Catalogue of Credit courses

- Engineering Degree
- Master of Science, Technologies & Health
Catalogue of Credit courses

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Content

1. Introduction .......................................................................................................................... 5
2. Who's who at the International Center? ........................................................................... 6
3. Advice for international students, ECTS and UTT grading system .............................. 7
4. Credit Courses taught in English ..................................................................................... 10
5. Description of all Credit courses ..................................................................................... 11

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1. Introduction

The “Université de technologie de Troyes” (UTT) is a public institution awarding degrees and diplomas that depend directly on the French Ministry of Higher Education and Research. It occupies an original place within the French educational system as it combines all the assets of the engineering "Grandes Ecoles" and those of universities. It carries out simultaneously and coherently three missions: education, research and transfer of technology.

The UTT maintains close links with the industrial world both at national and international levels and it is reputed for its ability to innovate, adapt and provide an education that matches the ever changing demands of industry. Research also plays an important role in the development of the university as it provides a solid foundation for its technology-oriented educational mission. The UTT has set up its own doctoral school which has the authorization to award Ph.Ds.

Since its creation in 1994, UTT’s growth has been outstanding. Student enrolment has increased from 150 in 1994 to over 2,500 in 2010. The university’s main building reveals an outstanding architecture, with a futuristic elliptic-shaped facility that includes first rate equipment. The Campus is located next to a sports complex, at the heart of the "Technopole de l'Aube en Champagne", less than five kilometers from the city center.

The UTT is part of a network which includes two other Universities of Technology: the Université de technologie de Compiègne (UTC) and the Université de Technologie de Belfort-Montbéliard (UTBM). The network represents more than 9,000 students and more than 700 professors scattered throughout the 3 campuses. The Universities of Technology offer 14 engineering Majors and more than 20 post-graduate degrees (at Master's level) including some that lead to Ph.D. studies.
2. **Who's who at the International Center?**

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3. **Advice for international students, ECTS and UTT grading system**

Exchange students are welcome to the UTT for a period of study (up to 1 academic year). Before the start of the regular semester, we strongly recommend that students enrol in the intersemester program for the Intensive French Language course.

The UTT curriculum offers a high level of flexibility as they are based on a cumulative credit system divided into semesters. There is a wide range of credit courses from which students can choose. The annual workload for a UTT student is 60 ECTS.

Upon arrival, each student is assigned to an academic advisor (Faculty member) whose role is to provide advice throughout the student’s period of studies at the UTT.

Visiting students can select courses from both Common Core and/or Major studies (including the specializations) under the conditions that the courses are available for the given semester and compatible with the university’s timetable. They can choose credit courses across Majors.

The students’ final selection must be approved by both their home institution and the UTT. Although most of the teaching is conducted in French some of the courses are taught in English.

The 4-week intensive French language course and the credit courses offered in English have been created to facilitate the students’ cultural, social and academic adaptation to the UTT and France.

The intensive French language course which takes place before the start of each semester is completed by weekly sessions (from 4 to 8 hours) throughout the semester. For students with a good language level, these courses will enable them to study in French while for others, they will provide them with the necessary skills to function at ease within French society.

The courses taught in English allow for a gradual integration into the UTT academic system by making it possible for students whose knowledge of French is limited to follow their courses and enjoy their stay in France.

A suitable scheme for such students is to follow the January-February intersemester program in which they can validate an intensive French language course (4 ECTS) and “Project Management” (6 ECTS). Upon completion, they can move on to the Spring semester where they can validate an additional 4 courses (around 20 ECTS) to reach a total of about 30 ECTS, which represent the usual workload of any European student for a semester. This way, international students can benefit from the intersemester period to validate courses (10 ECTS) and they have the possibility to carry a lighter workload during the Spring semester (20 ECTS instead of 30).

The UTT offers a certain number of credit courses (called “TX”) that require practical knowledge and project work. Students who select these courses work in small groups in close contact with a member of the teaching staff. A list of these topics for these courses is published before each semester and students can easily register for them.
Also, there is a possibility for visiting students to undertake a practical internship in one of the university’s laboratories or in a company. For students who intend to do a work placement outside the university in a company, their internship must be preceded by a semester of studies at the UTT.

The various possibilities presented above have been created to help visiting students to find the "right combination" as to satisfy to their home institution's requirements and to have a very enriching experience in France.

Application Forms must be returned to us at the latest by the 15th of Avril for the Autumn semester and the 15th of October for the Spring semester.
The European Credit Transfer System (ECTS)

Since 1990, with the introduction of the ERASMUS and later the SOCRATES programs, the European Union has set up the ECTS scheme (European Credit Transfer System) to enable students to validate their periods of study abroad. The ECTS is a system of academic recognition of learning achievements and transfer of credits throughout the EU, providing a way of measuring and comparing academic results and transferring them from one institution to another.

The ECTS system is based on 3 main principles: **information** (on courses available and students’ results); **agreement** (between the participating institutions and the students), and the use of **Credit Points**.

These three core elements are implemented by means of three key documents:

- the information package
- the application form/learning agreement
- the transcript of records

ECTS credits are a value allocated to course units to describe the student workload required. They reflect the quantity of work each course requires in relation to the total quantity of work required to complete a full year of academic study at the institution. Thus, 60 credits represent the workload of a year of study (30 credits = one semester). It is up to the individual participating institution to subdivide the credits for the different courses over the year.

The ECTS system is based on the principle of mutual trust and confidence between the participating institutions. The code of practice offered by the ECTS ensures that all members adhere to the agreed guidelines and facilitates academic recognition of studies abroad.

**ECTS grading scale**

The ECTS grade is complementary to but does not replace the mark given by the institution concerned.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Excellent</td>
<td>(10% of students)</td>
</tr>
<tr>
<td>B</td>
<td>Very Good</td>
<td>(25%)</td>
</tr>
<tr>
<td>C</td>
<td>Good</td>
<td>(30%)</td>
</tr>
<tr>
<td>D</td>
<td>Satisfactory</td>
<td>(25%)</td>
</tr>
<tr>
<td>E</td>
<td>Pass</td>
<td>(10%)</td>
</tr>
<tr>
<td>F</td>
<td>Fail/FX</td>
<td></td>
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</table>
**The UTT grading system**

The UTT has adopted the European Transfer Credit System (ECTS) and its grading scale.

Each credit course is worth 4 or 6 ECTS.

At the UTT, there is no “catch up” or second examination session in any given semester.

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4. **Credit Courses taught in English**

While some courses are taught exclusively and entirely in English, others combine both French and English. This depends largely on the number of international students enrolling in each course.

In such cases, lectures are given in French (2 hours per week) and tutorials/seminars (2 hours per week) are held in English depending on the number of students enrolled in English.

If the number of students is too small (2 or 3 students), help in English is provided by the teacher.

This method allows students to receive information in both languages and to improve their French language skills while receiving some instruction in English. An English bibliography is provided and examinations can be written in English.

The theory behind this method is that while foreign students may require instruction in English they should not be isolated from French students, and that the UTT should offer students every opportunity to develop their language abilities (technical, scientific...) and to optimize their experience in France.

![Flags](image)  
This icon means that the course will be part in French and part in English

![Flag](image)  
This icon means the course is completely in English
5. **Description of all Credit courses**

One credit course at the UTT is worth **4 or 6 ECTS (European Credit Transfer System)**.

Each credit course described hereinafter has:

- a name and an identity code
- number of ECTS credits
- objectives and a description
- the semester in which it is taught (autumn and/or spring)
- number of hours of work required in the semester:

<table>
<thead>
<tr>
<th>L</th>
<th>SW</th>
<th>PS</th>
<th>PW</th>
</tr>
</thead>
</table>
  | lectures | supervised work | practical sessions | personal work.

*COURSES ARE LINED UP IN ALPHABETICAL ORDER BY CODE*
<table>
<thead>
<tr>
<th>Code</th>
<th>Credit Course</th>
<th>Autumn</th>
<th>Spring</th>
<th>Category</th>
<th>Level</th>
<th>ECTS credits</th>
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<td><strong>Arts and technology</strong></td>
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<td></td>
<td></td>
<td></td>
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<td>CT</td>
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<td></td>
<td>4</td>
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<tr>
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<td>CT</td>
<td></td>
<td></td>
<td>4</td>
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<td>6</td>
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<td>TM</td>
<td>Yr 4/5</td>
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<td>TM</td>
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<td>TM</td>
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<td>X</td>
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<td>Yr 3/4</td>
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<td>X</td>
<td>CS</td>
<td>Yr 3/4/5</td>
<td>6</td>
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<td>SY16</td>
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**Technology and safety**

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**Individual work (TPE)**

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**Practical and project work**

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</table>
Personal choice study

**AC**

**PW** 140hrs

**Objective:**
- This credit course allows students to acquire further knowledge of a subject they may choose and/or one which is suggested by a research lecturer.

**Programme:**
- The in-depth work involved must follow on logically from one or more basic core courses already available in the catalogue and judged of a suitable level. On the whole it must be relevant to the students' curriculum and chosen career profile.
- Before contacting the committee, the student must apply for the approval of the head of the basic course and/or the head of the Department concerned, the latter will advise as to its compatibility with the overall degree course.
- This credit will be judged on three elements: a detailed written report, an oral presentation and the accompanying material.

