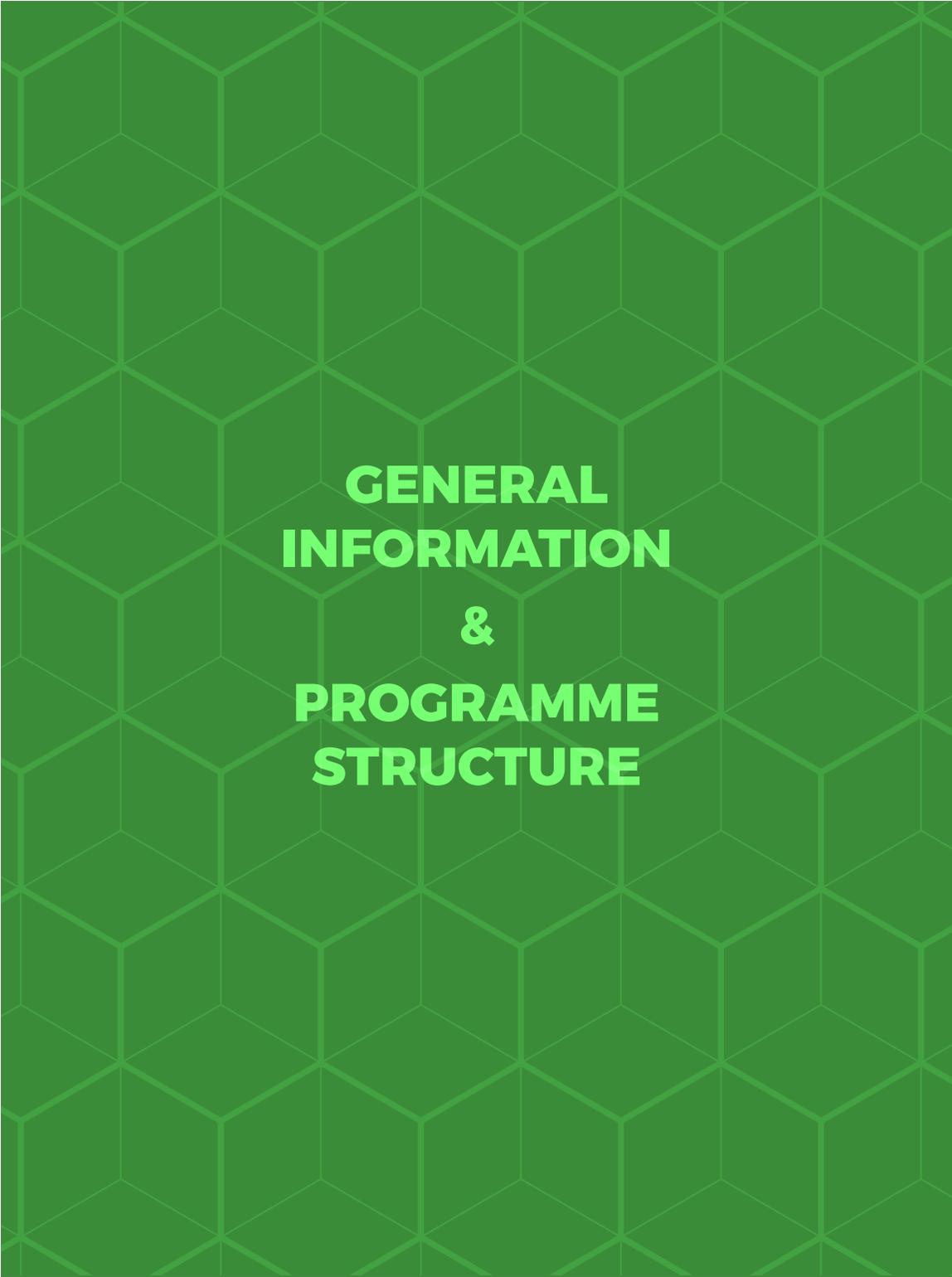# MASTER OF SCIENCE

IN

ELECTRONIC EMBEDDED SYSTEMS

(2026 - 2027)

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

Accredited by

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TABLE OF CONTENTS

GENERAL INFORMATION & PROGRAMME STRUCTURE

A COURSE STRUCTURE & DURATION

The Master of Science programme comprises of 3 semesters:

1. The first and second academic semesters are carried out on campus at University of Electronic Science and Technology of China – UESTC – in China, between September 2026 and July 2027. Lectures, tutorials, lab work, practical work and projects and assessment activities (quizzes, tests, exams, etc.) are part of these semesters. Faculty are from ESIGELEC and UESTC. The rules and regulations are laid out by UESTC (and approved by ESIGELEC).

2. In the third semester, students must do a mandatory internship in a laboratory or in a company for a period of 4 months (minimum) to 6 months (maximum). Assistance will be provided by UESTC to find internships but students are expected to play an active part, as the internships are not offered automatically by ESIGELEC or UESTC. Students have a maximum of 2 years after the two first academic semesters at UESTC to:

   · Find an internship,
   · Complete the internship
   · Submit the professional thesis and present it to a Jury comprising members from ESIGELEC and UESTC.

Failure to do so could result in the student not being awarded the Master of Science degree of ESIGELEC.

After they finish the last academic semester (semester 2) in UESTC in year N, students maintain their student status of ESIGELEC and UESTC during the following academic year N/N+1 (or until their presentation before the Jury of ESIGELEC, if it is organised before the end of the following academic year N/N+1). If at the end of the following academic year N/N+1, students have started but not finished their internship, their student status will be automatically renewed for one more and last academic year: N+1/N+2. But if students have not started their internship, they will have to renew by themselves their student status for the next academic year N+1/N+2, by paying the corresponding fees, or else they will be refused the MSc – Master of Science of ESIGELEC.

B OBJECTIVES OF THE PROGRAMME

The MSc Programme seeks to equip the students with the relevant knowledge, professional skills and practical experience in electronic embedded systems for industry. They will learn how to design, develop and implement electronic embedded systems in different sectors, such as aeronautics, space, automobiles and electronics. Students will also acquire basic managerial skills. The international environment with faculty from different countries allows students to discover new cultures, different teaching methodologies and to improve their English language proficiency. The mandatory internship gives the students a hands-on experience in the work environment. Our graduates find job opportunities as developers, project managers, consultants or researchers in the field of electronic embedded systems.

