



MUTHOOT GLOBAL CENTRE FOR  
EDUCATION AND RESEARCH, INDIA



**JOINT MSc.  
IN  
AUTOMOTIVE EMBEDDED SYSTEMS  
(2022-2023)**

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

Accredited by

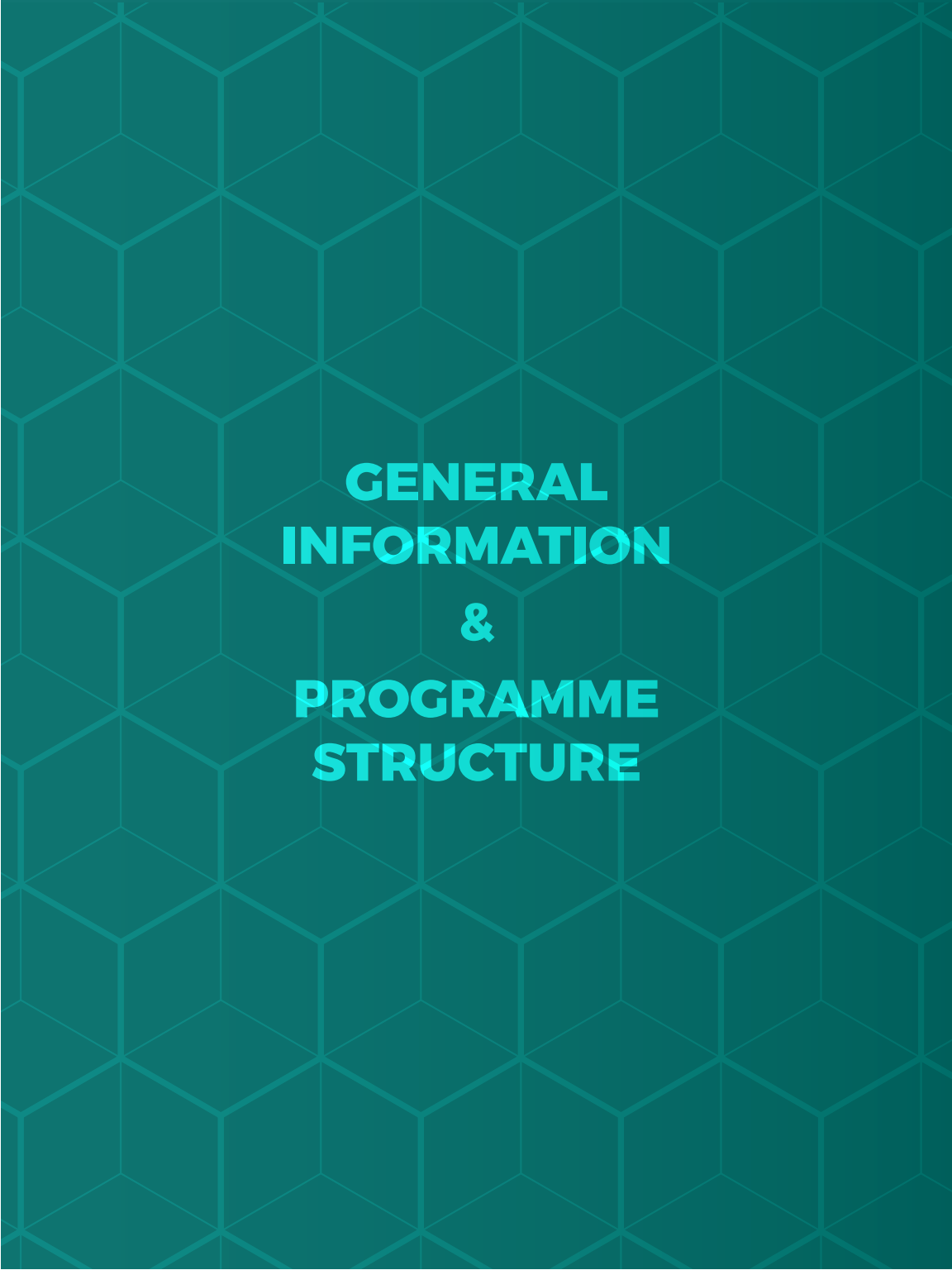




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**GENERAL  
INFORMATION  
&  
PROGRAMME  
STRUCTURE**

# 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 Automotive Embedded 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

