



# **PRO - The engineering Profession - S5-S6-S7**



## CLIC - CENTRALE LYON INNOVATION CAMP

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Lecturers: Clotilde MINFRAY, Jean-Pierre CLOAREC

| Lecturers : 2 | TC : 2 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 28 | Language : FR

#### Objectives

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- Awareness of all first year student to creativity.
- Appropriation and deployment of a methodological tool of creativity (C-K method).

**Keywords :** Innovation challenge, work in group (x5), C-K method

#### Programme

Pedagogical process put in place to respond by team of 5 students to an innovation challenge proposed by an industrial partner of Ecole Centrale de Lyon.

- 2h tutorial: appropriation of C-K method
- 1h tutorial: how to do a good pitch?
- Autonomous work by student teams on 4 days

#### Learning outcomes

- Make ideas emerge.
- Dare.
- Realise and create value.
- Generate individual and collective performance.

#### Independent study

**Objectifs :** Make ideas emerge, present them and convince a jury.

**Méthodes :** The autonomous work is organized in several phases: appropriation of the subject, phase of exploration, phase of analysis and selection, phase of deepening, restitution.  
At the end of the work in autonomy, the students must submit three

#### Core texts

Lina Alami, *INNOVER ? INNOVEZ ! INNOVONS...* [HTTP://COMMENT-INNOVER.FR/](http://COMMENT-INNOVER.FR/), 2015  
Cabinet Stim *LES MÉTHODES D'INNOVATION À L'AIDE DE LA THÉORIE C-K.*, Licence Creative Commons, 2014

#### Assessment

Validation by competencies



## WEEX : HYDROGÈNE

### WEEX 1

Lecturers: Anne LAMIRAND, Jean-Pierre CLOAREC, Loris PACE

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

### Objectives

This course aims to increase the students awareness about energy resources and their management. The students form a team of engineers engaged to analyze the feasibility of an energy autonomous residential area with zero carbon emissions. The district is powered by solar panels and a long term hydrogen storage system. In order to achieve this goal, each team has to mobilize their technical knowledges and soft skills.

**Keywords :** Hydrogen production, Hydrogen storage, Fuel cell, Off-grid micro-grid, zero carbon emission residential area

### Programme

- Introduction to hydrogen systems for energy-autonomous residential area
- Study of PV technologies, electrolyzer and fuel cell
- Sizing of PV system, power electronics and hydrogen boiler
- Study of material properties for hydrogen storage
- Design of openings in the storage area to ensure security, selection of H2 and/or smoke sensors
- Technical and economic analysis of the PV + H2 system using HOMER Pro software
- Conference linked with the topic made by an external speaker

### Learning outcomes

- C5N3 : Clever use of the available resources
- C2I2 : Evaluate the relevance of the obtained results. Question the proposed method regarding relevant criteria and hypothesis.
- C3N3 : Valorize the obtained results through good writing and speaking abilities
- C4I2 : Generate performances individually and in his/her team. Positive interactions during team work. The student is involved in team work and promote cohesion in his/her team. C2I3 : Think and act in an unpredictable environment. Identify issues according to an unknown long-term context.

### Independent study

**Objectifs :** Propose a PV + H2 energy system for an energy-autonomous residential area

**Méthodes :** Team work  
Flipped classroom in most of the activities  
Deliverables regularly required

### Core texts

Dawood, F.; Shafiullah, G.; Anda, M., *STAND-ALONE MICROGRID WITH 100% RENEWABLE ENERGY: A CASE STUDY WITH HYBRID SOLAR PV-BATTERY-HYDROGEN*, Sustainability, 2020  
Evangelos Kalamaras, Meltiani Belekoukia, Zhengyu Lin, Bing Xu, Huizhi Wang, Jin Xuan *TECHNO-ECONOMIC ASSESSMENT OF A HYBRID OFF-GRID DC SYSTEM FOR COMBINED HEAT AND POWER GENERATION IN REMOTE ISLANDS*, Energy Procedia, 2019

### Assessment



## WEEX : EOLIEN

## WEEX : WIND POWER

Lecturers: Pierre DUQUESNE, Giacomo CASADEI, Jean-Pierre CLOAREC

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

### Objectives

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- Increasing the capacity to work as an engineer in function.
- Apply theoretical course knowledge in a concrete situation.
- Link the different knowledge of a multidisciplinary technological object.
- Increasing the capacity to work in an uncertain/unpredictable environment that evolves over time.
- Increasing the team work capacity.

