UI based application using swing components
- Write a java application for multi thread programming
- Apply collection framework and utility library in java applications

**List of Topics**

- Coding patterns – Structural vs. procedural languages
- Introduction to OOPS concept – Data Abstraction - Encapsulation – Polymorphism – Inheritance
- JAVA language constructs – Applications and Applets
- Java GUIs, JAVA Beans
- The Java Library – The Collection Framework, Utility classes

## Linux & Scripting languages

**Module code: AES 615.1 Duration:72h**

**Objectives:**

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

- Relate the Linux operating system in real world applications
- Name the different shell command interpreters, Operate Linux System and understanding of shell scripting features
- Write shell script programmatically using different features and debugging the code
- Write pattern matching using grep, sed, awk, perl commands
- Schedule the task using shell script
- Create an application using dialog utility
- Operate SED & AWK commands to do more complex task in easy way
- Generate a report using AWK commands
- Differentiate between globbing and pattern matching operators
- Create Make file
- Write PERL scripts that create and change scalar, array and hash variables
- Use control structures to branch or loop in PERL
- Read and write in a file using PERL file handle

* This course will help the students to understand the various tools available in Linux and be able to write shell scripts using sed, awk, grep commands, and how to apply them to the problem

**List of topics:**

- Shell scripting
- Dialog utility
- Power utilities like cut, paste, grep, tr, uniq
- Sed
- AWK
- PERL
- Make file

## Internet of Things

**Module code: ESI 615.5 Duration: 72h**

**Objectives:**

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

- Illustrate the IoT Protocols and IoT architecture.
- Write basic python programming.
- Explain the wireless sensor network protocol standards, issues, routing design and applications
- Illustrate the Bluetooth architecture, stack, profile
- Explain Zigbee protocol stack, different layers, and communication
- Distinguish between IPv4 and IPv6
- Explain 6LoWPAN architecture
- Design and develop database and web server for some IoT Frameworks

**List of topics:**

- IoT Protocols
- Introduction to Python
- Wireless Sensor Networks
- Protocols – Bluetooth, Zigbee
- Internet Protocol
- 6LoWPAN - 6LoWPAN architecture
- Sockets
- Databases & Web Programming

## Microcontrollers & its Applications

**Module Code: ESI 607** **Duration: 72h**

**Objectives:**

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

- Explain the architecture of Microcontrollers
- Explain the concepts of Communication protocols, Memory map, Interrupts and Exception handlers of Microcontrollers
- Employ the knowledge of Microcontrollers to build embedded systems
- Explain the concept of Programming Microcontrollers using Assembly and Embedded C
- Design Embedded Systems by interfacing Sensors and Actuators

**List of topics:**

- Introduction to Microprocessors & Microcontrollers
- ARM Microcontrollers
- Reset Circuitry, Relays and Timers
- Serial vs Parallel Buses
- Introduction to SPI and I2C Protocol, Interfacing with SPI and I2C Devices – RTC
- ADC and DAC

## Minor Project 1

**Module code: AES 695** **Duration: 75h**

**Objectives:**

At the end of the course student shall be able to:

- Search and identify the most relevant technical problem to be implemented
- Learn to gather related and relevant information related to the identified problem
- Design hardware/software, algorithms, flowchart, and block diagrams
- Learn to Analyze the results
- Justify the methodology used
- Develop the skill to write a technical report and paper

## Seminar 1

**Module code: AES 697** **Duration: 20h**

**Objectives:**

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

- Search and identify a most relevant technical topic for presentation
- Learn to identify a current and relevant research topic
- Develop the skill to write a technical report
- Learn to design an effective technical presentation slides
- Improve overall presentation skills
- Develop the ability to work in groups to review and modify technical content

## French Language 1

Module code: AES 637 Duration: 60h

**Objectives:**

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

- Listen (basic everyday situations)
- Read (basic everyday situations)
- Write (basic everyday situations)
- Speak (basic everyday situations)

# rules & regulations, evaluation

# RULES & REGULATIONS

Applicable to students admitted to the dual-degree programme offered by MSIS-MAHE, India & ESIGELEC, Rouen, France
(August 2018 and later)

## 1. EDUCATIONAL PROCESS AT MAHE

### 1.1 CREDIT BASED SYSTEM

1.1.1 The educational process at MSIS-MAHE uses a credit-based system, wherein the module content is expressed in number of credits.