3 Semesters

The programme comprises two semesters of study, one semester each at MGCR, 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

7

## SEMESTER 1 ( JULY-DECEMBER 2022)

Location: MUTHOOT GLOBAL CENTRE FOR EDUCATION AND RESEARCH, India

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

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

Faculty: MGCER, India

The rules and regulations for this semester are prescribed by MGCER, India (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 MGCER, India).

## 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 MGCER, India provide assistance to find internships, students are expected to play an active part, as internships are not provided automatically.***





**SEMESTER ONE**  
**MUTHOOT GLOBAL CENTRE**  
**FOR**  
**EDUCATION AND RESEARCH,**  
**INDIA**

## Module Summary

### SEMESTER 1 – MGCR, INDIA: JULY 2022- DECEMBER 2022

Module Name	Hrs / Week				Exam Duration (hrs)	Maximum Marks		
	Lecture	Tutorial	Practical	Credits		Internal Assessment	Final Exam	Total
Sensors and Transducers	3			3		50	50	100
Real Time Operating Systems	3			3		50	50	100
Vehicular Adhoc Networks	3			3		50	50	100
Embedded Systems	3			3		50	50	100
Elective 1	3			3		50	50	100
Sensors and Transducers Lab			3	1	3	50	50	100
Vehicular Adhoc Networks Lab			3	1	3	50	50	100
Real Time Operating Systems 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
<b>TOTAL</b>	<b>492 HOURS / 25 CREDITS</b>							

## List of Electives

MGCER, India
Elective - 1
Module
Internet of Things
Microcontrollers and its Applications
Linux and Scripting Languages
Internet of Things Labs
Microcontrollers and its Applications Lab
Linux and Scripting Languages Lab

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**

**Sensors and Transducers**

Module Code: AES 651

Duration: 72h

**Objectives:**

At the end of this module students will:

- Be familiar with the working principles of different sensors available in the market
- Be able to design consideration of sensors depending on the applications
- Be able to build a general-purpose Data Acquisition System using multiple sensors
- Be able to manage a group project demonstrating application of sensors

**List of topics:**

- Working principles of Sensors
- Sensor selection parameters
- Working principles of:
  - Mechanical & Electromechanical sensors
  - Thermal sensors
  - Magnetic sensors
  - Electro-analytical sensors
  - Smart sensors
- Application of sensors in the area of:
  - Automotive industry
- Recent trends in Sensor technology

## Real Time Operating Systems

Module Code: AES 655      Duration: 72h

### Objectives:

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

- Examine the evolution of operating systems and real time operating systems
- Explain the concepts involved in process management
- Design programmes based on threads
- Explain the concepts involved in scheduling of processes
- Explain the concepts involved in synthetization of processes
- Explain the concepts involved in detecting, avoiding and recover from dead locks
- Explain the concepts involved in memory management
- Explain the concepts of real time systems and real time operating systems

\* This course will also help students to improve their programming skills, also understand the real time systems, multi-threaded programming concepts

### List of topics:

- Various types of processor systems and their working operating systems
- Types of threads and multi-threaded programming
- Scheduling algorithms
- Synchronization and deadlocks
- Memory management and real-time scheduling of algorithms

## Vehicular Adhoc Networks

Module Code: AES 653

Duration: 72h

### Objectives:

At the end of this module students will be:

- Familiar with the concept of Adhoc Networks in the Vehicular scenario
- Familiar with vehicular safety applications and information dissemination in VANETs
- Familiar with vehicular mobility models
- Able to simulate vehicular movements, using different simulation tools and perform its analysis