**AUTUMN-SPRING**

Painting, writing or drawing

**AP01**

**SW** 51hrs

**PW** 60hrs

**Objective:**
- To develop an artistic approach about art and writing with techniques and concepts related to visual art for an exhibition purpose.

**Programme:**
- To study the importance of writing the ancient civilizations art as well as modern and contemporary art
- To develop a sketches book about a chosen theme using various techniques and materials
- To develop new drawing, printing and 3D pieces techniques as well as new concepts such as the line, the form and the colors in order to enlarge the personal research.

**Prerequisite:**
To have already studied art within an identified structure.

**Group restricted to 16 max**

Artistic creation

**AP02**

**SW** 51hrs

**PW** 60hrs

**Objective:**
- To find, manipulate, and produce artworks from objects.

**Programme:**
- The object in the art of the 20th Century (Ready-made, Surrealism and New Realists).
- The curio cabinets of the 18th Century and the fascination for collection.
- The curio as a source of invention and means of appropriation: sketch and graphic research.
- Creation of an artistic work around a 3-dimensional object.
- A public exhibition of individual projects in the form of a curio cabinet.

**SPRING**
AP03

Art and technology

Objective:
• To express one's imagination in a series of images thanks to modern technology and processing of photography by computer graphics.

Programme:
• Panorama of image processing since the appearance of new technologies.
• Problems of joining, painted works of Arcimboldo during the Renaissance to the virtual images of contemporary artists and graphic designers, while passing by the Surrealist and Dadaists.
• Research and development of images in the form of portfolio.
• Creation of a virtual gallery.

Prerequisite:
To have already studied art within an identified structure.

Group restricted to 16 max

4 ECTS credits

AUTUMN-SPRING

APP10

Professionalization project management

Objective:
• To define his/her professionalization project
• To develop knowledge on French industrial fabric
• To stand knowledge developed during the training against industrial needs

Programme:
• Participation to 15 Industrials Lectures "Company's Thursdays".
• Participation to at least one interview with one UTT's partner company (Interviews simulation days, meetings days UTT/PME, individual interviews of "Company's Thursday's", etc...)
• Participation to UTT/Company's forum
• Realization of a summary memo on one of the industrials lectures' subject.

4 ECTS credits

AUTUMN-SPRING

AT01

Theatre

Objective:
• To develop communication skills, both verbal and body language, through group work.

Programme:
• Development of oral skills (work of the voice).
• Introduction of the work of top contemporary playwrights.
• Free and guided improvisation skills.
• Body movement and choreography in relation to the spoken word.
• Text interpretation.
• Creation of playing spaces and imaginary worlds based on themes and studied works.
• Performances, participation in festivals.

4 ECTS credits

SPRING

Back to list
Multi-media production

Objective:
• To carry out an audio-visual or multi-media product with an aim or with clearly defined functions.

Programme:
• The project can be a video, a combination (video, audio, slide...) or a multi-media product (Cd-Rom, Web site...).
• The evaluation will take into account the technical qualities, the choices made for its implementation, and the adequacy of the result in light of the objectives laid down at the start.
• The course will be evaluated on the basis of three operations: an audio-visual or multi-media creation, a presentation of the implementation of the project, and an oral presentation of the project.

Computing and Internet certificate – Level 1

Context/Framework:
Expertise in the Internet and IT tools involves essential skills, including: the ability to protect a personal digital environment and control a personal online reputation, the ability to use an office software suite and conduct information searches.

Objectives:
• working in a changing digital environment
• responsibility in the digital era
• production, processing, use and distribution of digital documents
• organization of information searches in the digital era
• networking, communication and collaboration

Matter structure and process

Context/Framework:
Many everyday processes and objects (materials, respiration, medicines, plant health products, cosmetics, etc.) can be understood through a knowledge of the structure and the reactivity of the material concerned

Objectives:
• understanding and acquisition of basic chemical knowledge, concepts and models
• ability to describe a chemical system
• ability to anticipate the reactivity of a chemical system
• selection and deployment of relevant methods for chemical analysis and characterization
• observation of health and safety rules in the laboratory
CHMA02  Chemistry of industrial processes

6 ECTS credits

Context/Framework:
This course involves the investigation and scientific appraisal of key industrial processes (metallurgy, petrochemistry, catalysis, etc.) which are essential to the production of high added-value materials.

Objectives:
- ability to construct and use a binary diagram (L/V, L/S)
- ability to make the link between theoretical models and practical industrial applications (distillation, crystallization, etc.)
- ability to construct and use an Ellingham diagram
- anticipation of conditions for the purification of an ore to obtain pure metal (corrosion temperature and pressure)
- investigating the production of iron and steels
- ability to analyse the kinetics of a complex mechanism
- understanding and modelling of catalysis processes (homogeneous, heterogeneous and enzymatic)
- introduction to the concept of agri-resources

AUTUMN

Back to list

CHMA03  Structure and properties of solids

6 ECTS credits

Context/Framework:
Thanks to their reduction potential and their mechanical properties, metallic materials are used in energy storage, vehicle structures, pipe systems, etc. Their corrosion resistance must be considered through the analysis of their crystallographic structures.

Programme:
- ability to anticipate the corrosion/protective of a metal in an oxygenated aqueous environment
- ability to measure and calculate rates of corrosion
- ability for the deployment of anti-corrosion strategies
- familiarity with various electrical energy storage devices
- training in the synthesis, processing and analysis of common polymers
- ability to describe metals, metal oxides and hydroxides by crystallographic methods
- ability to analysis a simple X-ray diffraction spectrum

SPRING

Back to list

CHMA04  Chemical analysis, safety and environment

6 ECTS credits

Objectives:
- To master the scientific basics related to safety and environment
- To understand the different chemical and physicochemical analysis techniques, how to implement them for simple cases

Back to list
Level: Yr 2

Programme:
- Physico-chemical aspects of safety (example of dissolved gaz)
- Reactivity of heavy metals
- Chemical analysis (spectroscopies, physical methods, chemical methods)
- Applications to oxygen in aquatic environment
- Pollutant chemical effects on environment
- Pollutant physical effects (including greenhouse effect)

SPRING

CL01

International trade and logistics

6 ECTS credits

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Context/Framework:
Key concepts for the execution of an export or import project, incorporating logistical issues.

Objectives:
- awareness of global players in international trade
- ability to apply basic customs rules
- planning and organization of international logistics flows and management of transport operations (maritime, air and road transport)
- budgeting, financing and execution of logistics operations in international trade

Level: Year 4/5

AUTUMN

CL02

Packaging, materials handling and warehousing

6 ECTS credits

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Context/Framework:
Warehouse organization and administration is required to permit the optimum management of the internal flow of goods, in accordance with incoming and outgoing flows of goods.

Objectives:
- ability for the organization of reception operations
- identification of different types of configuration and determination of the most appropriate
- proposal of appropriate types of handling facilities
- ability for the dimensioning and deployment of an operational management mode for handling facilities
- deployment of techniques for the packaging and conditioning of goods: palletization, siting issues
- application of principles for the preparation of dispatch operations

Level: Year 4/5

AUTUMN
CL03  Logistics of transportation and distribution

Context/Framework:
This course addresses the key issues facing carriers and other logistics service providers (warehouse managers, packers, etc.).

Objectives:
- ability to analyze a logistics network
- awareness of key issues of network design (siting of plants and warehouses)
- modelling and calculation of the shortest routes and flows of goods in a transport network
- awareness of key issues involving the circulation of vehicles and fleet management
- ability to apply an optimization software for transport issues

Level: Year 4/5

CL04  Design and management of supply chain
Customer-supplier coordination

Objective:
To understand the models, concepts, and methods, to design, control, exploit and manage supply chains.

Programme:
- Configuration of supply networks.
- Inventory management in integrated supply chains.
- Planning of supply chains.
- Sharing of information, partnerships and strategic alliances.
- Coordinated product and supply chain design.
- International issues in supply chain management.
- Information systems and software for the management of supply chains.

Level: Year 4/5

CL07  Integrated logistics support and customer services

Context/Framework:
The logistical support of a complex system allows the latter to be maintained in an overall operational condition. Its integration at the design stage permits the effective management of the overall cost of ownership and operational availability.

Objectives:
- understanding methods for the analysis and design of complex systems
- modelling and evaluation of the performance of a complex system
- modelling and optimization of a logistical maintenance network
- dimensioning of stocks of spare parts
- analysis and calculation of overall cost of ownership

Level: Year 4/5

Back to list
CS01  Value analysis and functional analysis

**Context/Framework**
Dictates for product design at optimum cost, while delivering a high-quality service, involve the measurement and management of product values.

**Objectives:**
- management of the 7 stages of value analysis
- specific management of functional modelling methods
- application of value analysis for the (re)design of products or industrial processes

**Level:** Year 3/4

**Autumn-Spring**

CS02  Complex mechanical systems design

**Objective:**
To present an integrated view of various technologies that could be implemented for the construction of a complex mechanical system.

**Programme:**
- Integration of mechanisms and mechatronics systems.
- Integration of new technological solutions (mechanical, optical, computer-aided).
- Group projects for the design of complex mechanical systems.
- Case study.