1.1.2 The content of individual modules – theory and practical – is expressed in terms of a certain number of credits. The number of credits assigned to a module, depends on the number of contact hours per week. Normally, in the case of theory modules, the number of credits is equal to the number of contact hours (lectures & tutorials) per week, while in the case of practical sessions, one credit is assigned for every three contact hours per week.

1.1.3 The content delivered in each semester, is expressed in terms of a specified number of credits. Students are deemed to have successfully completed a particular semester's programme of study, when they earn all the credits of that semester, i.e. they have not been awarded grade F, in any module in a given semester.

1.1.4 Students who earn the prescribed number of credits in all the modules of the programme, are deemed to have completed the requirements for graduation. This implies that students should obtain grade E or higher, in every module, of every semester, in order to be awarded the degree.

1.1.5 During the second year (semesters 3 & 4) of the programme, students are required to do an internship. The duration of the internship is of 10 months (min.) to 12 months (max.), from the date of commencement of the internship.

1.1.6 Students are required to do an internship of 10 to 12 months, in the second year of the programme (semesters 3 & 4), in one or more companies or laboratories, in any country.

- If an extension of internship beyond 12 months is required, they may do so by taking prior approval from the institution.
- If a student gets a full-time job, before completion of the internship, he / she can join as an employee, provided:
  - The company/laboratory authorises him/her to present the work done as an internship. If not, the student will be required to do an additional project under the guidance of faculty at MSIS-MAHE, for the remaining period of the internship, during his / her free time.
- If the work done prior to accepting full-time employment is satisfactory, the remaining duration of internship / project can be used to prepare the thesis for submission, upon prior approval from the guide at MSIS-MAHE. However, in this case, students will be allowed to submit the thesis, only after completing the internship.

## 1.2 OUTLINE OF EVALUATION

1.2.1 The progress of a student is assessed by means of a continuous evaluation process.

12.2 Theory modules are evaluated on a maximum of 100 marks: 50 marks for the in-semester assessment and 50 marks, for the end-semester examination.

1.2.3 Lab modules are evaluated on a maximum of 100 marks: 50 marks for the in-semester assessment and 50 marks, for the end-semester examination.

1.2.4 The Seminar and Mini-Project are evaluated internally, on a maximum of 100 marks.

1.2.5 The in-semester assessment is based on continuous evaluation, which includes assignments, case presentations, class tests, quizzes etc.

1.2.6 Students' performance is duly documented and announced (including on the notice board) within a week of assessment of the assignments, case presentations, etc.

1.2.7 A faculty committee headed by the Director, will address all grievances of students, with regard to their performance in tests / quizzes, practicals and end-semester examinations.

1.2.8 The overall performance of a student in each module, is expressed in terms of a Letter Grade for which the Relative Grading System is used.

1.2.9 Answer scripts of the end-semester exams for theory modules are evaluated by the faculty members who teach the modules.

1.2.10 Marks awarded in End Semester Theory Examinations of all the modules, will be displayed on the notice board by the faculty members concerned.

1.2.11 Paper seeing: Interested Students can approach the respective module faculty member, to see the marks awarded in the module. However, it is not mandatory.

1.2.12 Students who obtain grade F / I in a module(s), may appear for make-up exams.

1.2.13 Make up exams for Theory/ Lab modules will be conducted within a month of the End Semester Examination.

1.2.14 Students who obtain grade F / I in a make-up exam, will be eligible to re-appear for the said exam, only after ONE YEAR.

1.2.15 Students who do not register for the make-up exams, are eligible to appear for the said exams, only after ONE YEAR.

1.2.16 Marks scored in the in-semester evaluation and the end-semester examination, on a maximum of 100 marks, will be used to calculate and award the grade in each module.

1.2.17 The Class Committee (Ref. 5.2.2) will decide the credit cut-offs in each module and hand them over to the Director.

1.2.18

GPA and CGPA are calculated from semester 1 of the programme.

1.2.19 The internship at the end of the third semester, is evaluated on 25% of the total weightage allotted for the internship, by the internal faculty members (IA Mark), and the evaluation for the remaining 75 %, is conducted at the end of the fourth semester, by two examiners. The maximum marks for the internship is 400 and is based on a fixed grading system, as explained in 4.8.6.

