ESIGELEC Course Catalog
2020 - 2021

Introduction and Overview

First year instruction at ESIGELEC (Semesters 5 and 6) is the base for all students and provides the critical scientific, managerial, and soft skill set for an engineer. The 1st year curriculum is designed to:

- Deepen student knowledge in science (math and physics)
- Help students acquire technical knowledge and skills relating to Esigelec's majors (telecommunications, IT networks, electronics, embedded systems, electrical and mechanical engineering)
- Through project and class work, students will work on and perfect their soft skills as well as increase their general culture; both of which are useful for an engineer (communication, general culture, project management, and English)

Participating in a school club, representing Esigelec at fairs, or being a class delegate are also ways to validate credit; participation in an Esigelec sports team will be subject to assessment.

At the end of the 1st year, students must find a minimum 4-week internship, in France or abroad, allowing them to gain real-world professional experience. For evaluation purposes, students will be required to write a report and give a presentation about their internship and experiences. This evaluation takes place at the beginning of the 2nd year.

Second year instruction at ESIGELEC (Semesters 7 and 8) has two elements:

- A majority of instruction is common to all students and is spread throughout both semesters
    - This common curriculum is for students to deepen their knowledge of targeted technical knowledge and skills relating to Esigelec's majors (telecommunications, IT networks, electronics, embedded systems, electrical and mechanical engineering).
    - To continue to give students opportunities to work on their soft skills (i.e. group project work), general culture and English.
- The rest is coursework specifically tailored to a student's major. Esigelec offers 15 majors:

- ARI: Industrial Automation and Robotics
- BDTN: Big Data
- CERT: Network and IOT Cybersecurity
- EDD: Energy and Sustainable Development
- ESAA: Electronic Systems for Auto and Aerospace Engineering
- GET: Electrical Engineering and Energy Transport
- IA (2 variations): Business Engineering
  - IA DES: Energy & Signals
  - IA IR: IT & Networks
- ICOM: Telecommunications Engineering
- IF: Financial Engineering
- ISE (2 variations): Embedded Systems Engineering
  - ISE OC: Communicating Objects
  - ISE VA: Autonomous Vehicles
- ISN: IT Services Engineering
- ISYMED: Medical Systems Engineering
- MCTGE: Mechatronic & Electrical Engineering

As in 1st year, participating in a school club, representing Esigelec at fairs, or being a class delegate are also ways to validate credit; participation in an Esigelec sports team will be subject to assessment.

At the end of the 2nd year, students must find a minimum 8-week internship, in France or abroad, allowing them to gain real-world professional experience in their field of study. For evaluation purposes, students will be required to write a report and give a presentation about their internship and experiences. This evaluation takes place at the beginning of the 3rd year (Semester 9).

Third year instruction at ESIGELEC (Semester 9) has three elements:

- In this semester approximately 50% of instruction is common to all students (for the same reasons mentioned in the 1st and 2nd year overviews)
- Major-specific courses
- An engineering internship: at the end of the 3rd year / 9th semester, students must find a minimum 4-month internship, in France or abroad, allowing them to gain real-world engineering career experience. For evaluation purposes, students are required to write a report and give a presentation about their internship and experiences.

1st Year – Term 5
COMMON CURRICULUM

E 1C1 – F Electronics 1: 7 hours lecture, 7 hours class, 52 hours labwork, 12 hours independent groupwork
(7 ECTS credits)

Objectives

For students to

*choose a suitable measuring apparatus, put together a testing cycle (using 2 sources and 3 apparatus) and use the results,

*calculate current and voltage to determine characteristic variables (gain, impedance, etc.) in a schema including several branches (3 or 4)

*Design an electronic schema working from design specifications and using a logical methodology.