**Level:** Year 4/5

**Autumn**

CS03  Project management

**Objective:**
To understand the basics necessary to organize and successfully lead a project.

**Programme:**
- Types of projects and their management.
- Organization of a project group and management of the project.
- Tools of project management (PERT method, Gantt chart...).
- Collaborative tools for project management.
- Estimation and control of costs, risk management.
- Industrial reports.
- Real case study, use of standard software (MS Project).

**Level:** Year 3/4

**Autumn**

**Back to list**
CS05

Flow and economics of materials

Objective:
- To understand the flow of materials: from the extraction of minerals, to the eventual recycling of the materials. To obtain a global view of each family of materials, and to follow the composition of expenses at each stage of the material flow.

Programme:
- Flow of material and economic aspect of the use and choice of materials, (metals, polymers, ceramics, building materials...).
- To understand new technologies, technological solutions and their use.
- Analysis of the different methods of performance improvement, and environmental problems.

Level: Year 4/5

6 ECTS credits

Spring

Back to list

CS21

Complex systems design

Objective:
- To present a view of the collaborative design of complex systems

Programme:
- Design and sizing of complex systems
- Collaborative design in an engineering consulting firm context
- Integration of environmental constraint in design
- Studies of the data transmission of classical and hybrids power

Level: Year 4/5

6 ECTS credits

Spring

Back to list

CS22

Complex systems industrialization

Objective:
- Be able to realize the study of the industrialization of a mechanical system considering the environmental impacts

Programme:
- Manufacturing process choices
- Range of manufacturing
- Substance Flow Analysis/ Material Flow analysis
- Criteria evaluation and technical feasibility evaluation (process) of costs and environmental impacts
- Overview through a project
- End of project deliverables: documents relating to Range/process/flows/SFA/MFA/environmental impacts CAD updated according to the previous choices/ performances evaluation (return, costs, environmental impacts and risks)

Level: Year 4/5

6 ECTS credits

Autumn

Back to list
**CTC1**

**Cinema, technology and creation**  
(Making of a film from the script written by students of LI03)  
6 ECTS credits

**Objective:**
- To be able to integrate different types of constraints (technical, artistic, organizational) into the making of a film
- Being self-confident, to control the audiovisual language et self-expression in front of the camera

**Programme:**
- Setting up a complete team, sharing out everyone's functions: acting, choice of the scene, authorization request, shooting schedule, team management, script, production, lighting, etc....
- Making of an original creation (short film), with the help of a professional

**Spring**

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**DI02**

**Methods for diagnosis of industrial systems**  
6 ECTS credits

**Context/Framework:**
Operational security involves the deployment of fault detection tools which alert the user, before the fault concerned deteriorates into a failure. Methods for the detection of faults are presented in this course.

**Objectives:**
- data validation
- deployment of monitoring systems for the automatic identification of a given mode of operation, based upon knowledge of diagnostic methods
- management of methods for the detection of potential faults
- identification of the source of a fault

**Spring**

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**DS01**

**Design and the human senses**  
6 ECTS credits

**Objectives:**
- To familiarize students with concepts related to design.
- To define the scientific indicators related to the perceptions detected by our senses.

**Programme:**
- Design in the field of habitat and the design of furniture and industrial objects, the history of design, design management.
- Constraints related to aesthetics, the materials used (compatibility) and the costs, impact of materials in the design of products.
- Sensory analysis, intelligent sensors, examples of material choice of recovering (changing the look) and of surface treatments.
- Development of specifications for a designed object, leading to its eventual creation.

**Autumn**

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EA01

Automation and control

Objective:
- To be able to control the concepts and the tools of automation, regulation and control.

Programme:
- Modeling of sequential automation (sequential function chart...).
- Technology of automated systems (sequencer, programmable automate...).
- Modeling of physical systems.
- Laplace transformations.
- Control, diagram block.
- Transfer functions, Bode diagrams, Nyquist, Black
- Correction of linked systems.

Level: Year 3

SPRING

Back to list

EA03

Electric drives and actuators

Context/Framework:
The aim is to know, to understand and to be able to implement the different types of electromagnetic or piezo-electric actuators that are used, for instance, to design robots or automated manufacturing systems.

Objectives:
- To know the physical principles on which electromagnetic actuators are based
- To know the electromagnetic, thermal and mechanical phenomena that occur in these actuators
- To be able to use the technical documents of the providers to calculate the evolution of mechanical, electrical and thermal quantities versus time
- To be able to write the specifications to implement an actuator and its power supply or control module
- To know the simplified models of actuators and to be able to identify their parameters from technical documents or from experimental measurements
- To be able to propose operation modes that do not necessarily correspond to the standard mode proposed by the provider

AUTUMN

Back to list

EA04

Sensors, measurement and digital control

Context/Framework:
Sensors are present in the majority of technological tools (for the measurement of physical, chemical or biochemical variables) and are necessary for the control of a system, specifically mechanical control, by means of signal conditioning and interfacing.

Prerequisite: EA01

Objectives:
- knowledge of metrology (measurement of physical variables) in industrial systems: standard measures, uncertainties, statistical modelling
- conditioning and acquisition of a signal for digital processing
- digital control of a mechanical system (using an Arduino controller)
- ability for sensor interfacing using LabVIEW
- through seminars conducted by industrial operators, understanding of technical issues and applications for categories of sensors
- ability to select and dimension a sensor for a given application

Level: Year 4/5

SPRING

Back to list
EC01

Eco-design

Objective:
• To introduce the principles, methods and tools of eco-design.

Programme:
• Design methodologies and products environmental stakes, eco-design principles.
• Organization, monitoring and roll-out of eco-design approach.
• Eco-design methods and tools.
• Implementation of a product orientated management system.
• Application of European law regarding products.
• Eco-innovative design methodology.
• Design strategies around the 5R (Refuse/Reduce/Reuse/Reform/Recycle).

Level: M2

6 ECTS credits

Autumn

Back to list

EE06

Organizations in international and European contexts

Objective:
• To understand the new rules, risks of international trade, and the role of Europe.

Programme:
• Historical background of the globalization of the economy.
• Business enterprises opposite to the World Trade Organization.
• Role of the European Union.

Spring

Back to list

EG01

Workstation ergonomics

Objective:
• To implement ergonomics within the stages of design or of correction in a company, and to study the ergonomic tools that can be used to solve problems.

Programme:
• To work on various examples within commercial environments: stages of correction or general design.
• Principles of ergonomics.
• Medical work data and the table of occupational diseases.
• Postural and cognitive loads.
• Means of protection.
• Age related factors in the workplace.

Level: Year 4/5

6 ECTS credits

Autumn

Back to list
EG23

Human-Machine Interaction and ergonomics

6 ECTS credits

Context/Framework:
By definition, software development must take account of ergonomic constraints. The analysis of Human-Machine Interfaces (HMI) is essential to the future success of any software.

Objectives:
- design and realization of human-machine interfaces
- production of models and software prototypes in the context of human-machine interfaces
- development and management in an environment specialized to software interface development
- use of ergonomics rules for software

Prerequisites:
NF04, NF05, LO01 or LO02

Level: Year 3/4

SPRING

EI01

Industrial ecology

6 ECTS credits

Objective:
- To present the stakes, the principles, the methods, the industrial ecology tools as well as the environment territorial management principles.

Programme:
- General introduction and historic approach to industrial ecology.
- Principles of eco-reorganization of the industrial society.
- Principles of implementation of industrial ecology: approaches typologies, methodologies, tools, etc.
- Feedbacks on industrial ecology approaches in France and internationally.
- Institutions operations.
- Territorial planning mechanisms and national planning and development
- Networks leadership and principles of environment national planning.

Level: M2

AUTUMN

EN01

Analog electronic circuits

6 ECTS credits

Context/Framework:
In engineering, electronic circuit boards employ basic components from analogue electronics. The combination of these components permits the execution of various functions, including amplification, filtering, comparison and rectification.

Objectives:
• understanding the functions and properties of various basic analogue components
• introduction to the execution of linear circuit calculations, using various laws and theorems
• execution of linear and non-linear functions, including amplification, branch connection, filtering and comparison, by the combination of components
• design of multi-stage electronic circuits for the conversion of measured noisy signals into useable signals

Level: Year 2

EN03

Digital electronics

6 ECTS credits

L 24hrs
SW 30hrs
PS 36hrs
PW 60hrs

Context/Framework:
This course provides an understanding of the functions of electronic systems, both analogue and digital, together with the problems associated with the practical realization of these systems.

Objectives:
• Ability to construct the following:
  o a low-voltage direct-current power supply, powered by mains voltage
  o an amplification and filtering circuit
  o a digital solution incorporating elementary logic functions in a FPGA
• Ability to program a microcontroller using assembly language

Level: Year 2

EP01

Company ethics and performance

4 ECTS credits

L 34hrs
SW 17hrs
PW 34hrs

Objective:
• To give practical training to principles and techniques of company social liability.

Programme:
• Ethics, morals and liability.
• Stakes and methods of liable company management.
• Participants and strategies of company social liability.
• Means of action (quality, pollution, corruption, social management, subcontracting).
• Tools, audit and reporting; ratings, certification, standards and accreditation.
• Business ethics, social management, sustainable finance, fair trade.

ER

Documentary research and surveys

4 ECTS credits

PW 140hrs

Objective:
• To introduce the students to a method for, and give them experience in,
documentary research.  