C ATTENDANCE POLICY

All lectures, tutorials, seminars, practical work, projects and conferences, are mandatory. Attendance will be checked by the faculty members at the beginning of each academic activity. The attendance forms will be collected by the Studies Office of UESTC in China.

A student who does not report within 10 minutes after roll call, will be marked absent and will be refused entry into the classroom. The absence will be considered as an unjustified absence.

A student who arrives in the classroom within 10 minutes after roll call will be accepted in the classroom but their tardiness will be marked on the attendance sheet. Three (3) late arrivals will be considered an unjustified absence.

In the event of too many unjustified absences (more than 20) in multiple academic activities (including tutorials, practical work, seminars, etc...), ESIGELEC and UESTC can decide the dismissal of the student from the programme.

The justifications of justified absences (sickness or other specific & accepted situations) will have to:

- Be handed over, or sent, to the Studies Office of UESTC (who has to inform ESIGELEC) within 3 working days, in case of sickness;
- Be intimated through an official letter and accepted/signed at least 2 days earlier, by the Academic Coordinator of the programme at UESTC (who has to inform ESIGELEC), for specific situations.

In case of no show at an examination:

- Only students whose absences have been justified and accepted by the Academic Coordinator of the programme at UESTC will be allowed to resit the examination,
- The other students whose absences have not been justified or accepted by the Academic Coordinator of the programme at UESTC will have the mark 0 in the said examination.

D EXAMINATIONS, SCORES AND ECTS CREDITS

Tests

Assessment activities are decided by the faculty member (written exam, oral exam, project, report, oral presentation, etc.). Use of material like calculators and other documents during the assessment activity is also decided by the faculty member.

Each test will be weighted and given a mark from 0 to 20.

Scores and ECTS credits

The Master of Science programme is divided into several weighted modules. Each module represents a certain number of ECTS credits.

The score of a module is the average of the weighted scores of the different evaluations in the module.

The final general score of the student is the result of the weighted averages of all modules included in the Master of Science programme.

The number of ECTS credits for the Master of Science programme is equal to the total of all the ECTS credits corresponding to the modules.

One ECTS credit corresponds to about 25 hours of student work (lectures, projects, practical work, exams, personal work).

Attendance

Attendance is assessed based on the number of absences, and is proceeded as follows:

- 0 absences → 10% of the final grade (out of 20), which means an attendance grade of 20/20

- 1 absence → 8% of the final grade (out of 20), which means an attendance grade of 16/20

- 2 absences → 5% of the final grade (out of 20), which means an attendance grade of 10/20

- 3 or more absences → 0% of the final grade (out of 20), which means an attendance grade of 0/20

E

FRAUD AND CHEATING

Any behaviour identified as fraud by a faculty member or a supervisor during an exam, oral presentation, project or practical work will be given a score of 0/20 at the exam, oral presentation, project or practical work.

Examples of plagiarism, fraud or cheating, include (but are not limited to):

- Duplication of another students work during a written assignment,
- Use of document or calculator or any unauthorized material during an exam,
- Plagiarism (>20%) of reports, presentation or computing programs, obtained by any means (book, magazine, other students, electronic files, internet, work previously submitted in another course).

F

GRANTING OF THE MSc – MASTER OF SCIENCE OF ESIGELEC

For each teaching semester at UESTC, the sum of the ECTS credits related to the modules is 30. For the internship, professional thesis and oral presentation, the number of related ECTS credits is 30.

ECTS credits associated to a module are obtained by the student from the score 10/20 in the said module. The MSc – Master of Science is granted to the student if at the end of the term of the semesters, the student has 90 ECTS credits in total.

The Jury of ESIGELEC for the Master of Science includes a President, who is member of ESIGELEC, representatives of the managing staff of the school and faculty members. The Jury of ESIGELEC will be held in April, July, September and / or December every year.

If students do not obtain the minimum number of ECTS credits required to be granted the Master of Science degree, even after resitting the exams, in the 2 academic years after the end of the first 2 academic semesters in China, they will receive a certificate from ESIGELEC which will indicate the total number of ECTS credits they received in the different modules.

The MSc – Master of Science "Electronic Embedded Systems", awarded by ESIGELEC to the successful students is accredited by the Conference of Top Schools of Engineering & Management in France (CGE).

G RESITTING EXAMS

If a student obtains less than 10/20 in one or several modules, the student will be required to resit one or more exams, in the modules concerned:

- as advised by the Academic Coordinator of the programme at ESIGELEC, and,
- at no extra cost,
- if his/her ECTS credits are not yet validated in the modules concerned, and,
- within the 2 following academic years after the first 2 academic semesters in China, at the latest, and,
- if possible at the same time as the regular or resit exam schedule for the following batches and,
- without mandatory requirement to redo the modules (a student may choose to do so provided the modules concerned are not already validated ; in which case, no extra fees would be charged to redo the modules).

The student is not allowed to redo an exam or a module with the sole intention of improving his/her average score in the module concerned, in case the ECTS credits of the module concerned are already validated. If a student does not obtain the 30 ECTS credits in the 3rd semester (internship), the Academic Coordinator of the programme at ESIGELEC could:

- Ask the student to redo a fresh internship, with a new report and an oral presentation

OR

- Ask the student to redo the report and/or the oral presentation

OR

- Deny the student another chance to obtain the 30 required ECTS credits, if deemed necessary.

The new scores obtained at the resit exams in different modules replace the previous averages obtained by the student in the concerned modules. If the student is absent at a resit exam, the student will be given 0/20 for the resit exam. The new averages of the concerned modules have to be greater than 10/20 to grant the associated ECTS credits to the student.