Coursework

° Electric circuit fundamentals: Kirschoff and Milman, calculating basic electronic functions, Bode diagrams

° Operational amplifiers basics

° 1st and 2nd order filters

° Measurement apparatus and their uses

° CAD and PSPICE software

° Project: creating an electronic setup

PJ 1C1 – F Programming with Java: 27 tutored hours, 52 hours independent study and project work
(7 ECTS credits)

Overall objectives

Working from a given set of instructions (including a UML class diagram) students will write, test and document a Java application and its

* data base

* graphic interface (using WindowBuilder)

* algorithms

Learning objectives

° Working from a given set of instructions, choosing the structure of controls, determining the variables and the instructions sequence leading to an expected result

° Using a debugging tool with a method

° Characterize a subprogram

° Use the language and jargon of: 1) Object-Oriented Programming, and 2) DBMS- DataBase Management System

° Use existing classes and packages

° Use Javadoc

° Create a graphic window incorporating using interaction

° From a given problem, identify, choose and use the pertinent data structure (ArrayList, Text document, Spreadsheet)

° Explain what purpose catching an exception serves

° Formulate a query on a table and putting together commands such as Select, Insert, Update, and Delete

° Explain the role of JDBC

° Adapt a given example (to follow SQL instructions) in a Java application

° Interpret a class diagram, identify the elements that make up a class diagram, and produce the corresponding Java code

° Read and write in English in this technical context

ATS 1- C1F Engineering and Signal Processing 1: 11 lecture hours, 14 class hours, 21 laboratory hours

(4 ECTS credits)

Overall objectives

To be able to model a monovariable linear system, analyse its performance and design a digital filter or corrector respecting design specifications

Learning objectives

1 To be able to put together a block diagram
2 To be able to establish the transfer function of a monovariable system
3 To be able to identify the characteristics of 1st and 2nd order monovariable systems
4 To be able to analyse stability using Nyquist and Routh criteria
5 To be able to analyse stability using Black-Nichols method
6 To be able to assess the response time of a system
7 To be able to use assess the precision (static and dynamic errors) of a system
8 To be able to explain basic correction actions (PID values) in a control loop
9 To be able to set the parameters of a PID controller
10 To be able to use set the parameters of an equalizer
11 To be able to calculate the z transform of a given function
12 To be able to calculate filter parameters from design specifications
13 To be able to establish optimal design structure of a digital filter
14 To be able to use Matlab and Simulink for block diagrams and their functions
15 To be able to analyse and interpret experiment results

FUNDAMENTALS FOR ENGINEERING

Electromagnetism, Maths, Probability Theory, and Heat Transfer = 5 ECTS credits

OCI 1C1 – F Electromagnetism: 8 hours lecture, 10 hours class

Objectives

At the end of this course students will be able to design (given a set of functional requirements and specifications) a simple electromagnetic setup. This semester students will

- apply various mathematical equations to electromagnetic situations.
- identify different phenomena (magnetostatic, electrostatic, propagation)
- describe the composing elements of Maxwell Equations
- explain the various phenomena functioning in a capacitor and solve electrostatic problems by taking into account the properties of different materials
- explain the various phenomena present in a magnetic system and resolve problems relating to magnetic fields by taking into account the properties of different materials
- explain the phenomena of propagation by using Maxwell equations to obtain propagation equations
- solve propagation equations while considering the properties of different materials

Coursework

* Tools and operators (mathematics)
* Introduction to various principles (magneto-static, electrostatic and propagation)
* Introduction to Maxwell's equations and governing laws
* Study of electrostatics with a capacitor
* Study of quasi-static magnetics with transformers
* Study of propagation with wave guides

OCI 1C2 – F Math: 10 hours lecture; 16 hours class

Objectives

This course provides the fundamental mathematical thinking, methods and skills necessary for an engineer tackling problems

and processes in electrical, electronic and control engineering.

Coursework

Laplace transforms, Differential equations, Fourier series and transforms, Solving partial derivatives, Z transforms

OCI 1C3 – F Probability Theory: 8 hours lecture, 10 hours class

Objectives

This course introduces the randomness of variables and how best to measure them to predict a minimum technological cost and assess follow-up decisions.

Coursework

This course studies the following selected topics: probability spaces, discreet and continuous random variables, the principle discreet laws, normal law and the central limit theorem, and convergence (The Weak Law of Large Numbers).

OCI 1C4 – F Heat Transfer: 10 hours lecture; 6 hours class

Objectives

*This course aims to work with the various types of thermal transfer (conduction, convection and radiation) and and the laws that govern them (Fourier, Newton, Planck and Stefan).