Programme:  
- The course will be based on a subject of general culture corresponding to a topic of interest to one of the research lecturers.  
- Students will have to follow customized face-to-face or online training on information search and processing, along guidelines that will be provided to them.  
- Students will be assessed through a written report and an oral presentation.

### EV00  
**Environmental foresight and philosophy**  
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**Context/Framework:**  
The inquiry into contemporary ecological challenges requires to reflect jointly on nature, technology and the future, and the think about global environmental change from the point of view of the humanities, including history and philosophy.

**Objectives:**  
- Describe the challenges of sustainability regarding materiality and ideas (e.g. ethics, politics)  
- Understand the relationship between Western knowledge, culture, and the idea of the future  
- Identify the key issues of global environmental change (climate change, biodiversity loss, etc.)  
- Discuss their potential consequences, both tangible (biophysical) and intangible (cultural)  
- Analyze and discuss the promises and limits of technology in the so-called Anthropocene.

### EV01  
**Scientific basics in environment**  
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</table>

**Objectives:**  
- State the different scientific approaches to environmental problems

**Programme:**  
- Ecology of natural environments.  
- Water cycle and hydrogeology.  
- Physical chemistry of environment.  
- Bio-geo-chemical cycles.
Environmental economics

Context/Framework:
Environmental economics examine the case for -- and provide with -- incentives likely
to regulate the impacts of production/consumption processes with regard to natural
systems and human welfare.

Objectives:
• Understand the neo-classical modelling of the economic system, its key
  assumptions and results
• Introduce the (conceptual and practical) ideas of external effects, public good,
  and the commons
• Understand the rationale underlying economic instruments for environmental
  policy (taxes, permits)
• Know how to write and solve basic equations for applied problems; appreciate
  their scope in reality
• Discuss cost-benefit analysis as an applied method for environmental decision-
  making
• Discuss the issue of intertemporal discounting to assess long-term economic
  impacts
• Describe the heterodox approach of ecological economics for sustainability
  studies.

Minor: EDD

EV03

Environmental law

Objective:
To study and understand the legal tools of environmental law.

Programme:
• National, community and international institutions.
• National laws and European directives regarding water, waste, noise and air
  management.
• precaution principle and liability right
• Multilateral agreements in environment and international conventions.

Minor: EDD

EV04

Environmental risks: management and controversies

Objective:
To analyze the jurisdiction of social risk management.

Programme:
EV10

Environmental analysis: basic methods and tools

Objectives:
- To become aware of the environmental problems related to industrial activities and to understand the tools and methods of environmental management and analysis.

Programme:
- Business environmental strategy and environmental communication.
- Environmental law and liability regarding environment.
- ISO 14001 standardization, EMAS, integrated management system.
- Environmental audit and environmental management system.
- Environmental analysis: legislative and regulation inventories and sensitivity studies and impact potentials.
- Wastes integrated management.
- Industrial ecology.

EV11

Materials life cycle management

Objective:
- To study the basics and some tools for developing/choosing the best environmental materials.

Programme:
- Presentation of environmental risks related to the materials productive processes.
- Technical and legal aspects to the environmental choice of materials.
- Introduction to materials life cycle thinking used in manufactured products.
- Presentation of the global reality of materials recycling.

EV12

Eco-design, “clean” technologies and recycling
Context/Framework:
Awareness of the limits of ecosystems and growing social pressures (originating from regulations and from clients) have encouraged companies to reduce environmental impacts at source by incorporating eco-design, recycling and cleaner production into their systems.

Objectives:
- defining eco-design and understanding its deployment in a design process
- facilitating eco-innovation
- awareness of environmental impacts associated with materials, products, processes and systems
- knowledge of tools and methods for eco-design and environmental evaluation (Life cycle assessment)
- knowledge of end-of-life technologies and the selection of responsible options
- learning to promote an eco-design strategy

FM01
French as a Mother language 1

Objective:
- To master the basics of orthography and grammar essential for professional and personal success.
- To increase opportunities for recruitment and promotion within companies which are now giving more and more importance to the writing skills.

FM02
French as a Mother language 2

Objective:
- To know how to use the French language especially in sciences and engineering
- To improve the quality of academic and professional writings
- To understand and write scientific and professional articles with advanced structure

Programme:
- Deepening in the scientific lexical field
- Be able to qualify and express concepts, experiments or research results accurately, clearly and unambiguously
- To learn how to make a positive effect on the reader, logical articulations: typology and practice
- Analysis of complex sentences construction
FQ01  Quality assurance and control 6 ECTS credits

Objective:
• To understand the essential concepts for effectively organizing the quality of products and services within a company.

Programme:
• To put the quality concept in a company's objectives as a finalized sub-system interacting with all the other systems in the company.

Prerequisite:
SY02

Level: Year 3/4/5

AUTUMN-SPRING

FQ02  Maintenance methods and techniques 6 ECTS credits

Context/Framework:
Maintenance involves the servicing of equipment and the reduction of outages.

Objectives:
• application of maintenance terminologies, technologies and strategies.
• deployment of qualitative methods for the optimization of maintenance: TPM, RCM, pro-active maintenance
• implementation of tracking indicators
• evaluation of maintenance performance
• optimization of maintenance in the interests of system availability
• modelling of a maintenance process

Level: Year 4/5

SPRING

FQ03  Experimental plans 6 ECTS credits

Context/Framework:
Design of experiments is a methodology based on an experimental approach that aims to describe an industrial system and predict its performance in the purpose of performance optimization

Objectives:
• To learn fundamental elements of experiment planning and study various experimental designs (full and fractional factorial designs, response surface designs, mixture design) and related scope
• To fit an adequate predictive model and use it for determining the optimal setup

Level: Year 3

SPRING
### Reliability: basic methods and tools

**Context/Framework:**
System reliability analysis includes the modeling of systems behavior, risk assessment and provide indicators dedicated to the decision making.

**Objectives:**
- To learn the fundamental concepts of system reliability, risk indicators and the associated objectives
- To study modelling tools (reliability block diagrams, binary decision diagrams, Markov models, Petri nets approach) and the associated analysis techniques and assessment tools

**Level:** Year 4/5

**Spring**

### Reliability and experiment feedback

**Objective:**
- To learn the methods of installation and exploitation of experimental feedback for the analysis of systems reliability.

**Programme:**
- Probability and statistics in quality and reliability, probability laws and physical phenomena, statistical estimate.
- Statistical modeling of reliability tests, probability and statistics for experimental feedback (Bayesian approach).
- Tools for processing and statistical analysis.
- Experimental feedback and data analysis of experimental feedback.
- Software applications: optimization of maintenance with reliability, probabilistic safety study, design of new installations, expertise.

**Level:** Year 4/5

**Autumn**

### Human resources management

**Objective:**
- To study and use human resource management techniques to understand the role and the thinking patterns involved in the management of personnel, their competencies and skills.

**Programme:**
- Human resource management techniques and tools.
- The latest trends in employment contracts.
- Lifelong training.
- Telecommuting.
- Laws and the 35 hour week.
- Career management.

**Minor:** Entrepreneurship

**Minor requirements:** B2 level in French required
GE10

**Introduction to micro-economics**

4 ECTS credits

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**Objective:**
- To study how, in economics theory, the customer and the manufacturer react in the market. This subject is mathematics oriented.

**Programme:**
- Productivity.
- Utility functions of customers, customers preferences.
- Benefit maximization calculation by companies.
- Pure and perfect competition market.
- Imperfect markets (oligopoly, monopoly, monopolistic concurrence).
- Relation between innovation and benefit research.

AUTUMN-SPRING

GE11

**Organizations and decision-making**

4 ECTS credits

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**Objective:**
- To understand the major difficulties of company organization, and of decision-making in a complex and uncertain environment.

**Programme:**
- Introduction to the theory of organizations.
- Decision-making and rationality, extension to risks and uncertainty.
- Psychological traps and organizational flaws.
- Theory and practice of negotiation.
- Conflict resolution.

SPRING

GE21

**Organizations and the law**

4 ECTS credits

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**Objective:**
- To understand the basic legal aspects which are useful in both practical and professional life.

**Programme:**
- Legal institutions: French legal institutions, legal vocabulary, courts, competence.
- Civil law: physical and moral personalities, civil liability.
- Penal law: penal responsibility.
- Employment law: hiring, discipline, layoff, contracts.

AUTUMN-SPRING
**GE25**

**Intellectual property and economic intelligence**

**Objectives:**
- To identify the means of protection for innovation and to understand how it can be used.
- To learn how to structure and benefit from information.

**Programme:**
- Study of the various types of industrial protection: patents, brands, drawings and models, royalties and software.
- To study the ways of fighting against counterfeiting.
- Training in economic intelligence, economics and competition.
- Research methods and tools to find relevant information.
- Organization, processing and diffusion of information.
- A project of economic intelligence, economics and competition (specific to those students registered in the Minor Entrepreneurship).

**Minor:** GEC, GEB

**Autumn**

**GE28**

**Business and commercial law**

**Objective:**
- To study the basic benchmarks of company structure in France, and their general rules of operation.

**Programme:**
- Legal structure of organizations: partnerships (eg: SNL), joint stock company (eg: commercial partnership), mixed companies (eg: limited liability company).
- Legal structure of one-man businesses: tradesmen, craftsmen.
- Legal structure of contracts related to the activities of the company (sale contracts, etc.).
- Companies in difficulty (rectification and bankruptcy).
- Legal requirements of e-business.