SEMESTERS ONE & TWO
# UNIVERSITY OF ELECTRONIC SCIENCE AND TECHNOLOGY OF CHINA

H MODULES AND ECTS CREDITS

SEMESTER 1 :

MODULE	PROPOSED BY	HOURS	TEACHING LANGUAGE	CREDITS	ON SITE/ PLACE
Bibliographical Studies	UESTC	30	Chinese	2	CHENGDU - CHINA
Sensors and Transducers	UESTC	30	Chinese	4	CHENGDU - CHINA
Modelisation	UESTC	30	Chinese	4	CHENGDU - CHINA
Simulation Using MATLAB	UESTC	30	Chinese	4	CHENGDU - CHINA
Virtual Instrumentation	ESIGELEC	30	English	4	CHENGDU - CHINA
Specific Instrumentation	ESIGELEC	30	English	4	CHENGDU - CHINA
Technical Project	ESIGELEC	30	English	4	CHENGDU - CHINA
Microprocessors	ESIGELEC	20	English	4	CHENGDU - CHINA

SEMESTER 2 :

MODULE	PROPOSED BY	HOURS	TEACHING LANGUAGE	CREDITS	ON SITE/ PLACE
Embedded C	ESIGELEC	30	English	4	CHENGDU - CHINA
System Control	ESIGELEC	30	English	4	CHENGDU - CHINA
Embedded Systems Using IA	ESIGELEC	30	English	4	CHENGDU - CHINA
Project Management	ESIGELEC	30	English	3	CHENGDU - CHINA
Real-Time Operating Systems	UESTC	30	Chinese	5	CHENGDU - CHINA
MtoM Communications	UESTC	30	English	5	CHENGDU - CHINA
Project	ESIGELEC	10	English	5	CHENGDU - CHINA
	UESTC	50	Chinese		

The course is followed by a mandatory internship ranging from 4 to 6 months.
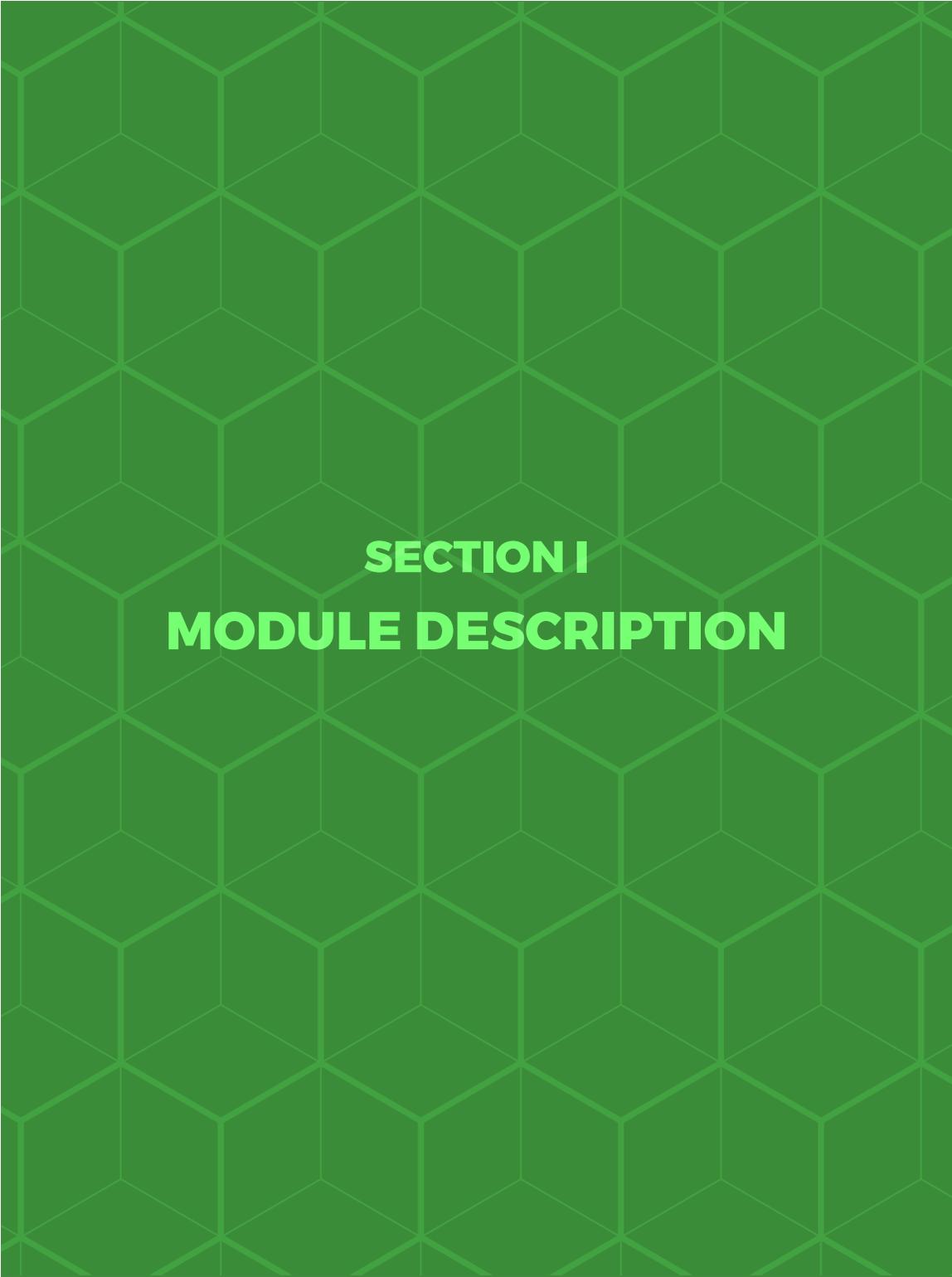
SECTION I
MODULE DESCRIPTION

BIBLIOGRAPHICAL STUDIES

ECTS Credits: 2   Duration: 30h

Module Objectives
Students can master the basic knowledge and information processing skills of document information retrieval, and proficiently use the library's traditional document retrieval tools and online academic database to check and obtain the literature information needed for learning and research. Additionally, they can also have a certain understanding of the relevant laws and regulations and common sense on information security and intellectual property rights, so as to initially form the awareness and concept of responsible use of literature resource.

Module Content
The course consists of 30 (Theory 10+ Practice 20) hours and is divided into the following eight chapters:

- Chapter 1: Introduction to Document Information Retrieval that the key teaching point is on the ways, methods and steps of document information retrieval.
- Chapter 2: Network Information Resource Retrieval that the key teaching point is Basic methods and basic techniques for network information resource retrieval.
- Chapter 3: Foreign Full-text Database Search that the key point is Key points and characteristics of each full-text journal.
- Chapter 4: Chinese Full-text Database Search that the key teaching point is The use of CNKI China Journal Full-text Database.
- Chapter 5: Foreign Language Abstracts Search that the key teaching point is The use of the US Science Citation Index (SCI) network database.
- Chapter 6: Patent Literature Search that the key teaching point is Chinese patent search method, Derwent patent search tool.
- Chapter 7: Special Literature Search that the key point is Dissertation retrieval method, standard literature retrieval method.
- Chapter 8: Writing of Scientific Papers that the key point is the method of writing scientific papers.