## 2. THE CLASS COMMITTEE

A common Class Committee is constituted for all programmes. Teaching faculty of all the programmes are members of this committee and a senior faculty member is nominated as the Chairman, by the Director.

### FUNCTIONS OF THE CLASS COMMITTEE

2.1 The Class Committee meets three times during a semester. The first meeting is held within two weeks from the date of commencement of the semester, during which the nature of the cycle of tests and broad outlines of assessment of the different tests and practicals (if any) are decided.

2.2 The second meeting is held two weeks after the first cycle of tests. During this meeting, ways and means to improve the effectiveness of the teaching-learning processes are discussed and the performance of the students is analysed.

2.3 The Chairman of the Class Committee sends the minutes of the class committee meeting to the Director, immediately after the first two class committee meetings.

2.4 The third meeting is held immediately after the end-semester exams and evaluation are completed. The marks obtained by the students, in all modules are reviewed, in order to analyze their performance and to decide their grade ranges in each module. The statement of grades is handed over to the Director thereafter, who in turn, publishes these results.

## 3. ATTENDANCE REQUIREMENTS

3.1 Under the relative grading system, a student must maintain an attendance record of at least 75% in every module. Attendance in the case of lectures, tests, practicals and tutorials are all taken into consideration, to calculate the attendance percentage.

3.2 Students who fail to meet the minimum attendance requirement, will not be eligible to appear for the end-semester examination and subsequent grading in any of the modules of that semester.

3.3 There is no minimum attendance requirement during the period of the internship, for MSIS-MAHE.

## 4. PROMOTION TO HIGHER SEMESTER-ACADEMIC PERFORMANCE REQUIREMENTS

4.1 To be promoted from one semester to a higher semester, students must fulfil the minimum attendance requirement as in 4.4.1 and all other relevant academic requirements.

4.2 MAHE follows a carry over system for the academic requirements:

4.2.1 Students are given a maximum of four years to clear the academic requirements of a module, which in effect, translates to double the actual duration of the programme. Students who fail to complete a module within this duration, will not be eligible for the award of the MAHE Degree.

4.2.2 Students may start the internship at the beginning of the third semester, but must earn all the credits of the first and second semesters, before submitting the final presentation, to obtain the ME degree from MAHE. Further, they must complete the programme within the maximum period stipulated, for the award of the degree.

# 5. EVALUATION PROCEDURE

## 5.1 SEMESTER EVALUATION

5.1.1 A system of continuous assessment and end-semester exams, both internal, are used to monitor the progress of the students, in all modules, whether they are theoretical or practical.

5.1.2 Students are evaluated on various criteria: class / tutorial participation, assignment work, lab work, class tests, mid-term tests, quizzes, and end-semester examinations. All this contributes to the final grade awarded for the module.

5.1.3 The evaluation methods and weightage given to the different assignments and activities, are explained to the students at the start of the semester.

5.1.4 In-semester evaluation or Internal Assessment (IA mark) in each module, for 50 marks, includes the performance in class / tutorial participation, assignment work, lab work, class tests, mid-term tests, quizzes, etc.

5.1.5 End-semester examination is conducted for a maximum of 100 and is then scaled down to 50.

5.1.6 The end-semester marks on a maximum of 50 and the IA marks on a maximum of 50, are added, and these marks, on a maximum of 100, are used to calculate the grade, in a module.

5.1.7 The end-semester examination is conducted at the end of a semester for all the regular modules.

5.1.8 Students who earn grade F / I in the module(s) in the end-semester exam, may re-appear for the make-up exam.

5.1.9 The make-up exam for Theory / Lab modules will be conducted within a month, for students who earn grade F / I in the End Semester Examination.

5.1.10 Students who earn grade F / I in the make-up exam, will be eligible to re-appear for the regular module(s) exam only after ONE YEAR.

Students who earn grade F / I in the end semester examination and clear the module in the make-up examination (without re-registration) will get a maximum grade of C.

## 5.2. RELATIVE GRADING

5.2.1 Marks obtained in the relative performance / grading system, are considered to calculate the letter grade for all modules.

5.2.2 The Class Committee decides the grade cut-off in each module, which is then communicated to the Director.

5.2.3 The Director will in turn declare the results, based on the grade cut-offs.

5.2.4 GPA and CGPA are calculated from semester 1 of the programme.

5.2.5 Students who fail to score a minimum of 35% in the end-semester exams and 50% aggregate in each module (theory or lab) are considered failed.