### List of topics:

- Taxonomy of Vehicular Communication Systems
- VANET applications, principles and challenges
- Cooperative System Architecture and Safety applications
- Information dissemination in VANETs
- Vehicular Mobility Modeling and Integration with Network Simulators
- MAC Layer and Scalability Aspects of Vehicular Communication Networks
- Data Security in Vehicular Communication Networks



## Embedded Systems

Module Code: AES 661      Duration: 72h

### Objectives:

At the end of this module the 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

## Internet of Things

Module code: IOT 607

Duration: 72h

### Objectives:

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

- Explore the interconnection and integration of the physical world and the cyber space
- Design & develop IOT Devices
- Understand the application areas of IOT
- Realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
- Understand building blocks of Internet of Things and characteristics

### List of topics:

- Internet of Things - Protocols - Logical Design - Enabling Technologies
- Introduction to Python - Datatypes - Constructs - Packages
- Wireless Sensor Networks - Protocol Standards - Issues - Routing - Applications
- Protocols: Bluetooth, Zigbee, Internet Protocol
- 6LoWPAN - 6LoWPAN architecture
- Socket Programming
- Databases & Web Programming

## Microcontroller & Its Application

Module code: AES 615.1      Duration: 72h

### Objectives:

At the end of this module 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

## 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

## 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 the candidates admitted for MSc. in EIC/AES from ESIGELEC programs in August 2018 and later)

### 1. TITLE OF THE PROGRAMS:

Postgraduate MSc. program in Automotive Embedded Systems (AES), ESIGELEC, France

### 2. ELIGIBILITY CRITERIA

BE / B. Tech. in Electronics & Communication, Electrical & Electronics, Telecommunication, Computer Science or any other relevant branches in Engineering with minimum of 50% marks in aggregate.

### 3. DURATION OF THE PROGRAMS:

- 3.1 Normal Duration - 3 Semesters for MSc degree from ESIGELEC.
- 3.2 Maximum permissible duration of the program is 4 years. Candidates, who fail to complete the program within this stipulated maximum duration, will not be eligible for the award of the degree.
- 3.3 Semester I of the program is made up of about 16 weeks of classes & related academic activities followed by about two to three weeks of end-semester examinations.
- 3.4 The program will have three semesters of study, one semester at MGCEP and two semesters at ESIGELEC, Rouen, France. Third semester is for the project work / internship in an industry or in an institution..

## **4. EDUCATIONAL PROCESS AT MGCER:**

### **4.1 CREDIT BASED SYSTEM**

- 4.1.1** The educational process at MGCER uses credit based system wherein the subject content is expressed in number of credits.
- 4.1.2** The content of individual subjects – theory as well as practical – is expressed in terms of certain number of credits. The number of credits assigned to a subject depends on the number of contact hours per week. Normally, in the case of theory subjects, the number of credits is equal to the number of contact hours (lectures & tutorials) per week, while in the case of practical, one credit is assigned for every three contact hours per week.
- 4.1.3** The subjects' contents of each semester are expressed in terms of a specified number of credits. A candidate is deemed to have successfully completed a particular semester's program of study when earn all the credits of that semester, i.e., has no "F" grade in any subject of that semester.
- 4.1.4** When a candidate earns the specified number of credits in all the subjects of the program, is deemed to have completed the requirements for graduation. This also means, a candidate should have an "E" grade or better in every subject of every semester, in order to be eligible to receive the degree.
- 4.1.5** The second semester and third semester credit requirements will be as followed by ESIGELEC from time to time.

## 4.2

**OUTLINE OF EVALUATION**

## 4.2.1

The system makes use of continuous evaluation process.

## 4.2.2

Candidate performance in each Theory subject is evaluated out of a maximum of 100 marks of which 50 marks are for in-semester assessment and 50 marks for the end-semester examinations.