Teaching Methods and Tools (theory, case studies, software, etc.)
Classroom exercises, project (individual or group).

Modalities of Evaluation
- Assessment method: This course is an examination class, with practice assignments and search reports as the assessment method.
- Grade evaluation: The practice scores on the machine accounted for 40%, and the results of the final search report accounted for 50%.

Bibliographical References
Textbook
- **Bibliographic Retrieval and Scientific Paper Writing** (2nd Edition), edited by Huang Jun, China Petrochemical Press, 2013

Reference
- Bibliographic Retrieval and Paper Writing (Fifth Edition), Wang Xirong, Lu Yulong, Li Rende, Shanghai Jiaotong University Press, 2015
- Bibliographic Retrieval and Utilization (2nd Edition), edited by Hua Fang, Tsinghua University Press, 2014

SENSORS AND TRANSDUCERS

ECTS Credits: 4   Duration: 30h

Module Objectives

This course introduces the basic theory of various sensors, the working principle, main performance and characteristics of commonly used sensors, engineering design methods and experimental research methods of commonly used sensors, and appropriately extend the micro-electromechanical systems (MEMS) and wireless sensor networks of modern sensor technology.

Students will learn about the history, classification and future development of sensor technology and master the working methods of temperature sensor, force sensor, photoelectric sensor, magnetic sensor, ultrasonic sensor, common faults and troubleshooting, accompanied by the interface circuit and sensor network. It can help to develop students' ability to reasonably select and use sensors, and help them to be capable of handling with sensor characteristics and calibration.

Module Content

This course includes 30 (Theory 20+Practice 10) periods, divided into the following 6 chapters

○ Chapter 1 Introduction that The key teaching points are the stable characteristics of the sensors: the concepts and computation of linearity and sensibility, the definition and computation of the delay and repeatability and the dynamic characteristics of the sensors: the concepts and reasons of the dynamic error, methods of analysis for the dynamic characteristics from time dimension and frequency dimension and the index to estimate the dynamic characteristics from time dimension and frequency dimension and methods of analysis the frequency response of the first order sensors and the second order sensors.

○ Chapter 2 Temperature sensors that the key teaching points are the methods of cold junction compensation of the thermocouple and the practical measurements circuits of the thermocouple and temperature sensors and the characteristic parameters and the curves if the temperature resistances.

○ Chapter 3 Force sensor that the key points are the measurements principle and the measurements circuits if the strain gage and the equivalent circuits and measurements circuits of piezoelectric force transducers.

○ Chapter 4 Magneto-dependent sensor that the key points are the principle of Hall effects and the application methods of Hall elements and the principle of magnetic effects and the application method of magnetic resistance elements.

○ Chapter 5 Photosensitive sensors that the key teaching points are the structure and the operation principle of the phototube and photomultiplier and the application of the photosensitive resistances.

○ Chapter 6 Sonic sensors and ultrasonic sensors that the key teaching points are the basic principles of sonic sensors, piezoelectric sonic sensors and capacitance sonic sensors and the structure and mechanism of ultrasonic probes.

Teaching Methods and Tools (theory, case studies, software, etc.)

"Sensor technology" course is given priority to teach in class. It uses courseware as that main line, supplemented with the course experiment make students to understand the master resistive strain gauge sensors, inductive differential transformer, electromagnetic speed, hall speed sensor, infrared electric speed measurement and application of commonly used methods, and in the case of conditions have limitation design experiments.

Modalities of Evaluation

○ Examination method: Coursework +Laboratory report+ Final exam

○ Grades evaluation: Coursework results accounted for 10%, laboratory report results accounted for 30% and final exam results accounted for 50%.

MODELISATION

ECTS Credits: 4   Duration: 30h

Module Objectives

- It teaches students to have a good command of the basic methods and techniques of modeling and how to apply these methods to solve practical engineering problems.
- Students will master the concept of the system model and the basic methods of establishing the system model
- Have the ability to apply engineering fundamentals to solve complex engineering problems.

Module Content

This course includes 30 periods, divided into following six chapters:

- **Chapter 1:** Introduction that The key teaching point is the relationship between models and systems
- **Chapter 2:** The mathematical description of the systems that the key teaching point is continuous time model and discrete time model, random noise and random mathematical model of systems.
- **Chapter 3:** Continuous time modeling of systems that to know the modeling procedures of differential equations, construct state space model with physical laws, differential equation and transmission functions.
- **Chapter 4:** Discrete Event modeling which to understand the the generation of the random numbers and the modeling and comparison between entity flow chart and activity cycle map.
- **Chapter 5:** Modeling based on system identification that the key teaching point is the identification of the parameters in the models and the identification of the orders of the models.
- **Chapter 6:** modeling based on neural network that the key teaching point is the convolution neural network (CNN) and the recurrent neural network (RNN)

Teaching Methods and Tools (theory, case studies, software, etc.)

The course of system modeling is mainly teaching in class, the courseware is one of the main contents. Meanwhile, multimedia teaching to help students understand when necessary. At the same time, training students to solve the comprehensive application of the problem of the ability, if necessary, supplemented by the actual case of scientific research projects, domestic and foreign related literature to discuss.

Modalities of Evaluation

- Examination method: Coursework + Final exam (open book)
- Grades evaluation: coursework results accounted for 30%, final exam results accounted for 60%.

Bibliographical References

Textbook:

- [1] **"System modeling"** (second version), compiled by Ge Mu, Qiaoli Li, Qingjun Meng, Yibing Huang, National Defense Industry Press,2013.

References:

- [1] **"System modeling and simulation"** (second version), written by Xiaohua Zhang, Qinghua University Press,2015.
- [2] **"System modeling, analysis and control"** compiled by Jinqiu Mo and Lei Luo, Shanghai Jiao Tong University Press,2017.

SIMULATION USING MATLAB

ECTS Credits: 4   Duration: 30h

Module Objectives

- Students can understand the basic principles of control system simulation technology, master the control system theory, calculation method and the combination of computer technology knowledge and practical skills.
- Students have the ability to use control system simulation technology for analyzing, assisting design and simulation of the control system.
- Students will master the basic knowledge of the current popular MATLAB language, combined with the course System Control, they will learn to use MATLAB language in order to carry out the basic skills of control system modeling and simulation design, so as to lay a good foundation for engaging in the related fields of engineering technical work, scientific research and the development of new technology areas in the near future.