**Prerequisite**

GE21

**Minor:** Entrepreneurship

**Autumn-Spring**

**GE31**

**Business management: accounting**

**Objectives:**
- To discover and understand from the beginning how the various wheels within a company function.
- To learn the basics of company management via general accounting.

**Programme:**
- Themes covering every aspects of the daily life of a industrial or commercial company: VAT, sale and purchase invoices, depreciation, commercial drafts, disposals, provisions, income statement, balance sheet, annex, Management Information System, internal financing capacity, working capital, working capital needs.
- Practice with many real study cases from company daily life.

**Minor:** Entrepreneurship

**Autumn-Spring**
GE32  Corporate finance
4 ECTS credits

Objectives:
• To increase knowledge of management.
• To learn how to make a financial diagnosis on a company.
• To master the essential tools of decision-making for investment.

Programme:
• To study the treasury and its short-term management.
• Financial analysis and the concept of financial risk.
• Profitability of a company and the impact of its investments.
• Evaluation criteria for an investment project and the choice of financing.
• Analyses of real practical cases of French companies in various industrial sectors.

SW 26hrs
PW 60hrs

Minor:
Entrepreneurship

SPRING

Back to list

GE33  Organizational management
4 ECTS credits

Objective:
• To allow the future engineer to consolidate their knowledge and to become aware of the various overlaps which exist in management.

Programme:
Four projects corresponding to the four fundamental aspects of the creation of an industrial company must be carried out:
• Marketing: simplified market research (investigation to be carried out).
• Production: study of the production line, calculations of stocks, and study of the establishment of the factory.
• Personnel: to define the human resource policy and cost calculation.
• Business plan: starting from the assumptions worked out during three preceding projects, a synthesis of this information into a business plan.

Minor:
Entrepreneurship

NB: a public "oral defence" presentation must be made of the business plan.

PW 68hrs

AUTUMN

Back to list

GE34  Strategy and business management
4 ECTS credits

Objective:
• To understand the crisis through a deep analysis of the reasons of company success or failure.

Programme:
• Key factors for success (Michael Porter).
• The company growth phases (E. FLAMHOLZ, 1991).
• Development of crisis diagnostic methods.
• View of strategic reorganization tools (Mac Kinsey).

Minor:
Entrepreneurship

AUTUMN-SPRING

Back to list
GE36  Marketing

**Objective:**
- To master the "basics" of marketing.

**Programme:**
- The spirit and steps of marketing.
- Market studies: basics, techniques, applications.
- Marketing: product, price, distribution, communication.
- New marketing tools for the 21st century.
- Introduction to industrial marketing.

**Minors:**
- Entrepreneurship

**Level:** Year 4/5

**Semesters:** AUTMN-SPRING

GE37  Innovation management

**Objectives:**
- To present the various processes of innovation set up by companies in their technological and organizational dimensions.
- To study the specifics and the difficulties.

**Programme:**
- What is innovation? (risks, process of selection, key factors and obstacles in innovation, application of innovation).
- What is an innovating company? (new alliances and strategies, innovating structures, role of R&D, technological innovation: new information and communication technologies...).
- What is involved in leading an innovating project? (innovation management: models by phases, project logic, capitalization on innovation...).

**Minors:**
- Entrepreneurship

**Level:** Year 4/5

**Semesters:** AUTMN-SPRING

GE40  Materials trade

**Objective:**
- To understand the different parameters influencing the sale price of materials (cost of the primary material, stock market listings...).

**Programme:**
- Transport of materials.
- Buying and selling techniques of functional materials and structure.
- Practical case studies, such as the problem of copper and aluminum, or computer micro chips.
- Presentation of the cases of steel, concrete, petrol, and silicon, to show the importance of international management of resources, and its medium or long-term influence on the markets.

**Level:** Year 4/5

**Semesters:** SPRING

Back to list
GE41 Technology and management

Objective:
• Teach the students the transversal problematic between technology management and management sciences.

Programme:
• Comparison of management approaches between business school and engineering school: convergence and divergence.
• From technology to marketing: how to reconcile a technology approach with a commercial and marketing approach?
• Case studies: automotive area, nano-technology, micro-electronics, aerospace.
• Particularities with biotechnologies: the different markets (health, agro-food industry, industry), markets structure, products (impacts on markets, innovations), ethic problems.

PW 16hrs
L 30hrs
PW 60hrs

Project with students from the Business school in Troyes

AUTUMN

GE43 Enterprise creation: practical phase

Objectives:
• Realization phase of the enterprise project started in GE33.
• Creation of a business plan.
• Enterprise creation when graduated or later on.

Programme:
• Independently, each group will contact the interveners from GE33 in order to do the necessary steps for their project.
• Organize meetings with professionals in order to get a real approach to enterprise creation.
• Learn how to be organized and how to manage a group.

PW 34hrs

Prerequisite: GE33

Minor: Entrepreneurship

SPRING

GE44 Multicultural approach of business and management

Objective:
• Work within an international organization represents a challenge and an opportunity: it is a matter of understanding the stakes and possibilities of such an experience.

Programme:
• Introduction to work in an international environment.
• Differences between the laws and the rules.
• Cultural differences.
• How to adapt and take advantage of those differences.

L 34hrs
SW 17hrs
PW 60hrs

Prerequisite: LE03 or B2 level

AUTUMN-SPRING
GL01
Introduction to software engineering

Context/Framework:
This course provides an understanding of the functions and features of software as an engineering product, together with an introduction to the methods and tools required for the success of a software project.

Objectives:
- understanding software development as a process composed of distinct work phases (systems development lifecycle)
- being able to identify and process key software elements (MVP - Minimum Viable Product)
- being able to work in a team for the design and development of applications
- understanding the basic principles of object-oriented and event-driven programming
- being able to deploy the acquired skills (practical implementation in a team based project using a simple development environment)

Level: Year 1/2

SPRING

GL02
Software engineering foundations

Context/Framework:
Understanding and practical application of the links between specification, implementation and testing, as core elements of the software engineering process, for the development of efficient, maintainable, useable and reliable software projects

Objectives:
- modelling of software functions
- specification of data formats and processing formats
- control of compliance with a specification
- execution of a source inspection for a software project
- coordination of developments within a team
- execution of a complete small team project, permitting involvement in all stages of a software engineering project
- self-instruction in a programming language (Python, Javascript, Ruby or Lua)

Level: Year 1/2

AUTUMN

GP06
Production organization and management

Context/Framework:
Key concepts for the operation of a production system and the management of logistics operations, incorporating economic and human aspects of the industrial environment.

Objectives:
- understanding the technico-economic context of a business, differentiation of types of production and identification of issues in the management of operations
- organization of the movement of the flow of goods associated with the location of sites/siting of production facilities
- planning of activities (anticipation of demand, development of a project and production schedule)
- identification and calculation of indicators for the management and tracking of operations
- expertise in key management parameters: stocks, MRP, Kanban, TOC
- knowledge of concepts for the reduction of wastes, flexibility and responsiveness

Level: Year 3

AUTUMN
GP17

Production planning and scheduling

**L** 34hrs  |  **SW** 30hrs  |  **PS** 10hrs  |  **PW** 80hrs

**Context/Framework:**
Scheduling of the production load and procurement operations, the sequencing of tasks and the allocation of resources must be optimized in the interests of minimizing costs, subject to the observation of certain constraints.

**Objectives:**
- ability to identify NP-hard basic problems, and to calculate key scheduling criteria
- deployment of methods for scheduling issues on one machine (SPT, SRPT, EDD, etc.)
- deployment of methods for scheduling issues in the workshop (flow-shop, job-shop, open-shop) with parallel machines
- deployment of project scheduling techniques
- modelling of a planning and procurement issue (lot-sizing) and deployment of resolution methods (Wagner-Within, Silver Meal, etc.)

**Level:** Year 4/5

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GP27

Forecasting methods and inventory control

**L** 34hrs  |  **SW** 30hrs  |  **PS** 10hrs  |  **PW** 40hrs  |  **PRJ** 40hrs

**Context/Framework:**
This course involves the analysis of methods for the forecasting of demand (short-term and long-term) and stock management policies in various configurations (mono- or multi-product, mono- or multi-site, deterministic or random).