## 4.2.3

Candidate performance in each Lab subject is evaluated out of a maximum of 100 marks of which 50 marks are for in-semester assessment and 50 marks for the end-semester examinations.

## 4.2.4

Candidate performance in Seminar and Mini-Project will be evaluated internally for a maximum of 100 marks.

## 4.2.5

In-semester assessment will be based on continuous evaluation, which will include: assignments, case presentations, class tests, quizzes etc.

## 4.2.6

Candidate performance will be properly documented and announced (including on the notice board) within a week of assessment of the assignments, case presentations, etc.

## 4.2.7

A faculty committee headed by the Chairman, board of studies will look into all grievances of candidates with regard to their performance in tests / quizzes, practicals and end-semester examinations.

## 4.2.8

The overall performance of a student in each subject is expressed in terms of a Letter Grade. This uses the Relative Grading System

## 4.2.9

For theory subjects, the evaluation of answer scripts of the end semester exam is carried out by the faculty who taught the subject.

## 4.2.10

Marks awarded in End Semester Theory Examinations of all the subjects will be displayed on the notice board by the faculty member who taught the subject.

## 4.2.11

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

## 4.2.12

In the end semester exam, if a candidate gets F/I grade in the subject(s), he / she will be eligible to appear for the make-up exam.

- 4.2.13** Make up exam for Theory/Lab subjects will be conducted within a month for the candidates who get F/ I grade in End Semester Examination.
- 4.2.14** If a candidate gets F/I grade in the make-up examination, he / she will be eligible to appear for the subject exam only after ONE YEAR.
- 4.2.15** If a candidate does not register for the make-up exam also, he / she will be eligible to appear for the subject exam only after ONE YEAR.
- 4.2.16** Marks scored from in-semester evaluation and end-semester evaluation (for a maximum of 100 marks as in 4.2.2 to 4.2.4, will be considered to award the grade in each subject.
- 4.2.17** Candidate has to complete the required credits assigned for first semester to be eligible to move to ESIGELEC for continuing with the second and third semester.
- 4.2.18** GPAs for the candidates are calculated from 1st semester of the program.

#### **4.3 CLASS COMMITTEE**

For all the programs, a common class committee is formed with one senior faculty (normally course coordinator) nominated by program coordinator, as the Chairman and other faculty members involved in handling the subjects for that program.

#### **Functions of the Class committee:**

- 4.3.1** The class committee shall meet thrice a semester. The first meeting will be held within two weeks from the date of commencement of the semester in which the nature of the cycle of tests as well as broad assessment procedure for the different tests and practicals (if any) will be decided.
- 4.3.2** The second meeting will be held two weeks after the first cycle test to meaningfully interact and express opinions and suggestions to improve the effectiveness of the teaching-learning processes and analyze the performance of the candidates in the cycle test.

**4.3.3** The Chairman of the class committee should send the minutes of the class committee meeting to Program Coordinator immediately after the first two class committee meetings.

**4.3.4** The third meeting will be held soon after getting marks in all the subjects obtained by the candidates in the end-semester examination to analyze the performance of the candidates in the program of study and decide the grade ranges in each subject and hand over the statement of grade to the Program coordinator. The Program coordinator will in turn publish the results.

#### **4.4 ATTENDANCE REQUIREMENTS:**

**4.4.1** Under the relative grading system a candidate must maintain an attendance record of at least 75% in every subject. Attendance of lectures, tests, practical and tutorials all count towards the calculation of this attendance percentage.

**4.4.2** Without the minimum attendance, candidate becomes ineligible for the end-semester examination and subsequent grading in any of the subjects of that semester.

**4.4.3** However there is no minimum attendance requirement during the period of project work / internship.

#### **4.5 PROMOTION TO HIGHER SEMESTER-ACADEMIC PERFORMANCE REQUIREMENTS**

**4.5.1** Promotion of a candidate from the one semester to the next higher semester is subject to him/her fulfilling the minimum attendance requirement as in 4.4.1 and is not the only criterion to be met for the fulfillment of the academic performance requirements.