Module Content

This course contains 30 (Theory 10+ Experiment 20) periods, divided into eight chapters

- Chapter 1: The automation control and introduction of simulation that The key teaching point is the concepts of the simulation, the elements and the basic procedures of the computer simulations.
- Chapter 2: The mathematical modeling of the control system based on MATLAB that the key teaching point is the relative function of the transfer function, the zero pole functions, the state space function and the connection and reduction of the block chart model in MATLAB.
- Chapter 3: Stability analysis of the control systems that the key point is the relative functions of the direct determination of the stability of the systems with MATLAB and the relative functions of the graphical determination of the stability of the systems with MATLAB.
- Chapter 4: Time domain analysis of control systems that the key points is typical functions for simulation of time domain response with MATLAB and the time domain analysis with MATLAB LTI Viewer.
- Chapter 5: The analysis and compensation of root locus of control systems that the key teaching point is the relative functions of the analysis of root locus of the control systems and the graphic analysis and design tool of MATLAB.

- Chapter 6: The analysis and compensation of the frequency domain of control systems that the key teaching point is the frequency domain analysis with MATLAB, the stability determination with frequency domain method with MATLAB.
- Chapter 7: The design of PID controller of the control system that the key teaching points: the setting methods of the parameters for the PID controller and the design of PID controller.
- Chapter 8: The analysis of nonlinear control systems that the key point is the setting methods of the parameters for the PID controller and the design of PID controller.

Teaching Methods and Tools (theory, case studies, software, etc.)

Classroom instruction (theory and application examples) is combined with open laboratory simulation experiments. Interest groups (3 ~ 5 per group) are organize and that students are guided through the relevant literature and discussion. After each student is finished with this course, they will be able to write an independent paper about the simulation of the simulation.

In the preliminary stage of the course, students are required to independently consult data, use at least one control system, write a complete mathematical model modeling process, analyze and design, and at least use one simulation method to complete the simulation study. Students are able to discuss and design and design control systems with their requirements and information.

Modalities of Evaluation

- Examination method: Coursework +Laboratory report +Essay
- Grades evaluation: Laboratory work accounted for 50% and final report for 40%.

Bibliographical References

Textbook:

"MATLAB and simulation application of control system"(third version), compiled by Guangyuan Zhao, Beijing university of aeronautics and astronautics press,2016.

References:

- "MATLAB and simulation application of control system"(fourth version), compiled by Zhenglin Wang, Shengkai Wang, Guoshun Chen,Qi Wang, Electronic Industry Press,2017.

Faculty

Dr. Feng Yang

VIRTUAL INSTRUMENTATION

ECTS Credits: 4   Duration: 30h

Module Objectives

In this course, the students will learn a graphical programming language for instrumentation. This course prepares them to do the following:

- 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.

Module Content

- T1: Introduction to LabVIEW
- T2: Modular Programming
- T3: Graphical Representation
- T4: Control Structures
- T5: Arrays and Clusters
- T6: Strings and File I/O
- T7: Data Acquisition

Teaching Methods and Tools (theory, case studies, software, etc.)

Classroom exercises / project (individual or group).

Modalities of Evaluation

Continuous evaluation of classroom exercises, project and final test. Break up as follows:

- Classroom exercises / Project (45% of the final grade)
- Final exam (45%)

Final grade= Exercises grade + Project grade + Final test grade

Bibliographical References

- LabVIEW

SPECIFIC INSTRUMENTATION

ECTS Credits: 4   Duration: 30h

Module Objectives
At the end of this module, students will be able to manage the entire information sampling chain in an instrumentation-type embedded system

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

Teaching Methods and Tools (theory, case studies, software, etc.)
Classroom exercises, project (individual or group).

Modalities of Evaluation
Continuous evaluation of classroom exercises, project and final test. Break up as follows:
- Classroom exercises (30% of the final grade)
- Project (individually or group) (20% of the final grade)
- Final test (40% of the final grade):

Final grade= Exercises grade + Project grade + Final test grade

TECHNICAL PROJECT

ECTS Credits: 4   Duration: 30h

Module 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

The aim of this project is to build an embedded system platform successfully and to learn how to manage a technical project.

Module Content
Students work in workgroups of 2 or 3. They have to plan their work, to find, to compare and to select different kind of technical solutions, to develop their project, and to test them. Each workgroup is managed by the faculty member: Students work alone with high level of autonomy. The projects are given by the faculty member and are in the field of embedded system, computer vision, autonomous navigation and mobile robotics.

Teaching Methods and Tools (theory, case studies, software, etc.)
Embedded systems software and hardware tools: microcontroller boards, embedded languages, technical and functional specifications, risk analysis, tests protocol, development, etc.

Modalities of Evaluation
Feasibility study, weekly meetings, platform demonstration, Final Oral Presentation and Final Report.

Final grade= Exercises grade (40%) + Project grade (presentation + report) 50%

MICROPROCESSORS

ECTS Credits: 4   Duration: 20h

Module Objectives

Target knowledge

- Hardware architecture and technologies for widely used processors
- Machine level programming concept and practice
- Embedded real-time software application coding and MCU porting

Target skills

- Understanding ARM Cortex-M4 MCU core & peripherals architecture
- Ability to create ARM Assembler programs
- Experience in using Integrated Development Environment (IDE) for ARM processors programming
- Understanding and practice the configuration and the programming of ARM Cortex-M4 peripherals
- Experience in embedded software development and tests for ARM MCU target

Module Content

- **Chapter I - Microprocessors Basic Concepts:** Introduction to Embedded Systems, Microprocessor Units, Classes of Architectures, Memory Technologies & Hierarchy, Embedded Processors Applications
- **Chapter II - ARM Cortex-M4 Processor Architecture:** ARM Architectures and Processors, Cortex-M4 Processor Overview, Cortex-M4 Processor Registers, Cortex-M4 Processor Memory Map
- **Chapter III - ARM Cortex-M4 Processor Assembler Programming:** ARM Cortex-M4 Program Image, Assembly Program Structure, Data Definition Directives, ARM and Thumb® Instruction Set & Format, Functional groups of Cortex-M4 instructions
- **Chapter IV - ARM Processors System Architecture & Peripherals:** ARM Processors System Architecture, Memory Systems, General Purpose I/O, Exceptions and Interrupts, Timer Peripherals, Serial Communications
- **Chapter V - ARM Cortex-M4 Programming Practice:** Software Development Tools, Initiation to µVision Simulation Environment, Assembler Programs Analysis, Assembler Programs Coding

Teaching Methods and Tools (theory, case studies, software, etc.)