*Students will put together a thermal heat balance equation of a system while considering its characteristics and limits.

*Students will use the notions of thermal resistance

*Students will apply all of the aforementioned to electrical engineering situations.

Coursework

1. Fundamental notions: temperature, flux, flux density
2. Fundamental laws and limits
3. Heat Balance – producing thermal energy
4. Thermal resistance – applications to housing
5. General forms – equations, sizing, efficiency
6. Non-steady-state (or transient) heat transfer calculations - Biot number, Fourrier number
7. Thermal propagation – thermal diffusivity, thermometric conductivity
8. Characteristics of radiative transfer
9. Blackbody radiation
10. Greybody radiation
11. Absortivity – the greenhouse effect

GENERAL EDUCATION / GROUP-PROJECT WORK

PI 1C1 – F 1ST Year Group-Project: Initiative and Creativity (PIC)

Initiative and Creativity Project (Semesters 5 & 6)

Objectives

- Live the experience of creating, managing and bringing to fruition a non-technical, six-month, team project (group organisation, goal & deadline setting, identifying needs, delegating responsibility and workload, conflict resolution, creating and updating a balanced budget, practicing professional behaviour, handling the ups and downs of a long-term, group project)
- Practicing effective communication (oral & written) within the group as well as with outside parties (writing effectively due to focus on form and content, writing to respect intellectual property, speaking with purpose and efficiency while explaining, convincing, debating, presenting (informally and formally) analytically and succinctly while respecting constraints and respecting a given audience.
- Cultivate students' creative and initiative skills (developing autonomy, cultivating ideas, developing original and personal work habits)

LANGUAGES & COMMUNICATION

Semester 5: English, 2nd Language, and Communication (5 ECTS credits)

LC 1C1 – F[1] English: 30 hours class

*At the beginning of the year students are organized into three level-groups (beginner, intermediate, and intermediate plus) based on their performance on an English competency test.

*Throughout the year students will work on oral and writing skills while focusing on practical, social and business themes. Students will work on their oral and written comprehension skills. Students will start preparing for the Test Of English for International Communication (TOEIC).

* *Oral comprehension* goals: For students to understand the essential points from clear and standard English is used in relation to familiar, everyday situations such as work, school, current events, and so on.

* *Written comprehension* goals: For students to be able to understand texts written in everyday English and related to the world of work and school.

* *Oral expression*: For students to be able to participate in a conversation based on familiar/everyday subjects; to be able to ask and exchange information; to be able to prepare and give a short formal presentation

* *Written expression*: For students to be able to write short, clear and understandable texts (about familiar/everyday situations) with a minimum of correct grammar and vocabulary.

Objectives

1 Use and refine the usage of vocabulary relating to business travel and oral presentations

2 Put together a group presentation on a non-technical subject with several main points that are clearly communicated and explained

3 Understand and answer questions at the end of the aforementioned presentation

4 Be able to write a short researched document that respects intellectual property and citing sources correctly

5 Reinforce and develop additional notions of grammar

LC 1C2 – F 2nd Language (Spanish, German, Chinese, or Japanese): 18 hours class

Objectives for students starting a language

* Students will be able to understand the fundamental elements of the language (alphabet, pronunciation, syntax, basic vocabulary) and the writing and punctuation specific to their chosen language of study. For example, in Chinese, students will master approximately 50 characters and in Japanese students will master approximately 50 "hiragana" and "katakana".

* Students will work with the various phonetics and specificities of pronunciation in their chosen language of study.

* Students will understand the most common words and phrases in their chosen language of study.

* Students will be able to present themselves and use simple phrase forms to speak of themselves, their activities and their surroundings.

* Students will be able to write simple sentences in their chosen language of study.

Objectives for students continuing a language previously studied

* Students will be able to understand and use expressions and vocabulary of everyday life in their chosen language of study. For example, in Chinese and Japanese, students will master approximately 100 characters.

* Students will be able to read a short text and find specific information.