Keywords : Wind turbines, energy, team work

### Programme

The activity is a role-playing game; "in the skin of an engineer."

Students, in groups, work in three engineering professions, linked to each other:

- Design/measurement engineer
- Project engineer.
- Operations engineer.

### Learning outcomes

- First Engineer Mission: Design/measurement Engineer From measurement database model a wind turbine and a map of winds.
- Second Engineer Mission: Project Engineer Propose a wind turbine farm implantation projects on a territory to optimise the electricity production and respecting the constraints (progressing over time).
- Third Engineer Mission: Operations Engineer Solve all problems of the wind farms under the team responsibility.

### Independent study

**Objectifs :** Most of the work is in autonomy to put students in the position of a working engineer.

Deliverables:

- Modelling reports.
- Presentation of modelling.

**Méthodes :** Team work in a limited time.  
Automatic correction (server)  
Presence required

### Core texts

### Assessment

Skills assessment:  
- oral presentation  
- group observation



## WEEX : MOBILITÉS

### WEEX : MOBILITY

Lecturers: Sylvie MIRA, Jean-Pierre CLOAREC, Olivier BAREILLE

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : MI

### Objectives

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The course aims to have students work on a current, complex and multi-skilled theme: urban mobility.

Students will have to propose smart and sustainable mobility solutions on a delimited geographical space, by deploying modeling tools on mobility databases.

The course aims to anchor the analysis of mobility problems in a specific socio-historical context.

**Keywords :** urban mobility, traffic modeling, data visualization, business model

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### Programme

Analysis of urban mobility data bases in foreign languages (German, English, Spanish, French (for foreign students))  
Problems identification  
Modeling and optimization of flows  
Data visualization  
Usage scenarios and business model

### Learning outcomes

- Know how to analyse mobility data bases in a foreign language and accordingly with the cultural and historical context
- Be able to propose use and economic scenarios
- Know how to model and optimize mobility flows
- Know how to use data visualisation tools

### Independent study

**Objectifs :** Present solutions to solve a mobility issue

**Méthodes :** Group work

### Core texts

### Assessment

Pitch the solution in the language of the concerned country (German, English, Spanish or French)  
Detail the solution in a bilingual report



## WEEX : DÉCHETS ET POLLUTION

### WEEX : WASTE AND POLLUTION

Lecturers: **Andrea MAFFIOLI, Frédéric DUBREUIL, Jean-Pierre CLOAREC**

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : MI

### Objectives

The WEEX DEPOL is a 5-day project to be conducted in teams of 7 students. Each team conducts an environmental investigation to determine the causes of a public health problem, using fluid mechanics, mathematics and environmental chemistry.

**Keywords :** pollution; waste; circular economy ; fluid mechanics; chemistry; materials;

### Programme

The concepts used are: transport of pollutants (see Fluid Mechanics course); modeling and numerical simulation (see Mathematics course); deposition and speciation of pollutants in the environment, toxicology concepts.

### Learning outcomes

- Dare: actively contribute to the smooth running of the working session in groups by a good balance between active listening and participation; take care of your language, adapt your communication to others; express yourself assertively: affirms your point of view while respecting differences of opinion.
- Knowing oneself, building oneself: analyze a situation based on the concepts of personal resources (strengths, values, motivations, etc.), emotional intelligence and self-esteem to be aware of your preferred modes of functioning and the diversity of behavioural profiles.