## 5.3 LETTER GRADING SYSTEM

The final evaluation of a module is carried out on a ten-point grading system, as explained below:

PERFORMANCE GRADE

| Grade Points | 10 | 9 | 8 | 7 | 6 | 5 | 0 |
|---|---|---|---|---|---|---|---|
| Grade | A+ | A | B | C | D | E | F |

5.3.1 Students who earn a minimum of 5 grade points (grade E) in a module, are deemed to have successfully completed that module.

5.3.2 Students must appear for the end-semester examination of the prescribed module of study (appearing only for the continuous assessment tests is not sufficient) to be eligible for the award of the grade in that module.

5.3.3 Students who are eligible, but fail to appear for the end-semester examination, are awarded grade I (incomplete) on the grade report card. For all practical purposes, grade I is treated as grade F.

5.3.4 Students who earn grade F / I in a module and clear the module in the subsequent examination, without re-registration, will earn a maximum grade of C.

## 5.4 GRADE POINT AVERAGE, (GPA) AND CUMULATIVE GRADE POINT AVERAGE (CGPA)

Each module grade is converted into a specific number of points associated with the grade. These points are weighted in accordance with the number of credits assigned to a module. The grade point average for each semester will be calculated only for those students who have passed all the modules of that semester. The weighted average of GPA's of all semesters that the student has completed at any point of time is the cumulative grade point average (CGPA) at that point of time.

CGPA up to any semester will be calculated only for those students who have passed all the modules up to that semester.

## Calculation of GPA and CGPA:

| Modules | Credits | Letter Grade | Grade Value | Credit Value | Grade Points |
|---|---|---|---|---|---|
| Mathematics | 3 | C | 7 | 3x7 | 21 |
| Chemistry | 3 | B | 8 | 3x8 | 24 |
| Physics | 3 | A | 9 | 3x9 | 27 |
| English | 2 | B | 8 | 2x8 | 16 |

| TOTAL CREDITS | 11 | TOTAL GRADE POINTS | 88 |
|---|---|---|---|

**In this case GPA = Total Grade Points / Credits = 88 / 11 = 8**

Suppose the GPA in two successive semesters is 7.0 and 8.0 with 26 and 24 respective credits in those semesters, then the

**CGPA = (7.0 x 26 + 8.0x24) / (26 + 24) = 374 / 50 = 7.48**

Generally,

$$\text{GPA} = \frac{\sum_{i=1}^{n} CiGi}{\sum_{j=1}^{N}( GPAj * \sum Ci )j}$$

$$\text{CGPA} = \frac{\sum_{j=1}^{N}( GPAj * \sum Ci )j}{\sum_{j=1}^{N}( \sum Ci )j}$$

Where

n = Number of modules

Ci = Number of credits of ith module

N = Number of semesters

Gi = Grade of the ith module

After the results are declared, all students who have appeared for the exams will receive a grade report card, carrying a list of modules of that semester, the grades, the GPA and the CGPA.

## 5.5 RE-REGISTRATION

5.5.1 Students who do not fulfil the attendance requirements of a module(s) and who are detained, will not be allowed to appear for the examinations, and can re-register for the module(s) concerned, (in the semester in which those modules are offered) by paying the prescribed fees.

5.5.2 Students who wish to improve their GPA in a semester, may re-register for all the modules of that semester by paying the prescribed fees. Students must attend classes, write the tests, assignments and appear for end-semester examinations of all the modules of that semester, for which they have re-registered to improve their GPA. The attendance percentage, the IA marks and the new GPA obtained will replace the old records and render them null and void. Moreover, in such cases, students must also surrender their previous grade report card, along with the re-registration application.

5.5.3 Students may re-register to improve their GPA of a semester, within 15 days from the date of announcement of the result.

5.5.4 Students may re-register for one or more modules offered in the current semester (both Theory and Labs) within 15 days from the date of announcement of the result for internal assessment improvement, after paying the prescribed fees, if they have obtained grade F/ I. They may attend classes in the next available semester, in which the module is taught and will be required to submit assignments, appear for sessional tests and the end-semester examination. The new grade earned will replace the previous one. However re-registration will be allowed only with prior permission of the Director.