* Students will be able to participate in a discussion to exchange specific information

* Students will be able to use numbers (with money for example) and communicate the time.

* Students will be able to write a short note or message.

LC 1C3 – F Communication: 14 hours class

Objectives

[1] This "F" should be an "A" for *Anglais*. For the other listing in the Excel spreadsheet you have LCG 1C1 - A

♦ For students to be able to express themselves clearly and efficiently orally and through writing, in professional and informal contexts

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

1 Clearly express themselves using appropriate form and content (register, vocabulary, syntax, grammar, and so on.)

2 Write professional documents, such as e-mails, letters, meeting agendas, meeting minutes, and reports

3 Give a presentation (using presentation materials) in a formal setting

4 Do research, use resources (while respecting intellectual property), and referencing findings when writing or presenting

1st Year – Semester 6
COMMON CURRICULUM

CL 1C1 – F LiFi Communications: 8 lecture hours, 54 laboratory hours (5 ECTS credits)

Course Objectives

♦ To design and realize wireless communication using visible light

Learning Objectives

* Extract useful information from a technical document
* Analyse a set-up and calculate variables
* Design a set-up working from design specifications and choosing components
* Cable then validate a set-up by taking relevant measurements

Students must be familiar with the following to participate in this class

* Fundamental theorems
* Experience in measurements
* Set-ups of ideal operational amplifiers
* Filtering
* Temporal and frequential analysis on PSpice

PDL 1C1 – F Software Development Project: 3 lecture hours, 16 class, 42 hours laboratory (5 ECTS credits)

Course Objectives

♦ To design, create, and test software using UML, JAVA, GIT, and Oracle DB and following pre-established steps.

Learning Objectives

* Use UML to write a software requirement specifications (SRS) document
* Conduct acceptance testing working from the SRS document
* Write up a preliminary design review (PDR)
* Write up Software Design Description (SDD)
* Put together an Oracle Database
* Code a Java application using an Oracle Database and a layered model
* Assess the product of another team
* Use a source code management system (Git)
* Work with and contribute to a team project

Students are made aware of the issues of energy transition in three steps:

- At the beginning of the course thanks to a presentation on the environmental impact of the tools and technologies associated with project management, software engineering, and application architectures.
- At the beginning of the project by reflecting on good practices to adopt during the project and by establishing an action plan.
- At the end of the project by assessing the estimated impact of the project relating to the aforementioned elements.

CEE 1C1/2/3 – F Energy conversion[2]: 30 lecture hours, 18 class hours, 27 laboratory hours (6 ECTS credits)

Course Objectives

♦ Students will master the understanding of how a motor works, manipulate the speed, and learn how to power it with converters with goal of designing an energy conversion chain. The overreaching goal of this course is to design and build an energy conversion chain.

Learning Objectives

* To propose a method of measuring a single or three-phase set-up and analyse the results.
* To choose a converter adapted to an industrial usage requiring direct current
* To choose components used with power converters
* To explain and reason the basics of an electric motor (Direct Current and Induction motors) and a single-phase transformer
* To work with the speed of a DC motor given a model
* To identify the parameters of a single phase transformer in order to calculate its output

DIGITAL SYSTEMS

(4 ECTS credits)

SN 1C1 – F & SN 1C2 - F

Logic & Computer Architecture: 14 lecture hours, 18 class hours, 12 laboratory hours

Course Objectives

♦ Students will learn about digital systems by looking at computer architecture and how it is related to the principles of combinational and sequential logic.

Course content

* To analyse an electronic circuit incorporating logic functions
* Logic circuits
* Petri net (Place/transition net) and State machines
* Using and dealing with numbers and binary numeral systems
* Describing the elements that make up a computer system and how they function
* Practical applications for logic (circuits, levels, tools, simulations, cabling, and so on.)