### Independent study

**Objectifs :** Work in teams of 7 people. Each team carries out its project in semi-supervised autonomy, with intermediate deliverables to be handed in as the work progresses.

**Méthodes :** Investigate as a team using field data to determine which pollutants are responsible for a public health problem. Mobilize notions of the "tronc commun" (e.g. FLE, MATH, INFO...). Each team is composed of students with complementary know-how, according to the courses followed before ECL, and

### Core texts

### Assessment



## EDUCATION PHYSIQUE ET SPORTS

### PHYSICAL EDUCATION AND SPORT

Lecturers: Simon CHALTON

| Lecturers : 0.0 | TC : 90 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : MI

#### Objectives

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The objectives of this training action are multiple. It is firstly a question of maintaining and developing one's physical abilities through individual or collective activities, competitive or not; to develop self-confidence and psychological development. The teaching of sport and physical education is part of the development of professional and disciplinary skills, such as teamwork, autonomy, responsibility, knowledge of oneself and others, surpassing, commitment and perseverance. Through original situations, this teaching calls upon all the student's resources : motor coordination, cognitive,

Keywords :

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#### Programme

There are 20 activities the student can choose from.

The student can embark on a course with a weekly lesson of 2 hours or in a competition group of up to 2 training sessions per week + university competitions.

In addition to weekly lessons, many optional associative activities are offered during which the student can develop a variety of skills.

#### Learning outcomes

- Mobilize your resources (motor coordination, affective, cognitive, relational) to be efficient.
- Engage in a sustainable project for their health and well-being.
- Use a collective project approach.
- Take responsibility within a group, a team, an association. Know yourself better in your relationship with others. Communicate, listen. Demonstrate innovation and creativity.

#### Independent study

**Objectifs :** The course is organized so as to put the student in various situations requiring a good degree of autonomy.

**Méthodes :** Workshop work / self-help or co-supervision situations / associative projects

#### Core texts

#### Assessment

Attendance 40% - Mobilization of its resources 20% - Individual and collective commitment 20% - Progress, self-knowledge 20%



## PROJET D'ÉTUDES

### STUDY PROJECT

Lecturers: **Thierry FARGERÉ**

| Lecturers : 6 | TC : 7 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 100 | Language : FR

### Objectives

In the 1st year, students are introduced to their future engineering profession by being entrusted with their first mission called a Study Project. In autonomous teams of 4-6 people, they choose a scientific or technical issue in the School's areas of expertise. They will then have to specify the targets of their mission, design the organization of their project (schedule, tasks to be carried out, division of responsibilities, deliverables to be provided) and manage the budget entrusted to them. Students are supervised by an educational team made up of a scientific tutor and 2 advisers (communication, project management). Partner companies and research laboratories can also get involved.

**Keywords :** Project, autonomy, team work

### Programme

The project takes place all year round on Wednesday afternoons (minimum 100h). Students also follow different tutorials: 2 hours on bibliographic research, 2 hours on report writing, 4 hours on project management, 10 hours on communication (meeting management, written and oral expression). During this mission, with the support of the teaching team, the students research and use bibliographic data, formulate hypotheses and propose solutions, experiment or model, build prototypes. They must manage the vagaries of their project and report regularly on their progress to their tutors. They manage their purchases and seek additional funds if necessary. Two steering meetings are organized by the students during the year to report on the progress of the project.

### Learning outcomes

- Facing a complex problem without a single solution
- Build and manage a team project (C3N1)
- Search for skills and information
- Put in place the means to carry out the project and achieve the defined objectives (C3N2)
- Obtain results without achieving the obligation of success, given the formative nature of the approach
- Master written and oral communication (C3N3)

### Independent study

**Objectifs :** Achieve project goals

**Méthodes :**

- Documentary research: use of the digital tools available at the library.
- Construction of models or prototypes: use of the FabLab
- Use of digital simulation software
- Programming

### Core texts

### Assessment

• Final mark : 50% (work), 25% (final report), 25% (oral presentation)