Note:

- Grade I is equivalent to F grade, except if a student is unable to take the exam for a genuine reason (ex: health related problems)
- If a student earns a grade other than F (A, B, C, D or E), he/she cannot seek to improve upon them.

## 6. REQUIREMENTS FOR GRADUATION

A student is deemed to have completed the requirements for graduation if he / she has:

6.1 Fulfilled all minimum requirements in the prescribed modules of study and earned the number of credits specified in the programme of study.

6.2 Adhered to all rules of evaluation.

6.3 Satisfied the requirements specified by the Institution, if any.

6.4 Cleared all dues.

6.5 No case of indiscipline pending against him/her.

## 7. DECLARATION OF RESULTS

7.1 After the end-semester evaluation, marks secured on a maximum of 100 marks (50 for internal evaluation and 50 for end term evaluation) by all the students are compiled module-wise.

7.2 The academic committee, comprising the academic coordinator and senior faculty members of MSIS-MAHE, decides the cut off marks and the grades in each module, based on the credit system guidelines.

7.3 The academic committee will send the grades along with the marks to the Director, who in turn declares the results.

7.4 A student is given grade F if he / she fails to score a minimum of 50% in the end-semester examination.

7.5 The internship in the second year (third & fourth semesters) use the following fixed grading system.

| Grade | Range |
|---|---|
| A+ | 90% - 100% |
| A | 80% - 89.99% |
| B | 70% - 79.99% |
| C | 60% - 69.99% |
| D | 50% - 59.99% |
| E | 40% - 49.99% |
| F | < 40% |

7.6 In keeping with the guidelines of MAHE, credits earned from the partner university / institutions are considered for the award of the degree but not for the calculation of GPA / CGPA. Therefore, MAHE will issue a certificate for the credits earned from the partner university, but not a Grade Report for the said credits.

## 8. AWARD OF DEGREE

8.1 Students who successfully complete the programme by earning required number of credits, within the stipulated maximum duration of the programme are awarded the degree with CGPA.

Number of credits to be earned for the award of Master of Engineering - ME programme: 75

## 9. ELIGIBILITY FOR THE MAHE GOLD MEDAL

Graduates who have earned all the credits required for the award of the degree from MAHE and scored highest CGPA.

*The rules and regulations explained in this document, are subject to change without prior notice.

# SEMESTER TWO
# ESIGELEC, FRANCE

## Module Summary

| SEMESTER 2 - ESIGELEC, FRANCE: FEBRUARY 2023 TO JULY 2023 | | |
|---|---|---|
| **Module** | **ECTS** | **Duration (Hours)** |
| Virtual Instrumentation | 3 | 15h (Course) + 15h (Lab) |
| Specific Instrumentation | 3 | 15h (Course) + 15h (Lab) |
| Embedded C Programming | 3 | 15h (Course) + 15h (Lab) |
| Elective 2 | 3 | 15h |
| R&D Project | 5 | 60h (Project) |
| Project Management | 2 | 26h |
| Artificial Intelligence for Smart Systems | 3 | 15h (Course) + 15h (Lab) |
| Smart Sensors | 3 | 15h (Course) + 15h (Lab) |
| Oral Communication | 1 | 15h (Course) |
| French Language 2* | 4 | 64h (Course) |
| **345 HOURS / 30 CREDITS** | | |

## List of Electives

| ESIGELEC, France |
| --- |
| **Elective - 2** |
| **Module** |
| Real-time Operating Systems |
| Embedded Java |
| Mobile Robotics & Perception |
| Embedded Linux |
| EMC Automotive Systems |

**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**

**ESIGELEC PARTNER AWARD - AWARDED BY ESIGELEC**

- Eligibility: Student with the highest academic score at the end of the programme

# module description

# Semester 2: ESIGELEC, FRANCE

## Virtual Instrumentation

**Module code: MSCCEIS01** **Duration: 30h**

**Objectives:**

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

- Use LabVIEW to create applications
- Understand front panels, block diagrams, and icons and connector panes
- Use built-in LabVIEW functions
- Create and save programs in LabVIEW so students can use them as subroutines
- Create applications that use plug-in DAQ devices. The application must respect standard LabVIEW practices (taken from the Certified LabVIEW Developer (CLD) test) and use a modular and evolving architecture
- Design a program with LabVIEW for an electrocardiogram that monitors real and "noisy" data. This program must:
  - Respect design standards
  - Use standard programming