**Objectives:**
- classification of products and valuation of stocks
- selection and application of models for the forecasting of short-term and long-term demand
- selection and implementation of an appropriate storage policy, determination of parameters (review period, quantity to be ordered, restock trigger threshold, safety stock)
- programming of mathematical models derived from operational research and methods of resolution (VBA, solver)
- selection and analysis of an article from scientific databases

**Level:** Year 4/5

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GP28

Industrial excellence

**L** 34hrs  |  **SW** 30hrs  |  **PS** 24hrs  |  **PW** 30hrs  |  **PRJ** 50hrs

**Context/Framework:**
Continuous Improvement concepts and tools represent a tremendous opportunity for manufacturers to develop competitive advantages by improving customers satisfaction, while optimizing material and cash flows and mobilizing their employees

**Objectives:**
- Being able to modelize an overall industrial system by linking processes characteristics to the economical performance, the customers satisfaction, the company reactiveness and its cash flow
- Being able to construct Key Performance Indicators matching the actual situation, the actual objectives and taking into account the actual competitive context of the company
- Being able to mobilize employees in a virtuous improvement journey by creating a confidence and well-being climate
- Mastering the concepts and tools of continuous improvement: Lean Management, Six Sigma and Theory of Constraints

**Level:** Year 3

**Prerequisite:**
GP06
GS10

Information Systems Security: legal and mandatory aspects

4 ECTS credits

L  30hrs
PRJ 10hrs
PW  40hrs

Context/Framework:
Any ISS head has to know and may have to refer to rules and legal aspects related to the use of digital technologies

Objectives:
- To understand the definition of cyber-criminality in French criminal law
- To know how to secure a development project
- To adapt intellectual property notions to software
- To master the legal bounds of cyber-supervision and control in companies

Level: Year 5
B2 level in French required

GS11

Security technologies

6 ECTS credits

L  30hrs
SW  30hrs
PW  90hrs

Context/Framework:
There are basic techniques used too secure system components such as workstations, servers, smartphones, etc... Some architectures (Cloud, SCADA) represent significant (and important) challenges that must be known

Objectives:
- To be aware of the challenges and the issues of physical and material security
- To be able to protect workstations and Microsoft servers
- To be able to protect web servers
- To learn about security challenges and vulnerabilities of architectures such as cloud and SCADA systems

Level: Year 5

GS13

Security management

6 ECTS credits

L  30hrs
SW  30hrs
PW  90hrs

Context/Framework:
Information systems require an overall approach to assess risks and bring coherent and relevant protection solutions

Objectives:
- To learn about the main risk analysis methods (ISO, Mehari, Ebios) and how to compare and implement them
- To be able to define a System Security Policy (ISSP) and to establish a disaster Business Continuity Planning (BCP) and a Disaster Recovery Planning (DRP)
- To be able to perform a security audit
- To be able to keep track of new technologies, threats and solutions

Level: Year 5
## GS15  Cryptology and electronic signature

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**Context/Framework:**

The security of communication systems and networks is very substantially dependent upon cryptographic methods. In addition, numerical encryption algorithms are invariably used in processes involving an electronic signature, authentication and the exchange of key codes.

**Objectives:**

- understanding the benefits of different numerically-encrypted signature and authentication techniques; assessing the advantages and disadvantages of each technique
- knowledge of modular arithmetic base systems and their application for the resolution of diophantine equations using efficient algorithms
- advanced knowledge of the operation of symmetrical and asymmetrical numerical encryption standards (DES, AES, El-Gamal and RSA)
- understanding the operation and the benefits of the main hashing and electronic signature algorithms
- knowing how and when to apply numerical encryption, hashing and electronic signatures, which constitute different tools

**Level:** Year 5

**Spring**

Back to list

## GS16  Internet networks security

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**Context/Framework:**

The attachment to internet leads to be exposed to cyber-attacks, which requires protection and also detection systems.

**Objectives:**

- To know the fundamentals of network protection (secured protocols, security devices and filtering policies).
- To understand the vulnerabilities and countermeasures for ToIP, wireless, for further integration
- To know the main attacks for better anticipation
- To master intrusion detection techniques and their applications (IDS/IPS)

**Level:** Year 5

**B2 level in French required**

**Spring**

Back to list

## GS21  Digital forensic in companies

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**Context/Framework:**

It is important for future ISS heads to manage incidents (legally and technically) and to know what service may be involved in a forensic process.

**Objectives:**

- To be able to lead preliminary investigations
- To know the various services concerned in a forensic process: N-Tech, National Police, Customs
- To master the legal management of incidents
- To be able to manage a crisis
- To know the key antagonisms between forensic and ISS processes
- To understand the concept of industrial property and personal data protection

**Level:** Year 5

**Autumn**

Back to list
**GS22**  
**Search of the digital proof**  
4 ECTS credits  
L 20hrs  
SW 20hrs  
PW 50hrs  
PRJ 10hrs  

**Context/Framework:**  
Skilled investigators are required to deal with techniques of concealment (of behaviours and information) which call for appropriate detection tools and methods, not only in respect of networks, but also in respect of content.  

**Objectives:**  
- Knowledge of new architectures (cloud, nomadism) and new types of devices (smartphones, IPBX, chip cards) for the more effective location of data  
- Knowledge of key file formats and associated metadata  
- Ability to conduct searches in directories and databases  
- Awareness of specific issues associated with images (watermarking, steganography)  

**Level:** Year 5  
**Autumn**

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**GS25**  
**Computing watch and cybercrime**  
4 ECTS credits  
L 20hrs  
SW 20hrs  
PW 60hrs  

**Context/Framework:**  
Cyberspace is associated with the emergence of a new concept which affects both individuals and corporations: digital identity. Legislation on this matter is in place.  

**Objectives:**  
- Awareness of the accumulation of information in cyberspace (identity, e-reputation)  
- Understanding the concept of information denial  
- Familiarity with, and ability to handle data mining tools  
- Ability to search for strategic information on the Internet  

**Level:** Year 5  
**Autumn**

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**HT03**  
**History of art**  
4 ECTS credits  
L 34hrs  
SW 17hrs  
PW 50hrs  

**Objectives:**  
- To study the great stages of the history of art, and of the origins of our time  
- To introduce students to the art of the XXth century  

**Programme:**  
- Prehistoric, Egypt, Greece and Byzance, Primitive Italian, Rebirth and Classicism, Romanticism, the major realists, Impressionism, Van Gogh and Munch, Symbolism, the art of old China, Pre-Colombians  
- Expressionism, Surrealism, Abstraction, American art from Hopper to Warhol, the Fifties from Cobra to Michaux, rough art, marginal art, new figuration, conceptual art, new forms of art.

**B2 level in French required**

**Autumn**
HT05  
**Physics and astronomy history**  

**Objective:**  
- To discover the great scientific ideas which led to the development of physics and astronomy.  

**Programme:**  
- The Greek heritage.  
- The main ideas of classic European (16th to 18th century).  
- Basics concepts of quantum physics.  
- The Einstein relativity.  
- History and concepts of astronomy.  
- Astrophysics.  
- Cosmology and its recent questions.  

**L** 26hrs  
**SW** 26hrs  
**PW** 60hrs  

B2 level in French required  

**S**PRING  

Back to list

HT06  
**Contemporary history and industrialization**  

**Objective:**  
- To expose and to analyze the consequences of industrialization on lives in the Western World.  

**Programme:**  
- The birth of the industrial revolution.  
- Important phases of industrialization.  
- Social, economic, and political consequences of industrialization.  

**L** 26hrs  
**SW** 26hrs  
**PW** 60hrs  

B2 level in French required  

**A**UTUMN  

Back to list

HT07  
**Geopolitics and the modern world**  

**Objectives:**  
- To provide the keys to comprehension today’s world, considering the contributions made by geopolitics and modern history.  
- Learn to analyze a particular geopolitical situation.  

**Programme:**  
- Structure of the modern world: what is the world situation at the dawn of the 21st century? Presentation of international relations and the major geopolitical areas (Europe, Africa, Asia-Pacific, Middle East, and the Americas).  
- Case studies at different levels (world, continental, regional, and local) using real examples.  
- Methodologies of geopolitics and modern history; presentation of sources, actual research, and analysis tools.  

**L** 26hrs  
**SW** 26hrs  
**PW** 60hrs  

B2 level in French required  

**S**PRING  

Back to list
**HT08**  
**Introduction to archeology**  
4 ECTS credits  

**Objectives:**  
- To have a plurimillenium chronology perspective.  
- To understand the history, the actors, the scientific and economic stakes as well as the coordination of archeology in France.  
- To see the importance and diversity of the archeological heritage in France.  

**Programme:**  
- To learn about the evolution of practices, from antiquaries to preventive excavations, the archeological regulations, actors, funding, how the archeology is part of the territory development, discoveries valorization, investigation technologies evolution.  
- Focus on preventives excavations in Troyes, the protected archeological heritage (MH, Unesco), the archeological furniture, the aerial archeology, funeral archeology and the archeological heritage.

**B2 level in French required**

**SPRING**

**IAMC01**  
**Calculations and dimensioning of agro-material composites structures**  
6 ECTS credits

**Objective:**  
- To have a design and dimensioning approach for composite material structures.  
- To get the basic concepts of body or assembly design and optimization depending on transformation conditions and use constraints.

**Programme:**  
- Design of composites parts  
- Design, simulation and prototyping of part or assemblies  
- Dynamic behavior of packaging systems  
- Design of forming tools

**Level: Year 5**

**AUTUMN**

**IAMC02**  
**Behavioral laws**  
4 ECTS credits

**Objective:**  
- To get the basic knowledge on behavioral laws for polymer and composite materials  
- To identify the tests needed for the behavioral laws  
- To use the most used laws for finite element calculations programming

**Programme:**  
- Behavior of polymers (elasticity, viscoelasticity, plasticity, fracture)  
- Behavior of fibers  
- Behavior of composites (lamination theory, fracture criteria, damage concepts, cracks problems, fatigue and thermal load behavior)

**Level: Year 5**

**AUTUMN**
IC01

**Intercultural management**

**Objectives:**
- To prepare for a stay in another country (either as a study semester, or a professional experience).
- To make the most of a stay in France by comprehension the differences and complexities present between different cultures. The course is enriched by a constant interaction between the modern cultures represented in the class.