LANGUAGES & GENERAL CULTURE

Semester 6: English, 2nd Language, and Elective (4 ECTS credits)

(LCG 1C1 – A) English: 24.5 class hours

*Continuation of Semester 5

(LCG 1C2) 2nd Language: 15 class hours

*Continuation of Semester 5

(LCG 1C3 – F) Elective: 18 class hours

(ST1) Internship = 5 ECTS credits

[2] In the Excel spreadsheet this course is broken down into three elements; all have the same name but with different course codes (CEE1C1, CEE1C2, CEE1C3), suffixes (EK, EP, and TP), and 3 separate evaluations

ELECTIVES: 18 lecture / class hours

Students choose one among the following:

° Introduction to French Law; ° Literature and Critical Thinking, ° Introduction to Economics, ° Jazz and Cinema, ° Sustainable Development, ° Theatre,° Companies and Individuals, ° Modern Economic Theory ° Companies and Society, ° Geopolitics, ° Intercultural Awareness

(LCG 1E1-F) Introduction to French Law

Objectives

* Increase student awareness about law; understand where law originates; understand the legal contexts for companies and their workers

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

* Explain the main options for legal recourse
* Categorize a legal situation and find the principle sources of useable evidence
* Understand the legal notions behind a contract
* Give a definition of an employment contract
* Know the main clauses that specifically are integrated into employment contracts offered to engineers
* Know the principle rights and legal obligations for a salaried engineer.
* Do research on a legal subject and give an oral presentation of the content in a structured and organized manner
* Put together a PowerPoint presentation
* Assess the work of fellow classmates

Coursework

◊ Principal sources of French law (written, non-written, jurisprudence)
◊ Principal sources of community law (treaties, secondary legislation and jurisprudence)
◊ Principal sources of European law (Human rights)
◊ Hierarchy of law sources
◊ Overview of the French legal system
◊ Principal rights of action
◊ Judicial acts and facts
◊ Principal types of proof
◊ Employment contracts: definitions, content, implementation
◊ Principal rights of the salaried engineer: pay, time off, freedom of expression, retirement, right to privacy
◊ Legal obligations of the salaried engineer: exercise of profession, professional discretion, respect of one's colleagues

(LCG 1E2-F) Literature and Critical Thinking

Objectives

* To analyze various types of reasoning through literature
* To understand rhetoric
* To become aware of the importance and significance of the written word
* To put together a formally-defined "argument" and defend it in front of an audience

Coursework

◊ Overview of the influence of history and literary movements
◊ Definition of "argument", rhetoric and the reasoning behind the importance of vocabulary
◊ Direct "argument": essays by Montaigne; arguments by Bossuet, Rousseau and Decartes; political speeches by Danton, Robespierre and Jaurès
◊ Indirect "argument": apologues by Fénelon and More; utopia by Rabelais; fables by La Fontaine; philosophical tales by Voltaire, Montesquieu, Aymé and Calvino; anti-utopia by Huxley and Orwell; analogies by Canton l'Ancien
◊ "Arguments" through dialogue: philosophical (Plato, Lucien, Diderot and Valery), theatrical (Corneille, Musset and Vigny), and Romanesque (Rabelais, Stendhal and Malraux)
◊ "Arguments" with images: caricatures, photos and drawings taken from a variety of time periods
◊ Three-person group project with one of the following themes: 1) A politician's speech for the inauguration of a civil

structure; 2) An art critic's argument to defend an abstract art producing artist, or 3) Imagining an apologue or a utopia

(LCG 1E3-F) Introduction to Economics

Objectives: To get engineering students to ponder the following questions and subjects:

* Why has the field of research in market economies bounced back to bring into question the three fundamentals of markets - production, consumption and distribution of wealth?

* What are the criterion that distinguish one market economy from another? Social values? Social necessities for certain economic activities?

* What are the characteristics of an economic crisis? How is wealth measured? What about disfunctioning public institutions and consumer behavior? Employment and unemployment?

* For students to put together a speech/debate/discussion activity where they must show their skills in adopting a socio-economic and/or economic approach (putting together schemas, visual aids, and interpreting statistics)

Coursework

◊ What is an economy? What is the economic circuit (economic agents, financial flows, national economies and their relations to the rest of the world

◊ Identifying and constructing economic typologies using exchange instruments.