**4.5.2** As far as the academic requirements are concerned, the system is a full carry over system to ESIGELEC

**4.5.3** If the candidate fails to complete a subject in 2 attempts, can repeat both internal and external examinations of the same subject.

## **4.6 EVALUATION PROCEDURE**

### **4.6.1 SEMESTER EVALUATION**

- 4.6.1.1** All theory subjects taken by the candidates during the semester are evaluated using internal system of continuous assessment and the end-semester evaluation conducted internally.
- 4.6.1.2** All laboratory subjects taken by the candidates during the semester are evaluated using internal system of continuous assessment and the end-semester evaluation conducted internally.
- 4.6.1.3** The candidate is evaluated on class / tutorial participation, assignment work, lab work, class tests, mid-term tests, quizzes, and end-semester examinations, which contribute to the final grade awarded for the subject.
- 4.6.1.4** Candidates will be informed at the commencement of each semester about the evaluation methods being used for the subjects and weightages given to the different assignments, and evaluated activities.
- 4.6.1.5** In-semester evaluation is considered as the Internal Assessment (IA mark) in each subject for 50 marks which includes the performances in class / tutorial participation, assignment work, lab work, class tests, mid-term tests, quizzes etc.
- 4.6.1.6** End-semester examination is conducted for a maximum of 100 and the same will be scaled down to 50
- 4.6.1.7** End-semester mark for a maximum of 50 and IA marks for a maximum of 50 are added for a maximum of 100 marks to decide upon the grade in a subject
- 4.6.1.8** End-semester examination will be conducted every end of a semester for all the regular subjects.

**4.6.1.9** If a candidate gets F/I grade in the subject(s) in the end-semester exam, he / she will be eligible to appear for the make-up exam.

Make up exam for Theory/Lab subjects will be conducted within a month for the candidates who get F/I grade in End Semester Examination.

If a candidate gets F/I grade in the make-up exam, he / she will be eligible to appear for the subject(s) exam only after ONE YEAR.

**4.6.1.10** Even if a candidate not registered for this make-up exam, he / she will be eligible to appear for the subject(s) exam only after ONE YEAR.

**4.6.1.11** If a candidate get "F" / "I" grade in end semester examination and clears the subject in the make-up examination (without re-registration) will get a maximum of "C" grade.

#### **4.6.2** **RELATIVE GRADING**

**4.6.2.1** Marks obtained as in 4.2.1 to 4.2.3 are considered in the relative performance / grading system to award the candidate with an overall letter grade for all subjects.

**4.6.2.2** The class committee decides the grade cutoff in each subject and the same will be given to the Program coordinator.

**4.6.2.3** The Program coordinator will in turn declare the results using the grade cutoffs provided in 4.6.2.2.

**4.6.2.4** GPA and CGPA for the candidates are calculated from 1st semester of the program.

**4.6.2.5** A candidate will fail in either theory or lab or both, if he / she fails to score a minimum of 35% in the end semester and 50% aggregate in each subject..



### 4.6.3 LETTER GRADING SYSTEM

Final evaluation of the candidate in a subject is carried out on a TEN POINT grading system, which is as follows:

#### PERFORMANCE GRADE

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

4.6.3.2 A candidate who earns a minimum of 5 grade points ("E" grade) in a subject is declared to have successfully completed that subject.

4.6.3.3 A candidate should have appeared for the end-semester examination of the prescribed subject of study (mere appearance for the continuous assessment tests is not sufficient) to be eligible for the award of the grade in that subject.

4.6.3.4 If a candidate is eligible for but fails to appear in the end-semester examination, will be awarded an "I" grade (incomplete) on the grade report card. For all practical purposes, an "I" grade is treated as an "F" grade.