Classroom exercises, project (individual or group).

Modalities of Evaluation

Continuous evaluation of classroom exercises, project and final test. Break up as follows:

- Classroom exercises/laboratory (30% of the final grade)
- Project (individually or group) (25% of the final grade)
- Final exam (35% of the final grade)

Final grade= Exercises grade + Project grade + Final test grade

Bibliographical References

- **ARM® Cortex® -M4 Processor Technical Reference Manual**, 2015 ARM
- **Cortex-M4 Devices Generic User Guide**, 2011 ARM
- **Getting Started with MDK: Create Applications with µVision**, 2017 ARM

EMBEDDED C

ECTS Credits: 4   Duration: 30h

Module Objectives

At the end of the course students will be 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.
- Apply techniques and rules to ensure software quality and best coding practices.

Module Content

- Introduction to embedded system
- C language for embedded systems
- Best coding practices
- Programming the MSP432 microcontroller from Texas Instruments.

Teaching Methods and Tools (theory, case studies, software, etc.)

Lectures and programming exercises.

Modalities of Evaluation

Continuous evaluation of classroom exercises, project and final test. Break up as follows:

- Classroom exercises (30% of final grade)
- Final report (individually or group) (10% of final grade)
- Final exam (individually, open questions, closed-book) (50% of final grade)

Final grade= Exercises grade + Project grade + Final test grade

Bibliographical References

- **"MISRA-C coding guidelines"**. https://misra.org.uk/
- **"Embedded C"** Michael J. Pont, Addison-Wesley, 2002
- **"C programming for embedded systems"** Kirk ZurellLawrence, KS : R&D Books cop. 2000
- **"Patterns for time-triggered embedded systems"** Michael J. Pont, Addison-Wesley : ACM cop. 2001
- **"Programming embedded systems with C and GNU development tools"** Michael Barr 1971-Anthony J Massa Sebastopol, CA.; Farnham : O'Reilly 2006

SYSTEM CONTROL

ECTS Credits: 4   Duration: 30h

Module Objectives

- Be able to design a controller respecting performance specifications (example of the most popular one : PID controller)
- Be able to implement a controller on a microprocessor to control a system (use of the microprocessor MSP430G2553)

Module Content

PART 1 : System Control

- Chapter I : Introduction to System Control (Principles and objectives) / Notion of feedback control
- Chapter II : Presentation of a PID controller and a Neural Networks (NN) method for parameter tuning
- Chapter III : Definition and determination of the performances of a system
- Chapter IV : Design of a PID controller respecting performance specifications

PART 2 : Implementation of a controller on the microprocessor MSP430G2553 of TEXAS INSTRUMENT

- Chapter I : Presentation and architecture of the MSP430G2553
- Chapter II : Design, write and test an example of small C language program intended for the MSP430G2553 with the software "Code Composer Studio" of TEXAS INSTRUMENT / Use of the basic functions of debugging and test
- Chapter III : Presentation of the library of given functions and of some main modules of the microprocessor (timer, analog-digital converter, GPIO, interrupts)
- Chapter IV: Design, write and test in C language and on the microprocessor, an example of controller that respects performance specifications and using the elements listed above

Teaching Methods and Tools (theory, case studies, software, etc.)
- ○ Classroom exercises, project (individual or group).
- ○ Educational DC motor test bench driven by a microcontroller

Modalities of Evaluation
Continuous evaluation of classroom exercises, project and final test. Break up
as follows:

- ○ Project (individually or group) (40% of the final grade)
- ○ Final exam (50% of the final grade)

Final grade= Project grade + Final test grade

Bibliographical References
- ○ User manual of MSP430G2553 / PID controller

EMBEDDED SYSTEMS USING AI

ECTS Credits: 4   Duration: 30h

Module Objectives

The objective of this module is to provide students with the fundamental knowledge and practical skills required to design, implement, and deploy Artificial Intelligence (AI) algorithms on embedded systems. It aims to develop their ability to understand AI concepts, work with python-based environments, and apply machine learning techniques to real-world embedded applications, including data acquisition, processing, and prediction.

Module Content
- ○ T1: Fundamentals of AI
- ○ T2: AI models (introduction to machine learning, classification techniques, overview of common algorithms)
- ○ T3: AI deployment with python (Working environment, Python basics, AI algorithm deployment)
- ○ T4: Introduction to embedded systems (overviewpython environment on embedded boards of raspberry pi, arduino, stm32, pytrack, peripherals, sensors, and communication interfaces)
- ○ T5: Practical work
- ○ T6: Project

Teaching Methods and Tools (theory, case studies, software, etc.)
Classroom exercises, project (individual or group).

Modalities of Evaluation
Continuous evaluation of classroom exercises, project and final test. Break up
as follows:

- ○ Project presentation (individually or group) 45% of the final grade)
- ○ Final test (45% of the final grade)

Final grade= Project grade + Final test grade

PROJECT MANAGEMENT

ECTS Credits: 3   Duration: 30h

Module Objectives

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

- Appreciate the need for project management as a recognized discipline
- Understand the complexity of a technical project and the need for formal methods
- Appreciate the need to break up complex projects into smaller ones
- Appreciate the need for effective planning, monitoring and control mechanisms
- Understand the importancen a microprocessor to control a system (use of the microprocessor MSP430G2553)

Module Content

This course contains 30 (Theory 10+ Experiment 20) periods, divided into eight chapters

- Establish project's goals.
- Construct a project timeline, budget and resource schedule using a Gantt chart.
- Understand and use planning, controlling and reporting tools.
- Carry out a risk analysis, especially on risks introduced by international and cross-organizational project teams.
- Use formal leadership techniques to manage projects and project teams.
- Design, implementation and test of an application.
- Organization and planning of team work within project
- Return Of Experience (ROE)

Teaching Methods and Tools (theory, case studies, software, etc.)

- Case Studies / Agility / exercises to be done as a team /...
- Gantt chart / budget / Reporting review / Kick Off...
- Software : Spreadsheet software / Trello / Mural / text editor/ Presentation software

Modalities of Evaluation

- Collective : multiple team works during the course, Final report (60%)
- Individual : oral participation (30%)

REAL-TIME OPERATING SYSTEMS

ECTS Credits: 5   Duration: 30h

Module Objectives

This course, students will master the basic principles of the embedded operating system, and based on which, through the μC\OS-II source code learning, students will have in-depth understanding of the embedded real-time operating system. Then through the transplantation of μC\OS-II on ARM, and engineering practice, students can master the engineering application of embedded real-time operating system. This course plays an important role in cultivating students' well-organized scientific and logical thinking skills, analytical design ability, and summarizing ability.