**Programme:**
- Cultural adaptation; the use of space and environment.
- Intercultural management.
- Cultural or socio-cultural conflict.
- Institutions.
- Stereotypes; values.
- Verbal and non-verbal interactions.

**4 ECTS credits**

**L** 17hrs

**SW** 34hrs

**PW** 60hrs

For permanent students and exchange students with a good working knowledge of English

Minor: CIE, COESO

**AUTUMN-SPRING**

Back to list

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IF01

**Information theory and coding**

**Context/Framework:**

Information is one of the key resources in sciences and data communication technologies. Whether during acquisition, processing, storage or transmission, the integrity of information must be preserved.

**Objectives:**
- understanding the communication model known as Shannon's paradigm
- acquisition of basic concepts for the measurement of information (entropy, mutual information, average mutual information, etc.)
- knowledge of different techniques for discrete source encoding and source encoding theorem (Shannon's first theorem)
- familiarization with the principles of discrete channel encoding, channel capacity and Shannon's second theorem
- understanding detector codes and error correction codes (encoding and decoding of linear codes, Hamming codes)

**6 ECTS credits**

**L** 34hrs

**SW** 30hrs

**PW** 80hrs

Level: Year 3/4

**AUTUMN**

Back to list

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IF02

**Information Systems design**

**Context/Framework:**

The object of this course is instruction in the role of information and communication technologies for the resolution of problems in organizations. Students learn the concept of Information Systems (IS) and of object-oriented design within Information
IFA2

Information Systems design – for Non-French speakers

Level: Year 3/4/5

Objectives:
- understanding the strategic alignment of an Information System
- analysis of business tasks
- establishment of functional requirements on the basis of predetermined dictates
- collection, formal definition and validation of technical and non-technical requirements for complex socio-technical systems
- expert application of object-oriented specification techniques, standards and methods (UML: diagram of applications, classes, state transitions, sequences and operations)
- production of documentation

Level: Year 3/4/5

SPRING

IF03

Introduction to information systems security

Objectives:
- To understand the basic principles of Availability, Integrity, Confidentiality and Evidence (AICE)
- To identify potential security threats
- To design secured architectures
- To establish functional and technical requirements
- To perform computer forensics
- To perform security audits
- To suggest effective emergency measures

Level: Year 4/5

SPRING

IF05

Software quality

Objectives:
- planning and tracking of a software project (kanban)
- coordination within a project team (tickets, revisions)

Level: Year 4/5

SPRING
• drafting of scenarios and production of models to assist the client in the clarification of their requirements
• drafting of a user manual
• preparation, automation and execution of acceptance tests
• evaluation of the quality of code

SPRING

IF07

Pedagogical and online training engineering

6 ECTS credits

L 16hrs
SW 15hrs
PS 16hrs
PW 32hrs
PRJ 70hrs

Context/Framework:
Corporate personnel are required to train, adjust their knowledge and adapt their skills at an increasingly rapid pace. In response to this situation, conventional training options have been expanded. This course provides an introduction to theories of learning and currently available platforms.

Objectives:
• deployment of methods for pedagogical engineering and the set-up of Computing Environments for Human Learning (CEHL): rapid learning, serious game, network learning, mobile or pervasive learning, massive on-line open courses (MOOC)
• parameterization and utilization of free software platforms and educational applications in Web 2.0

AUTUMN

IF08

Software Project Management

6 ECTS credits

L 34hrs
SW 30hrs
PW 36hrs
PRJ 50hrs

Context/Framework:
The aim of this course is to teach principles and techniques to manage software development or integration projects. Both project owner and project sponsors points of view are covered.

Objectives:
• application of planning techniques, standards and methods, implementation of an activity plan
• risk management, proposal of effective emergency measures
• deployment of collaborative working techniques, standards and methods, coordination of team-based developments
• production of documentation
• customer relationship management, change management

SPRING

IF09

Documentary systems

6 ECTS credits
**Objective:**
- To analyze and design an information system in a company focusing on its digital documents rather than management data.

**Programme:**
- Digital archival storage (metadata, revisions, timestamping and signature)
- Automatic processing (pattern search, information search, transformation).
- Interpretation (matter indexing, hypermedia).

**Prerequisite:**
Experience in a company

**Level:** Year 3

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**IF10**

**Design with a focus on software use and interactive systems**

**Context/Framework:**
The implementation of a user-/application-centred approach is a prerequisite for the design of usable and high-performance interactive systems which will meet the expectations of clients and satisfy the needs of end users.

**Objectives:**
- identification of user requirements
- establishment of functional requirements on the basis of predetermined dictates
- identification of benefits and improvements associated with the adoption of new technologies
- production of low-fidelity and medium-fidelity MMI (Man-Machine Interface) models
- evaluation of the use of models
- application of rules for software ergonomics
- application of project management tools

**Level:** Year 4/5

**IF11**

**CRM portals and e-commerce**

**Context/Framework:**
Thanks to the Internet, corporate information systems are able to support major functions in the form of Customer Relationship Management (CRM), e-commerce and EDI (Electronic Data Interchange); system architectures must be subtly adapted to B2C or B2B requirements.
Objectives:
- end-to-end analysis of an innovative CRM/e-commerce solution, as an example of a complex socio-technical system, incorporating the requisite information architecture.
- collation, formal definition and validation, in a specification and coherent models, of technical and non-technical requirements for systems of this type.
- application of technologies (web services and different service levels - SaaS, PaaS, IaaS) to specific I-business and inter-business issues.
- modelling of economic factors and activities associated with these systems, in the interests of realizing professional benefits from recent technological innovations (mobility, geo-location, Big Data, Web 2.0) associated with these factors

SPRING

IF14  Information systems audit

6 ECTS credits

Objective:
- To model the operation of a company and tasks for informatization.

Programme:
- To organize a semi-structured interview.
- To analyze the company vocabulary (class diagram or UML objects).
- To analyze the company flows (UML activity diagram).
- To analyze the company organization (H. Mintzberg configurations).
- To analyze the employee tasks (UML activity diagram).

AUTUMN

IF15  Knowledge engineering

6 ECTS credits

Objective:
- To study methodologies for knowledge acquisition. This subject is based on projects.

Programme:
- History of knowledge acquisition seen as an artificial intelligence technique.
- Methods of knowledge acquisition using texts, expert interviews, databases.
- Methods of modeling based on Methods of Problem Resolution or systemic models (CommonKADS, MASK...).
- Representation of knowledge (semantic networks, conceptual graphs, directed representation objects). The students will make a modeling project and will be guided by instructions, step by step.

AUTUMN
**IF16**

**Computer Supported Collaborative Work**

6 ECTS credits

**Context/Framework:**
This learning module presents the basic concepts of the information systems for cooperation, applied to various contexts (intranet, extranet, mobility, Web 2.0)

**Objectives:**
- To understand and implement the CSCW models, both at functional and technical levels, to improve the social dynamicity of communities, social networks and socio-technical systems when using these models
- To model collaborative activity and collaboration patterns (with the SeeMe method)
- To achieve an end to an original project, using recent technologies (participation, architectures, wiki, discussion forum, participatory cartography, workflow, multiple viewpoints, social tagging, etc...) to innovatively answer to realistic clients’ requirements.

**Level:** Year 4/5

**Context/Framework:**

**Autumn**

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**IFA6**

**Computer Supported Collaborative Work (for non-French speakers)**

6 ECTS credits

**Context/Framework:**
This course introduces the basic concepts of the CSCW domain, examines software systems designed to support cooperative work - their design, use and evaluation. This course gives a taste of CSCW research issues.

**Objectives:**
- To critical read research papers
- To master how to support collaborative work with technology in a company
- To master how to present a synthesis of existing work

**Level:** Year 4/5

**Context/Framework:**

**Autumn**

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**IF17**

**Decision-making architectures**

6 ECTS credits

**Context/Framework:**
The aims of this course involve the appreciation of issues, tools and difficulties associated with the design and integration of decision-making applications in Information Systems, together with the acquisition of concepts involving data mining in large data corpuses.

**Objectives:**
- analysis of issues and specific features of decision-making projects
- design of hardware and software architectures for decision-making IT
- design of data warehouses
- identification of technological problems and solutions associated with the procurement of data from warehouses (heterogeneity, volumetry, etc.)

**Level:** Year 4/5

**Comment:** databases

**Autumn**

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**IF19**

**Sociology of organizations in Information Systems**

6 ECTS credits

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L  34hrs  Context/Framework:
The course addresses the formal dimension of organizations, then uses sociological evaluation grids for the analysis of cooperation at work. Finally, the course considers “business” factors in Information System engineering, using these grids.

Objectives:
- analysis of work situations by the application of theoretical principles of organizational sociology.
- systematic identification of “business” issues associated with an Information system (change management, consultation, client/lead contractor relations, etc.)
- alignment of Information Systems with organization (of work and “business” activities)
- establishing a position as a player in an organization.
- analysis of motivating forces for cooperation and commitment at work

Level: Year 4/5
Comment:
Internship:

SPRING

IF20 Integrated management and process modeling 6 ECTS credits

L  34hrs  Context/Framework:
The process-based approach is a core feature of modern corporate management. By this approach, existing processes are described and optimized and new processes are designed, together with associated Information Systems. This course teaches process modelling, which is a prerequisite for the adoption of the process-based approach.