4.6.3.5 If a candidate get "F" / "I" grade in an examination and clears the subject in the subsequent examination without re-registration will get a maximum of "C" grade

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

Each subject 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 subject. The grade point average for each semester will be calculated only for those candidates who have passed all the subjects of that semester. The weighted average of GPA's of all semesters that the candidate 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 candidates who have passed all the subjects up to that semester.

## Calculation of GPA and CGPA:

Example:

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**

$$\text{Generally, } \sum_{i=1}^n C_i G_i$$

$$\text{GPA} = \frac{\sum_{i=1}^n C_i G_i}{\sum_{i=1}^n C_i}$$

$$\text{CGPA} = \frac{\sum_{j=1}^N (GPA_j * \sum C_i)_j}{\sum_{j=1}^N (\sum C_i)_j}$$

Where

n = Number of modules

C<sub>i</sub> = Number of credits of ith module

N = Number of semesters

G<sub>i</sub> = 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.

**4.6.5****RE-REGISTRATION****4.6.5.1**

Candidates who are detained in a particular semester due to shortage of attendance and are not eligible to attend the examinations, can re-register in one or more subjects of that semester in which they are detained (in the semester in which those subjects are offered) by paying, the prescribed fees.

**4.6.5.2**

If a candidate is interested in improving the GPA in a semester, can re-register for all the subjects of that semester by paying the prescribed fees. Candidate has to attend the classes, write the tests, assignments and end-semester examinations of all the subjects of that semester for which has re-registered for improvement of GPA. When a candidate re-registers for the improvement in a semester, the attendance, IA marks and GPA obtained in that semester in the previous attempt becomes null and void. Candidate re-registering for improvement of GPA of a semester has to surrender his original grade report card along with the re-registration application. Actual grade will be awarded.

**4.6.5.3**

A candidate can re-register for the improvement on the GPA of a semester within 15 days from the date of announcement of the result.

**4.6.5.4**

Candidates can re-register in one or more subjects offered in 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 got F/ I grades earlier. They can attend the classes in the next available semester in which the subject is taught, have to submit assignments, appear for sessional tests and end-semester examination. Actual grade will be awarded. However re-registration will be allowed only with prior permission of The Director.

**4.6.5.5**

A student cannot re-register for the improvement of the grades in individual subjects.

## 4.7 **DECLARATION OF RESULTS**

- 4.7.1 After the completion of the end-semester evaluation, marks secured for a maximum of 100 marks (50 for internal evaluation and 50 for end term evaluation) of all the students will be compiled subject-wise.
- 4.7.1 The academic committee constituted at the institute will decide on the cut off marks and the grades in each subject based on the credit system guidelines.
- 4.7.2 The academic committee will send the grades along with the marks to the Program coordinator for the declaration of the results.
- 4.7.3 A candidate will get an "F" grade if fail to score a minimum of 50% in the end-semester examination.
- 4.7.4 The Program coordinator will subsequently declare the results.

## 4.8 **TRANSFER OF FIRST SEMESTER CREDITS TO ESIGELEC**

Credits of candidates who successfully complete the first semester by earning required number of credits within the stipulated maximum duration of the semester will be transferred to ESIGELEC.

These rules and regulations are subject to change / amendment from time to time, as and when need arises

*Compiled on 3rd Dec 2018*







**SEMESTER TWO**  
**ESIGELEC, FRANCE**

## Module Summary

SEMESTER 2 - ESIGELEC, FRANCE: FEBRUARY 2023 TO JULY 2023			
Course	Module	ECTS	Duration (Hours)
Automotive Systems	Communication Buses	3	15h(Crs) + 15h(TP)
	ADAS & Automotive Electronic Systems	3	23h(Crs) + 23h(TP)
	Robotics & Localization	3	15h(Crs) + 15h(TP)
Embedded Software	Embedded C Programming	3	15h(Crs) + 15h(TP)
	Elective 2	3	15h(Crs) + 15h(TP)
	Computer Vision	1	20h
	Artificial Intelligence for Automotive	1	20h
Project	R&D Project	5	60h(TP)
	Project Management	2	26h(Crs)
	Safety Systems & Automotive Constraints	1	20h(Crs)
Language	Oral Communication	1	15h(Crs)
	French Language 2*	4	64h(Crs)
<b>391 HOURS / 30 CREDITS</b>			