**List of topics:**

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

## 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:
  - From the physical signal to digital processing
- Sensors:
  - Types
  - Technology
- Signal conditioning:
  - Transport
  - Filtering
  - Amplification
- Sampling:
  - Period
  - Response time
- Information security:
  - Accuracy
  - Llifetime
  - Redundancy

## Embedded C Programming

**Module Code: MSCCEIS03** **Duration: 30h**

**Objectives:**

At the end of this module, students will be:

- Familiar with the C coding practices for embedded systems
- Familiar with the elements and tools for embedded software validation
- Able to 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
- Able to analyse and enumerate the various phases of development for a software project: the V cycle
- Able to program a microcontroller and develop embedded applications. These applications will deal with digital inputs/outputs, analog signals and will create delays and time events by means of hardware timer
- Able to apply techniques and rules to ensure software quality and best coding practices (A sizeable part of the course is devoted to programming the microcontroller)

**List of topics:**

- Specificities of C Language for embedded systems (variables, memory organization, physical address access, etc.)
- Introduction to embedded system and programming methods
- Software analysis and validation tools and principles for embedded systems
- C language for embedded systems
- Best coding practices
- Programming the MSP430 microcontroller

## Real-time Operating Systems

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

**Objectives:**

At the end of this module, 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 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

## Mobile Robotics & Perception

**Module Code: MSCCEIS04** **Duration: 30h**

**Objectives:**

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

- Name the name and function of the different elements of a mobile robot
- Describe the architecture of a mobile robot
- Design, code and test an algorithm allowing the robot to move while avoiding obstacles
- Cite the problems of mobile robotics: modeling, trajectory planning, localization, navigation

**List of topics:**

- Introduction to Mobile Robotics
- Sensors used in mobile robotics
- Actuators used in mobile robotics
- The different mobile platforms
- Modeling and Control Laws in Mobile Robotics
- Location
- Navigation and trajectory planning

## Embedded Linux

**Module Code: MSCAES07** **Duration: 30h**

**Objectives:**

At the end of this module, students will:

- 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.
- Be able to write a device driver for specific Linux run material
- Be able to 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)

## EMC Automotive Systems

**Module Code: MSCAES06 Duration: 30h**

**Objectives:**

At the end of this module, students will:

- Understand EMC System architecture
- Understand Integrity signal and how to calculate it
- Understand EMC of components and how to protect electronic system
- Understand near field and interactions with the environment

**List of topics:**

- EMC Introduction
- Integrity Signal (IS)
- EMC of components
- Near-field

## R&D Project

**Module Code: MSCCEISRDPRJ** **Duration: 60h**

**Objectives:**

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

- Design, develop and realize an embedded system in mobile robotics and embedded electronics
- Develop technical solutions-based electronic equipment or an electronic board: hardware and software
- Test the platform developed
- Develop and carry out an embedded system platform successfully
- Manage a technical project

**List of topics:**

- Project Management:
  - Benchmarking study
  - Technical and Functional specifications
  - Architecture Design and Risk analysis
  - Test protocol
- Technical Development:
  - Image processing and computer vision systems:
    - Image segmentation
    - Pattern recognition
    - Object detection and tracking
  - Artificial Intelligence and Deep Learning Applications for mobile robotics and electronic applications
  - Dataset collection
  - Mobile robotics and autonomous navigation
  - IoT and sensors
  - Smart mobility

## Project Management

Module Code: MSCCEISPRMG 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 recognized discipline
- Understand the complexities of different types of computing projects and some of the methods used to manage them
- Appreciate the need to break up complex projects
- Appreciate the need for effective planning, monitoring and control mechanisms
- Understand the need for formal project management organizational structures
- Understand the importance and management of stakeholders in an international project
- 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)
- Understand the complexity of a technical project and the need for formal methods

**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

## Artificial Intelligence for Smart Systems

**Module Code: MSCCEIS04** **Duration: 30h**

**Objectives:**

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

- Identify artificial intelligence problems in the smart embedded systems field.
- Describe the principle of some of the most widespread artificial intelligence methods
- Develop a basic scenario as an application for a smart embedded system: for example autonomous mobile robot problem, using existing building blocks and software tools