Module Content

The course consists of 30 (Theory 20+ Experiment 10) hours and is divided into the following six chapters

- Chapter 1 Real-Time Operating System Foundation that The key teaching point is the basic features of real-time operating systems, priority-based scheduling algorithms, clocks and interrupts.
- **Chapter 2:** Operating System Task Management that the key teaching point is task management data structure, task status and conversion, task scheduling.
- **Chapter 3:** Interrupt and Time Management that the key point is the interrupt processing flow, the time acquisition and setting.
- **Chapter 4:** Event Management that the key teaching point is event control block (ECB) data structure, semaphore and mutual semaphore, event flag group management data structures.
- **Chapter 5:** Memory Management that the key teaching point is memory control block data structure, memory partition operation.
- **Chapter 6:** Transplantation of μC/OS-II Operating System that the key teaching point is the μC/OS-II code structure and the μC/OS-II transplantation procedure.

Teaching Methods and Tools (theory, case studies, software, etc.)

The Real-Time Operating System course is based on courseware. When necessary, it is supplemented by multimedia to help students understand. At the same time, the key code is explained in detail, and the μC/OS-II operating system is transplanted to carry out certain experimental operations.

Modalities of Evaluation

Examination method: Coursework +Laboratory report + Final exam

- Grades evaluation: Coursework results accounted for 20%, laboratory/experiment for 30% and final report results accounted for 40%
.

Bibliographical References

Textbook:

- **Principles and Practices of Embedded Real-Time Operating System μC\OS** (2nd Edition), edited by Lu Youliang, Electronic Industry Press, 2014

References:

- **Principles and Applications of Embedded Real-Time Operating System μC/OS**-II (4th Edition), edited by Ren Zhe, Fang Hongzheng, Cao Jing, Beijing University of Aeronautics and Astronautics Press, 2016

- **Embedded Real-Time Operating System μC/OS-II**I, edited by Jean J. Labrosse, translated by Gong Hui, Zeng Ming, Gong Guanghua, Beijing University of Aeronautics and Astronautics Press, 2012

MtoM COMMUNICATION

ECTS Credits: 5   Duration: 30h

Module Objectives

MTOM Communication Technology is a compulsory course related to the Internet of Things in embedded systems. This course introduces a wide range of cross-cutting issues related to MTOM communication, including a common view of MTOM communication, architecture and traffic modeling, and the application of MTOM communication. By the lectures, experiments and other teaching links, students will understand the basic concepts of MTOM and the design methods of MTOM applications, including the use of MTOM communication capabilities to achieve an emerging computing model - the application of mobile phone group intelligence in cloud computing.

This course is based on the requirements of embedded system training, innovative technology development and application. By learning this course, students can acquire the basic knowledge and basic skills of MTOM application, and understand the current mainstream MTOM technology development level, research and development model. They can also master the ability of environment development and application design of relevant development platforms, and lay the foundation for engaging in relevant engineering technical work and scientific research.

Module Content

TThe course consists of 30 hours and is divided into the following eight chapters

- **Chapter 1:** MTOM Communication in the Physical World that the key teaching point is the MTOM concept and the MAC protocol in MTOM.
- **Chapter 2:** Architecture and Standards of MTOM Communication that the key teaching point is 3GPP MTC architecture, EXALTED system architecture.
- **Chapter 3:** MTOM Traffic and Models that the key point is MTOM traffic modeling activities of 3GPP, ETSI and IEEE, MTOM business modeling framework.
- **Chapter 4:** Efficiency Evaluation of IEEE 802.15.4 Network in MTOM Communication that the key teaching point is system model frame loss probability and frame collision probability analysis, numerical results and performance analysis.

- **Chapter 5:** Reliability of Wireless MTOM Communication Network that the key teaching point is: link reliability analysis and network-level reliability analysis for wireless communication networks.
- **Chapter 6:** MTOM Communication in Smart Grid that the key teaching point is Various wireless communication technologies for MTOM communication.
- **Chapter 7:** Intrusion Detection System for MTOM Communication in Smart Grid that the key point is the security and privacy of MTOM communication in NAN, and the intrusion detection system.
- **Chapter 8:** MTOM Interaction Example by Volunteer Computation and Mobile Group Sensing that the key point is the volunteer contribution model for MCS applications.

Teaching Methods and Tools (theory, case studies, software, etc.)

"MTOM communication technology" course is given priority to with classroom teaching, teaching content in the courseware as the main line, supplemented by actual case, the related literature at domestic and abroad to discuss research projects.

Modalities of Evaluation

- Examination method: Coursework + Final exam (open book)
- Grades evaluation: coursework results/report accounted for 50%, final exam results accounted for 40%.

Bibliographical References

Textbook

- Intelligent Factory-Based MTOM Communication, edited by Vojslav Misic, Mechanical Industry Press, 2016

Reference

- Machine-to-Machine (MTOM) Communication Technology and Applications, edited by Axel Galanz Oliver Jung, Defence Industry Press, 2011
- Internet of Things MTOM Development Technology, edited by Hong Li, Liu Ying, Kong Huijuan, Beijing University of Aeronautics and Astronautics Press, 2011

PROJECT

ECTS Credits: 5   Duration: 60h

Module Objectives

This course independently completes the development of a project through the student's existing subject expertise and research topics. It carries out the comprehensive training and improvement of students' research ability and ability to solve practical engineering application problems. Therefore, students can clearly understand and evaluate the project development process on the theoretical and practical levels, and further analyze and evaluate projects from the perspective of entrepreneurs, investors, and co-founders.