## List of Electives

<b>ESIGELEC, France</b>
<b>Elective - 2</b>
<b>Module</b>
LabVIEW Programming
EMC Automotive System
Embedded Linux

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

### Communication Buses

Module code: MSCAES01

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
- Design and implement bus-based communication architectures
- Understand and implement different bus systems like CAN, I2C, SPI, LIN, etc.
- Design communication programming for different board and protocol

#### List of topics:

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

## ADAS and Automotive Electronic Systems

Module Code: MSCAES02

Duration: 46h

### Objectives:

At the end of this module, students will be:

- Able to design ADAS automotive system architecture
- Familiar with Driver Assistance System for Autonomous Vehicle
- Able to describe the EMC as a generic immunity and emission mechanisms of an electric/electronic vehicle
- Familiar with interaction traffic, vehicles and infrastructures

### List of topics:

- ADAS Autonomous and Connected Driving:
  - Road safety
  - ADAS functions, Intellectual property and TRIZZ low
  - Lateral and longitudinal control
  - Autonomous driving, and Car2X
- ADAS Automotive Systems-based EMC:
  - Standards and regulations
  - EMC design, Mitigation techniques, Numerical simulation
  - Equipment validation, Vehicle validation, Future challenges
- Introduction to Highway Engineering and Traffic Analysis:
  - Vehicles and road infrastructures
  - Highway design
  - Introduction to traffic theory
  - Road transport system technologies
- Autonomous Vehicle:
  - Autonomous vehicle issues and how it works
  - Autonomous Driver (AD)
  - Sensors

## Robotics and Localization

Module Code: MSCAES03

Duration: 30h

### Objectives:

At the end of this module, students will be:

- Familiar with mobile robotic architecture
- Able to control a mobile robot like Wifibot
- Able to design and implement navigation algorithm on a mobile robot
- Able to design and implement a localization algorithm based on odometry
- Able to implement localisation of a robot in a known and / or unknown environment

### List of topics:

- Introduction to mobile and autonomous robotics
- Control software architectures:
  - Case study: the ESIGELEC VIKINGS robot (TOTAL ARGOS challenge)
- Location based odometry:
  - Project: Implementation of a Wifibot robot based on odometry
- Development of different projects using Wifibot and which has as application:
  - Mobile robot
  - Environment perception and navigation
  - Localization
  - Autonomous navigation

## Embedded C Programming

Module Code: MSCAES04

Duration: 30h

### Objectives:

At the end of this module, students will be:

- Familiar with C coding practices for embedded systems
- Familiar with the parts 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, in keeping with 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 programme 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 a 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

## LabVIEW Programming

Module Code: MSCAES11

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 and signal processing tools seen in the 2nd year

### List of topics:

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



## EMC Automotive System

Module Code: MSCAES06

Duration: 30h

### Objectives:

At the end of this module, students will:

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

### List of topics:

- EMC Integration
- Integrity Signal (IS)
- EMC of Components
- EMC Measurement tools:
  - Test facilities
  - Instrumentation
- EMC Tests on an Automotive equipment in reverberation chamber
- Near-field
- European requirements and associated tests

## Embedded Linux

Module Code: MSCAES07

Duration: 30h

### Objectives:

At the end of this module, students will:

- Be familiar with the uses of the Linux kernel for an embedded IT project
- Be familiar with 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)

## Computer Vision

Module Code: MSCAESCVC

Duration: 20h

### Objectives:

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

- Develop and validate skills in computer vision and image processing
- Calibrate a camera
- Use an image processing software, like Open CV
- Carry out filters and segmentation
- Manage with embedded computer vision, through an applied project
- Manage interactions between sensors and a GPU board
- Interpret training/validation loss curves
- Apply transfer learning from pre-trained models on large datasets following a fine-tuning strategy.