◊ The 3 basic functions of the economy

a) Economic models and identification of the factors of the crisis

b) LDCs: which economic and social model to choose to fight poverty

c) Millennium Development Goals

(LCG 1E4-F) Jazz and Cinema

Objectives

*Discover the connection between jazz music and the cinema

*Listen, share music and improvisation

*Be part of an artistic undertaking and musical ensemble

*Develop, without criticism, spontaneity and self-confidence

Coursework

◊ The dual histories of jazz and cinema

◊ Play jazz: develop an ear, theory and practice

◊ Individual and group improvisation

◊ Relationship between images, music, and the imaginary

◊ Live composition, arrangement and interpretation with a short film

(LCG 1E5-F) Sustainable Development

Objectives

* To understand an know what's at stake on a global scale when we talk about sustainable development ; to be able to take a step back and look at the history of humanity and our place on the planet

* "Think globally but act locally"; for students to understand how this concept links us all together, to understand local, reoccurring and technological problems for the planet's habitants; for students to consider the relationship between humanity and the Biosphere and our place in it

* For students to choose solutions and new developments for a given situation; to critique these aforementioned solutions and developments to propose better solutions

* For students to understand the links between the various fields touching the economy, ecology (the five biological kingdoms) and sociology; to observe the current trends of thinking and the cultural evolution associated with sustainable development

* For students to be able to consider a new point of view ("doing more with less"); constructing a "sustainable" future

* For students to develop new habits; to give an overview of a variety of approaches

* For students to use current problems and limitations as opportunities for invention and innovation

* For students to put together a plan for the various players and fields of expertise for collaboration

Coursework

◊ The history of life and humanity, where are we now?
◊ The bad news: what's at stake, emergencies and priorities
◊ The good news: positive actions, solutions that exist
◊ Trends: systemic, biomimetism, collective intelligence, new scientific approaches
◊ Cultural evolution, cooperation, resistance to change

(LCG 1E6-F) Theatre and Expression

Objectives
*Learn how to use speech
*Work with and have consideration for exchanging, reflecting, and being open towards others
*Learn how to manage and utilize an audience
*Learn how to use space
Coursework
◊ Acting in situation / Work on use of space and movement
◊ Voice work / breathing techniques / emotions
◊ Theatrical improvisation with a given theme / games using imagined language and invented stories

(LCG 1E7-F) Europe in the 21st Century - *This course description is currently being written*

(LCG 1E8-F) Companies and Society

Objectives
* Understand how companies function and their processes; and the different types of companies
* Understand the liaison between the whole of a company and the individual players
Coursework
◊ Companies and definitions / structures and institutions
◊ Companies and their interactions / social relations and strategies / decision making / collective actions/ the freedoms for each player / the strategy of power / what's at stake for those involved
◊ Companies / social ties / strategic issues / values and norms

(LCG 1E9-F) Geopolitics

Objectives
* Introduce students to the main currents of geopolitical thought
* Identify, classify, and interpret information relating to a specific geopolitical context
* Assess the validity of a theoretical approach when applied to a real-world geopolitical situation
* Analyse and assess issues related to geopolitics
* Evolutions of geopolitical issues
Coursework
◊ Current geopolitical debates
◊ Factors affecting geopolitical analysis (geography etc.)
◊ Geopolitics of Tibet and Pakistan
◊ China's arrival on the international scene
◊ New threats to world peace

(LCG 1E10-F) Intercultural Awareness

Objectives
* To define culture and see how culture lives and it's layers
* To explore the parameters of culture (as defined by Hofstede) as well as explore one's own culture preferences
Coursework: at the end of this course students will be able to
◊ define culture (and its layers) and subculture

◊ define and explain stereotypes (and stereotype threat), bias, and prejudice
◊ remember the 6 dimensions of culture defined by Hofstede
◊ give examples of attitudes, behaviour and traits that show the 12 extremes from these 6 dimensions and the stereotypes associated with each; consequently explaining where cultural misunderstandings come from
◊ identify and analyse one's own "mental programming", behaviors, peferences, attitudes stemming from the 6 dimensions of culture
◊ thanks to a deeper understanding of their own cultural heritage, students will be able to more readily understand cultural discord

Questions or comments about this translation? contact leila.buchmann@esigelec.fr
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