## **OUVERTURE AUX ENJEUX DE LA TRANSITION ÉCOLOGIQUE**

## **OUVERTURE AUX ENJEUX DE LA TRANSITION ÉCOLOGIQUE**

**Lecturers:** Cécile LACOIN, Christian VOLLAIRE

| Lecturers : 10 | TC : 6 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

### **Objectives**

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Keywords :

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### **Programme**

### **Learning outcomes**

### **Independent study**

Objectifs :

Méthodes :

### **Core texts**

### **Assessment**



## CONFÉRENCES UE PRO

### CONFÉRENCES

Lecturers: Vincent CLAIR

| Lecturers : 0.0 | TC : 9 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

### Objectives

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Conferences presented by invited guests, experts in their domain. They address a wide range of topics.

**Keywords :** General knowledge, Industry, Social matter, Research, Engineering activities, activity field, Tools for engineering

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### Programme

#### Learning outcomes

- Develop an open mind.
- Know where to find informations for your professional project

#### Independent study

**Objectifs :** Empower engineering students for the elaboration of their professional project through the choice of conferences they attend.

**Méthodes :** Participation to the conferences.  
Attending external conferences and write a short report (1 maximum per semester)

#### Core texts

#### Assessment

Validation of the activity by the attendance to conferences (or through the report for an external conference, with 1 external conference maximum per semester).



## ACCOMPAGNEMENT AU PROJET PROFESSIONNEL

### CAREER PLAN - TUTORING

Lecturers: Catherine MUSY, Philippe THIMONIER

| Lecturers : 0.0 | TC : 5 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

#### Objectives

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The construction of his own professional project is one of the major objectives that each student-engineer must achieve during their time at the Ecole Centrale de Lyon. The main objective of this activity is to allow the student to reflect on himself to advance in the construction of his short-term engineer training project and his longer-term professional career project. The accompanying activity to the professional project must allow each student, at their own pace, to conduct their personal reflection on his professional project, even their life plan. The professional project of each student is obviously bound to evolve and deepen during the course of schooling, and well beyond.

**Keywords :** Professional career project

#### Programme

In order to support the student in their reflection and in the construction of their professional project, a PCP (Principal Adviser) tutor is awarded to each student at the beginning of the course. This PCP tutor will follow them throughout their schooling, at least through 6 Bilateral Meetings (BM) scheduled during the common core. On the occasion of these BM, discussions will take place between the student and the PCP tutor on the progress of the reflection on the professional project and appraisal will be made at certain key moments of the curriculum. On these occasions, the PCP tutor will also be able to discuss with the student their integration into the life of the campus and their university results.

#### Learning outcomes

- To set up strategies to build their professional project.
- To argue their choices.
- To conduct their self-assessment.

#### Independent study

**Objectifs :** To build their professional project.  
To learn to self assess their professional skills.

**Méthodes :** Professional skills sheet.  
CV and Progress report.

#### Core texts

#### Assessment

Final mark = 100% Know-how  
Know-how mark = 100% continuous assessment



## PROJET APPLICATION - INDUSTRIEL

### PROJECT FOR INDUSTRIAL APPLICATION

Lecturers: David LENOIR

| Lecturers : 0.0 | TC : 50 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

#### Objectives

The Industrial Application Project (PAi) is aimed at students who wish to confront the reality of engineering work in all its operational complexity. They will have to respond to the request of a sponsor outside the school (large groups, SMEs/SMLs, public operators, start-ups, etc.) by offering them a project-process characterized around the cost/quality/deadlines triptych. Once the definition of this project has been validated, they will ensure its management and execution based on efficient reporting in order to adapt the proposed process to the difficulties encountered.

It is therefore a truly professional experience that is offered to students by the PAi, with a great diversity in the

**Keywords :** Work in project mode.

#### Programme

The PAi takes place in S7 and continues in S8 for a total of 75 hours. Supervised by a project adviser, the students will begin with an immersion and listening phase in order to fully understand the problem submitted to them and especially its context. They will then be able to propose and validate with their sponsor their Project Management Referential (PMR) for the end of November. The project execution and management phase will then begin, with a first meeting at the end of January which will give rise to an evaluation for the S7, then a final presentation at the end of S8 which will conclude the project.