Module Content

○ The course should instruct students to analyze complex engineering problems through the academic resources of the school library and their own professional knowledge;

○ The course should guide students to apply their professional knowledge in consideration of realistic constraints for selected design projects, along with composing the content of the subject and obtain a feasible implementation plan;

○ The course should instruct students to reasonably decompose and allocate the project tasks according to the characteristics of the project and the characteristics of the team members;

○ The course should guide students to rationally allocate the project budget and implement the project. It also should help the students to analyze the problem, identify potential risks in engineering practice in advance and take countermeasures to prevent it;

○ The course should guide students through theoretical explanations (including principles, industry laws and regulations, professional academic knowledge) and practical operations in the course practice to analyze problems and solve problems;

○ In the process of achieving the goal of the project, the course should instruct students to use the experimental skills and skills that have been learned to analyze whether the results of the experiment are consistent with the expectations in the plan. At the same time, the experiment in turn verifies the rationality of the plan and finally achieves the target demand;

○ The course should instruct students to assess the impact of the project's practical activities on the objective world and the responsibilities of the individual in the project activities, and adopt reasonable technical means to reduce the

○ The course should instruct students to pay attention to the expression of academic terminology, use professional terminology to communicate with peers and the public;

○ The course should guide students to understand the necessity of self-learning, establish lifelong learning awareness, and have the expertise to constantly explore the capabilities of new fields, as we can take a lifelong learning in a proper way to adapt to the development needs of ourselves and the industry.

Teaching Methods and Tools (theory, case studies, software, etc.)

The tutor is responsible for the proposition, and carry on the early, mid, and concluding stages such as the whole process of instruction, curriculum group is responsible for the examination..

Modalities of Evaluation

○ Examination method: The objective assessment shall be based on the completion of tasks such as early stage, middle stage, and settlement, as well as the results of each stage report and defense, and shall conduct comprehensive examination and evaluation for the students.

○ Grades evaluation: Monitoring of the project (25%)+ Technical aspects (25%) + Final report and oral presentation (50%)

Bibliographical References

Textbook

No fixed textbook

Reference

The students are asked to search through the literature database and library books by their topics.

Faculty

Guidance from permanent faculty members of UESTC (50H) and ESIGELEC (10H)

J

INTERNSHIP AND PROFESSIONAL THESIS

The student can do an internship either in a company or in a research laboratory in a university. Students are encouraged to do their internship in China, but may choose to do it elsewhere. The duration of the internship is of 4 months (minimum) to 6 months (maximum). Assistance will be provided by UESTC to find internships but students are expected to play an active part, as the internships are not offered automatically by ESIGELEC or UESTC.

The validation of the internship will be based on criteria such as the innovative character of the subject and its adequacy with the regard to the content of the programme. The internship must be approved by ESIGELEC's Academic Coordinator of the Master of Science programme, before the student starts the internship. Failing to seek this approval may result in the internship being rejected by ESIGELEC. The work placement agreement may be signed either by UESTC or ESIGELEC, depending on the situation.

A faculty member of ESIGELEC or UESTC will contact the student at least once during the internship. In the event of questions regarding the internship, the preparation of the oral presentation or the preparation of the professional thesis, the student can contact either the faculty member or the Academic Coordinator of the MSc – Master of Science programme at ESIGELEC or at UESTC directly, during the period of the internship.

A professional thesis will have to be completed during the internship. The subject of the thesis will be chosen by the student and validated by the Academic Coordinator of the MSc – Master of Science programme of ESIGELEC one month maximum after the beginning of the internship.

The professional thesis will be presented at UESTC before a Jury comprising of a President (from ESIGELEC / on site or on line), 2 faculty members from ESIGELEC (on site or on line), and 1 faculty members from UESTC (on site). The industrial tutor could also choose to be present, if possible. Professional thesis presentations are planned 4 months maximum after the end of the internship and ideally at the end of March, June, August or November.

The report of professional thesis will have to be sent to ESIGELEC (one soft copy in Word or PDF via intranet) and UESTC (two hard copies by post), at least two weeks before the date of the professional thesis presentation. The duration of the oral examination will be of 60 minutes (30 minutes of presentation + 15 minutes of questions + 10 minutes of evaluation + 5 minutes of feedback).

A student has a maximum of 2 years after the two academic semesters in UESTC, to find the internship, complete it and present the professional thesis to ESIGELEC and UESTC. Failing to do so in the stipulated time will render them ineligible for the Master of Science degree of ESIGELEC.

K ## STUDY BOARD AND EVOLUTION OF THE MSc – MASTER OF SCIENCE PROGRAMME

The members of the Study Board are representatives of the related industries, the universities (including representatives of UESTC) and ESIGELEC. The Board of Studies oversees the course content and recommends changes when necessary.

The Board of Studies, which meets at least once every two years at UESTC, also ensures that the course content and laboratories are streamlined in keeping with the changing industry requirements. A meeting between the Academic Coordinators of ESIGELEC or of UESTC, and the faculty members is convened at the end of each module, to assess the relevance of the content, equipment and issues which may have occurred while delivering the module.

A meeting is also convened regularly between the Academic Coordinator of the Master of Science programme at UESTC and / or ESIGELEC and the students, to discuss academic and non-academic issues.

The two Academic Coordinators of the MSc. programme at ESIGELEC and at UESTC communicate throughout the year for any issues related to the said programme and/or the students.

L ## SELECTION OF CANDIDATES

Eligibility
4-Year Bachelor's degree in engineering. Candidates must demonstrate a strong motivation for the programme and adequate English language proficiency.

Selection of candidates
Candidates are selected through:
- A pre-selection done by UESTC, and,
- An application form, and,
- An interview of language and motivation completed onsite with representatives of ESIGELEC (online or onsite) and UESTC (onsite).

Application deadline
30th May for the September intake at UESTC.

Admission to the MSc – Master of Science
Upon receipt of the application form and after the admission interview, ESIGELEC and UESTC communicate their decision to the applicants within two weeks.

Tuition deposit payment
Successful applicants receive a Letter of Conditional Admission. They pay UESTC 50% of the total tuition fees for MSc programme before the end of July and before the beginning of semester 1, to receive a Letter of Final Admission from ESIGELEC. The remaining part of the tuition fees must be paid directly to UESTC, before the beginning of semester 2.

Students who fail to do so may be refused permission to attend classes at UESTC.

M

TUITION FEES

The total tuition fees due to ESIGELEC and UESTC are 121 956 Yuan for September 2025 batch. There are no application fees.

N

SCHOLARSHIPS OF EXCELLENCE FROM ESIGELEC AND UESTC

UESTC and ESIGELEC provide the scholarship at a ratio of 10:1 for each batch, and based on the final academic results obtained by the students of the batch concerned. UESTC provides 16,000 Yuan per person and ESIGELEC provides 2,500 Euros per person. The final results for the candidates are assessed and approved by the Joint Management Committee of the MSc programme. Only the overall scores of each module before the resit exam will be used to nominate the awardees of the said scholarships.