**List of topics:**

- Artificial intelligence issues
- Possible applications in the field of mobile robotics: recognition of road signs, obstacles, pedestrians, faces, etc.
- Study of some of the most widespread methods
- Existing systems in the automotive field
- Implementation: C/C++ programming, Scilab, python, and use of the OpenCV library

## Smart Sensors

Module Code: MSTSEE32 Duration: 30h

**Objectives:**

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

- Describe the typical internal architecture of such a sensor, the advantages and disadvantages associated with it and the current uses of this type of system
- Understand the complexity and the benefits of using this kind of technology

**List of topics:**

- "Smart" vs "dumb" sensors
- Observer (human) effect and Schrödinger's cat dilemma in sensing
- Statistical modeling of sensing/measurements
- Signal processing for smart sensing
- Communication systems
- Case studies

## Oral Communication

**Module Code: MSCAES10** **Duration: 15h**

**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 shortcomings when presenting
- Practice and perfect final presentation skills
- Learn the importance of structure and how formal prepared speech differs from everyday social interactions
- Work with their presenting strengths and weaknesses via several short practice presentations and a final (individual and/or group) presentation

**List of topics:**

- Methods for creating a final presentation
- Practice

## French Language 2

**Module Code: MSCAESLANG** **Duration: 64h**

**Objectives:**

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

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

**List of topics:**

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

# rules & regulations, evaluation

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

The Master's Degree of ESIGELEC is awarded, if the student has obtained a minimum average score of 10/20 in each module, thereby obtaining the total number of 90 ECTS credits.

The jury of ESIGELEC for the Master's Degree comprises the President, faculty members and representatives of the managing staff of ESIGELEC. This jury, nominated by the General Director of ESIGELEC, convenes up to a maximum of four times per year, i.e. April, July, September and December (dates will be communicated at an appropriate time). The MSc. in Connected Embedded Intelligent Systems awarded by ESIGELEC, is accredited by the CGE (Conference des Grandes Écoles).

Evaluation includes tests, quizzes, presentations or other formats, as decided by the faculty members, who may also authorise the use of reference documents, calculators and other devices, 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 modules, each of which 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 final overall score of the student is the result of the weighted averages of all modules 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 modules.
- One ECTS credit corresponds to about 25 hours of coursework (lectures, tutorials, projects, practical work, evaluation, individual work outside of class hours).

- 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.

## RETAKING EXAMS

If a student has obtained less than 10/20 in one or more modules, in academic semester 2 at ESIGELEC, he / she will be required to retake an exam in each of these modules, as advised by the Academic Coordinator of the Master's Programme of ESIGELEC (even if the final overall score of the student in the Master's Programme is greater than 10/20).

Students who fail a module may appear for retake exams OR term-end exams with subsequent batches at ESIGELEC, within a 2-year period from the date of completion of the academic semester at ESIGELEC.

*In some cases, ESIGELEC may consider other alternatives, including conducting the exams at its representative offices abroad (China and India).

In case a student fails to obtain 30 ECTS credits in the third semester (i.e. the internship), the Academic Coordinator for the programme at ESIGELEC may prescribe one of the following at his / her discretion:

1. A fresh internship, which would include a new report and a new final presentation; or
2. Redoing the report and final presentation; or
3. Deny the student another attempt at the internship, if the student is found guilty of any fraudulent activity during the internship.

The score(s) obtained from exam(s) retaken replace the previous score(s) obtained by the student in the module(s) concerned.

If the student does not retake an exam as advised by the Academic Coordinator of the programme at ESIGELEC, and if no valid explanation is provided for the absence, he / she will be marked 0/20 for the module concerned.

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

## FRAUD & CHEATING

Students indulging in fraudulent practices or cheating during an exam / final 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 programmes, obtained by any means (book, magazine, other students, electronic files, Internet, work previously submitted in another course).

## ATTENDANCE POLICY

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 supplementary examination, in the month of July. 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 supplementary examination.