#### Learning outcomes

- Understand a problem and its context.
- Structure and design a project.
- Lead and manage a project.
- Restitute and promote a project.

#### Independent study

**Objectifs :** Manage and lead a project,  
Restitute and promote a project.

**Méthodes :** Capitalization of the tools and methods presented and implemented within the framework of the PE, in terms of project management and written and oral expression.

#### Core texts

#### Assessment

Rating = 100% know-how



## PROJET APPLICATION - RECHERCHE

### RESEARCH PROJECT

Lecturers: Cécile NOUGUIER

| Lecturers : 0.0 | TC : 50 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

#### Objectives

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Research projects (PAr) are intended for students who wish to acquire a first research experience or for those who are simply curious to discover the research. In a research laboratory of the Ecole Centrale de Lyon, all of them internationally renowned, students are initiated, alone or in pairs, in the research activity. Most often integrated into a research group and sometimes into an existing project, students have the opportunity to meet the various research stakeholders, to discover the many facets of the profession of researcher and the context of academic research in France. They may also be offered the opportunity to participate in the life of the research laboratory hosting them (seminars or other events).

**Keywords :** Research, project work

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#### Programme

The project takes place in S7 and continues in S8 for a total of 75 hours. Supervised by a scientific tutor and accompanied by a project management adviser, students search for and exploit bibliographic data, formulate hypotheses, experiment, simulate or model, face often unexpected results, interpret results, emit, validate or refute hypotheses, propose new ideas to explore... Two project reviews are organized by the students in S7 to report on the progress of the project.

#### Learning outcomes

- Structuring and managing a project.
- Implementing a research approach.
- Searching and citing bibliographic references.
- Writing a report or a scientific paper and making an oral presentation.

#### Independent study

**Objectifs :** Manage a project.  
Carry out a research work.

**Méthodes :** Bibliographic search: after formation, using of online bibliographic databases.  
Project management using appropriate methods and tools, under the supervision of a project management adviser.

#### Core texts

#### Assessment

Mark =100% know-how.



## ENQUÊTE DÉCOUVERTE

### DISCOVERING ENGINEERING

Lecturers: **Grégory VIAL**

| Lecturers : 0.0 | TC : 4.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : MI

#### Objectives

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The objective of this training is to discover various aspects of the engineer's job. Every student is invited to contact two engineers of his choice (one of them being centralien) and to meet them to talk about their career. Analyzing the different interviews will allow the student to build his own professional project. This training focuses on SD&CSR issues in companies as well.

**Keywords :** Engineer, career, professional project

#### Programme

Interviews of two engineers having different careers. Oral presentation by group of 6 students, in presence of a professor and an engineer

#### Learning outcomes

- Prepare and lead an interview
- Understand the realities of being an engineer
- Give a written and an oral report
- Build his own professional project

#### Independent study

**Objectifs :** Establish an individualized relationship with at least two active engineers, if possible from "Ecole Centrale de Lyon", with different profiles.

**Méthodes :** Preparation of the meetings (contact, questionnaire, ...). Report and preparation of the restitution (quick presentation of the survey framework, analysis of the information received and conclusions for the construction of the professional project)

#### Core texts

#### Assessment

Final mark = 100% Know-how  
Know-how mark = 100% continuous assessment



## **VISITES D'ENTREPRISE**

### **COMPANY VISITS**

**Lecturers:** ELISABETH COUZINEAU-ZEGWAARD, Delphine LAVERRIERE

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

### **Objectives**

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Keywords :

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#### **Programme**

#### **Learning outcomes**

#### **Independent study**

**Objectifs :** This activity is not concerned with framed autonomy activities outside personal work.

**Méthodes :** This activity is not concerned with framed autonomy activities outside personal work.

#### **Core texts**

#### **Assessment**