### List of topics:

- Computer vision basics :
  - Pinhole model,
  - Projective geometry,
  - Multiple view geometry,
  - Calibration,
  - Camera optics,
  - Sensors technologies.
- Applied computer vision :
  - OpenCV and Python,
  - Pixel operation (filtering, debayering, edge detection ...),
  - Segmentation (Background subtraction, colour segmentation, HOG),
- Embedded computer vision :
  - Sensors interfacing and configuration,
  - Computer vision project on Jetson embedded computer.

## Artificial Intelligence for Automotive

Module Code:MSCAESAIA

Duration: 20h

### Objectives:

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

- Design and develop MLP/CNN/RNN models for image / video and text analysis,
- Interpret training/validation loss curves ,
- Apply transfer learning from pre-trained models on largedatasets following a fine-tuning strategy.

### List of topics:

- Brief introduction to machine learning applications,
- The perceptron training algorithm from scratch,
- The MLP (Multi-Layer Perceptron) algorithm and gradient back propagation from scratch,
- MLP design and development using Tensorflow and Keras for image analysis,
- Improving the MLP performance: activation functions, optimizers, batch normalization, dropout and loss,
- Deep learning :
  - CNN models,
  - RNN models for data sequence analysis (video and text).

## R&D Project

Module Code:MSCAESPRJ

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 automotive systems
- Develop technical solutions - hardware and software
- Test the platform developed
- Develop and carry out an embedded system platform successfully and learn how to 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 automotive
  - Dataset collection
  - Mobile robotics and autonomous navigation
  - IoT and sensors
  - Smart mobility

## Project Management

Module Code: MSCAESPRMG

Duration: 26h

### Objectives:

At the end of this module, students will:

- Be familiar with the importance of project management, including formal methods, as a recognized discipline. They will also understand the complexities of different types of computing projects and methods to manage them
- Appreciate the need to break up complex projects
- Appreciate the need for effective planning, monitoring & control mechanisms
- Appreciate the need for formal project management organizational structures
- Appreciate the importance & management of stakeholders in an international project
- Be able to apply some of the skills and knowledge acquired, in any future project and, in particular, documentation for development project
- Appreciate the complexity of a technical project and the need for formal methods

**List of topics:**

- What is a project? The need for Project Management, formal methods
- Managing large, complex, international projects
- Un peu de français (Project Management 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
- Project Management 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 Project Management methods
- Cost-benefit analysis and project accounting may be touched upon, but are not in the scope of this course

## Safety Systems & Automotive Constraints

Module Code: MSCAES08

Duration: 20h

### Objectives:

At the end of this module, students will:

- Be familiar with the role EMC phenomena play in the field of embedded systems, by studying automotive examples
- Be able to design and develop automotive embedded systems
- Be able to verify mechatronics and electromagnetic compatibility constraints in the development
- Be able to design a functional safety system

### List of topics:

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



## 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 as 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**

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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 Automotive Embedded 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**

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### **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.





**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 (2 hard copies by post and 1 soft copy in Word or pdf via intranet) 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 2 teachers from ESIGELEC and a president from ESIGELEC.

The final presentation will have to take place at ESIGELEC in France (if required, representatives of MCCER, India may also be part of the jury remotely). The marks obtained for this internship will be communicated to MCCER, India.





**board of studies**  
**ESIGELEC & MGCER**

The Board of Studies of ESIGELEC and MGCER, India review the content, the architecture, the teaching methodologies 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 MGCER, India 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 MGCER, India and the academic coordinator at MGCER, India.

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 MGCER, India.

The academic coordinators at ESIGELEC and MGCER, India remain in touch throughout the programme.





MUTHOOT GLOBAL CENTRE FOR  
EDUCATION AND RESEARCH, INDIA



SMART AND CONNECTED SYSTEMS