# enrolled student status

## THE ENROLLED STUDENT STATUS AT ESIGELEC

- After completion of the last academic semester in France in year N, students will retain the Enrolled Student Status, till they graduate from ESIGELEC, and for a maximum period of two years, after completion of the academic semester and subject to the conditions mentioned below.
- If, at the end of N / N+1:
  - Students have started but not finished the internship for the MSc. of ESIGELEC, the Enrolled Student Status of ESIGELEC is renewed automatically for one academic year, i.e. N+1 / N+2. This is the only instance that will not entail payment of additional fees.
  - Students have not started the internship for the MSc. of ESIGELEC, they will have to renew their Enrolled Student Status for the next academic year N+1 / N+2, by paying the applicable fees. This is the last renewal that will be accepted for the Enrolled Student Status of ESIGELEC. Failure to pay the said fees, will result in the Master's degree of ESIGELEC not being awarded.
- The Enrolled Student Status of ESIGELEC, ceases to have effect immediately and permanently, after students have graduated with the MSc. degree. For the ME degree from MAHE, requiring an additional internship (or to extend the internship for a period of more than six months) with the Student Status, must do so on the basis of an agreement signed between MSIS-MAHE, the company offering the internship and the student.

# SEMESTER THREE INTERNSHIP

| SEMESTER 3 | | |
|---|---|---|
| **Module Name** | **Credits** | **Duration** |
| Internship in a laboratory or in industry | 30 | 4-6 months |

The internship can be done either in a company or in a research laboratory, anywhere in the world. The duration of the internship is of 4 months (min.) to 6 months (max.).

**Steps to be followed, once students have received an internship offer:**

- Fill an internship form and submit it to the Placement Office at ESIGELEC for approval.
- The Academic Coordinator of the Master's Programme and the Placement Office of ESIGELEC will review the offer of internship and approve it, if it meets all requirements.
- 3 copies of the Internship Agreement will be signed by ESIGELEC, the company / research laboratory and the student and each party will retain a copy.

**During the internship:**

- A faculty member of ESIGELEC will be in touch with the student to supervise the progress.
- The topic of the professional thesis must be communicated to the Academic Coordinator of the Master's Programme of ESIGELEC for approval within the first month of starting the internship.

**After completion of the internship:**

- The professional thesis must be submitted to ESIGELEC, at least 2 weeks before the final presentation.
- The final presentation must be done within four months, at the latest, of completion of the internship:
  - Location – ESIGELEC (or remotely, upon special written request.
  - Duration - 60 minutes (30 min. presentation + 15 min. Q&A + 10 min. deliberation among jury members + 5 min. feedback to the student)
  - Calendar – March, June, September, November (exact dates will be communicated at an appropriate time)

* Assistance will be provided to find internships but students are expected to play an active part, as the internships are not offered automatically by ESIGELEC.

* For internship related questions, students may contact either the assigned faculty member or the Academic Coordinator of the Master's Programme of ESIGELEC.

* Students have a maximum of 2 years, after the final academic semester, to finish the internship and complete the steps mentioned above, for the MSc. of ESIGELEC.

The final presentation will be done before a jury comprising 1 faculty member from ESIGELEC and a president from ESIGELEC.

The final presentation may take place offline, at ESIGELEC in France, virtually or at one of the representative offices of ESIGELEC, with prior authorization from the school.

# board of studies
# ESIGELEC & MAHE

The Board of Studies of ESIGELEC and MSIS-MAHE review the content, the architecture, the teaching methodolgies and modalities of the programme periodically, with a view to retain its relevance, in keeping with industry requirements. The Board meets once a year.

The Board of Studies is jointly presided over by ESIGELEC and MSIS-MAHE and comprises representatives of both institutions and related industries.

Periodic reviews are conducted by the academic coordinator and faculty members at ESIGELEC. Modifications are made as and when necessary, to improve the content of the programme. Other grievances are also addressed from time to time. Similar meetings take place between counterparts at MSIS-MAHE and the academic coordinator at MSIS-MAHE.

The academic coordinator at ESIGELEC meets with the students at least once a month, to address any concerns they may have, academic or otherwise. Similar meetings take place with the academic coordinator at MSIS-MAHE.

The academic coordinators at ESIGELEC and MSIS-MAHE remain in touch throughout the programme.


MANIPAL
ACADEMY of HIGHER EDUCATION
(Deemed to be University under Section 3 of the UGC Act, 1956)

MANIPAL SCHOOL OF INFORMATION SCIENCES
MANIPAL ACADEMY OF HIGHER EDUCATION, INDIA

ESIGELEC
SCHOOL OF ENGINEERING
SMART AND CONNECTED SYSTEMS