Objectives:
- identification and modelling of processes.
- expertise in the application of a process modelling software tool
- management of a process modelling project
- establishing the link between process modelling and the design of Information System applications

Level: Year 4/5

AUTUMN

IF22 Information systems management 6 ECTS credits

L  24hrs  Context/Framework:
This course involves the management of Information Systems by the global Enterprise Architecture (EA) approach, which encompasses the urbanization of Information Systems, the management of reference sources, the management of project portfolios, and transformation methodologies for the delivery of a competitive advantage to the business.

Objectives:
- description, analysis and improvement of the different layers in an Information System (business, functional, application and technical)
- management of an Information System urbanization project by the application of IS governance principles
- application of key reference sources for the Management System of a DSI (CMMI, ITIL, COBIT, ISO, etc.)

Level: Year 4/5

SPRING

IF23 Position determination technology 6 ECTS credits
Context/Framework:
Introduction to concepts for the acquisition of geographical data and its processing, management, representation and exploitation

Objectives:
• understanding the fundamental concepts of GNSS (Global Navigation Satellite System) and GNSS surveying methods.
• understanding and applying positional calculations in absolute mode and in differential mode, using pseudo distance measurements and phase measurements. Satellite orbits.
• understanding the reference surface, various landmarks and their associated coordinates.
• understanding and applying changes in coordinates, geographic projections, Lambert conformal conic conversion.
• understanding geographical information systems and their application in surveying, agriculture, logistics, surveillance and tourism.

Level: Year 4/5
Comment: Internship

Context/Framework:
This course on integrated management software packages involves both the modelling of corporate processes and the parameterization of SAPs (Systems, Applications and Products for data processing) for application to these processes. To this end, the architecture and modular operation of SAPs are analyzed and applied to a case study.

Objectives:
• modelling of corporate processes for the purposes of SAP parameterization
• SAP parameterization:
  o business set-up
  o parameterization of different modules (finance, accounting, procurement, sales, production, human resources)
  o process simulation

Level: Year 4/5

Context/Framework:
In recent years, social networks have become established as an exceptionally rich source of heterogeneous data (Big Data). The use of data mining not only permits the following of trends, but also the detection (and sometimes prediction) of atypical participants and interactions.

Objectives:
• modelling of social networks in the form of graphs (static and dynamic)
• deployment of techniques for the collection and storage of data (passive and active listening)
• deduction of rules for correlation, data classification and the detection of anomalies
• detecting weak signals in a large flux of noisy data
• detection of spams and social bots in a Big Data context.

Level: Year 4/5
IF26 Safe design of applications: Web mobiles and Smartphones

Objective:
• To learn the methods and tools of safe application design applied to development for Smartphones

Programme:
• An introduction to cyber-criminality, types of attacks on computers: “man in the middle”; brute force, denial-of-service, social engineering, etc.
• The need for safe design
• Encryption and protection of sensitive data
• Design of applications for Apple terminals
• Design of applications for Android terminals
• Principles of Web Mobile development and of multi-terminal development through Phonegap

Prerequisite: LO07
Level: Year 4/5

6 ECTS credits

AUTUMN

IF27 Ensuring service security

Objective:
The security of data exchange through networks such as the Internet is ensured by a large number of principles and techniques which apply at two different levels: the network itself and the communicating equipment. This course is a focus on security-related techniques used by the computers’ operating systems or even by the programs

Programme:
• A reminder on the principles of communications’ security
• Ensuring safety at operating system level (example: SSL protocol)
• Ensuring the safety of applications
• Application tunnels
• Implementation in a company

6 ECTS credits

SPRING

IR30 Initiation to research

Objective:
• To initiate the students into the scientific research.

Programme:
• To know the organization of a research project (project types, human and material resources, administrative procedures).
• To understand what is to be a researcher (at public or private institutions) and the outcomes of the research.
• To explore the different research fields developed at the UTT.
• To get exposed to intellectual and industrial property rights.
• Concrete examples of projects between company/laboratory and patent deposits.

6 ECTS credits

Level: Year 4/5
SPRING

IS01

Sport structure in France

6 ECTS credits

Objective:
• To allow a larger approach of sport institutional and staff structures in France.
• Get used with the management parameters in different sectors related to sport.

Programme:
• Professional, amateur and leisure sport, international comparisons, European regulations.
• Evolution and prospects.
• Sport management characteristics.
• Association and federation, the professional sport club.
• Sport in local communities, sport centre management.
• Event organization and management.
• The sport economic sector (the “agents”).

L 30hrs
SW 30hrs
PW 90hrs
Level: Year 4

AUTUMN

IS02

Sport marketing

4 ECTS credits

Objective:
• To master the marketing fundamentals for sport events.

Programme:
• Marketing spirit and approach.
• Marketing policies: product, price, distribution, communication.
• New marketing tools for the 21st century.
• Sponsoring.
• Marketing plan.

L 20hrs
SW 20hrs
PW 60hrs
Level: Year 4

AUTUMN

IS03

Communication strategy

6 ECTS credits

Objective:
• To allow the student to get used the different communication strategies and tools, applied to companies, institutions and/or newspapers.

Programme:
• Communication tools.
• To master the different communication strategies, oral and writing practice and setting public relations and press relations.
• Event communication.
• Communication applied to sport.

L 30hrs
SW 30hrs
PW 90hrs
Level: Year 4

AUTUMN
IS04
Human resources: team management in sport

6 ECTS credits

Objective:
• To allow the student to get access to the management principles and methods of human resources applied to sport.
• To learn and use the pertinent human resources tools to understand the operations and logics for the preventive management of human resources, competences and qualifications.

Programme:
• To give the students the fundamentals of human resources management and enable them to see the particularities related to sports.
• Different group work methods and techniques will be seen, as well as tools to optimize the management of human resources, efficiency and creativity emergence.
• Coaching.
• Basics of labor law.

Level: Year 4

SPRING

IS07
Sport event organization

6 ECTS credits

Objective:
• Confront students to the execution and concreteness of a sport event.
• Manage resources and work as a group.

Programme:
• The different phases of project management:
  • Group meetings.
  • Event communication.
  • Event logistics.
  • Event security.

Level: Year 4

SPRING

IS08
Event logistics modeling

6 ECTS credits

Objective:
• Learn the fundamentals for managing successfully a project in an event context.
• To learn the specific organizational logistics tools and methods.

Programme:
• Project management and decision-making tools.
• Needs and necessary resources analysis.
• Scheduling.
• Operation management.
• Practical and complex cases (national and international competitions...)

Level: Year 5

AUTUMN
IS09  
**Sports and leisure infrastructures management**  
6 ECTS credits  

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**Objective:**  
- Sensitize the students to the conceptual difficulties, operations and management of infrastructures.

**Programme:**  
- Standards related to infrastructures.
- Infrastructure maintenance and pay off.
- Government contracts, call for tenders, specifications.
- Networks building: institutional relations, time management.

**AUTUMN**

IS10  
**Organizers responsibilities**  
6 ECTS credits  

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**Objective:**  
- To study the manager and organizer responsibility concept, by giving the students the necessary elements to understand the governmental procedures: juridical operations, institutions, networks and mechanisms defining the governmental sector.

**Programme:**  
- Regulations for infrastructures receiving audience.
- Security regulations.
- Civil liability.
- Penal responsibility.

**SPRING**

IS11  
**Events security**  
4 ECTS credits  

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**Objective:**  
- To acquire the knowledge and tools for apprehending the crowd phenomena and then organize the users security during an event.
- To know the managerial techniques for preventing or curing in terms of infrastructures, organization and human and material logistics.

**Programme:**  
- History, social risks, crowd psychology, public order and demonstration or celebration.
- Crowd migration in transports, around stadiums, in stadiums…
- Architectural aspects of security in sports infrastructures. Crowds in stadium and crowds in open areas.
- The State and the security.
- The medical security mechanism, basics of passive security.
- Active security, intervention strategy.
### Direct marketing publicity – Sale strategy and techniques

**Objective:**
- Deepen the different communication means, especially the advertising techniques. To define the setting of a direct marketing operation.

**Programme:**
- Media communication:
  - Deepening, communication scheme and mechanisms used in advertisements.
  - Advertising and strategy copy, adverts tests, media and media planning.
- Outside media communication: direct marketing and sales promotion
  - Different approaches of direct marketing, files, zoning and spin-offs control of direct marketing campaign. Basics of mailing design.

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### Advanced networks

**Objective:**
- To have in-depth knowledge of the networks of the future, of these networks’ architectures, characteristics and performance and to be able to understand developments in the area of advanced networks

**Programme:**
- The Internet of the future
- Autonomous networks
- Mobile networks
- Service quality
- Operators’ networks
- Participation to a research congress on advanced networks

---

### Advanced information systems

**Objective:**
- to become familiar with, gain in-depth knowledge of recent advances and new stakes in the area of information systems.

**Programme:**
- PaaS tools (Platform as a Service).
- The extended Enterprise.
- Knowledge management.
- Open source.
- Collaborative tools development.
- Dematerializing of products into services.
- Information system governance.
ISC03

Architectures for services

Objective:
- To learn the software engineering knowledge needed for service design.

Programme:
- Web services.
- QoS network architectures.
- Mobile architectures.
- P2P architectures.
- Architectures for heterogeneous applications.
- Examples (Microsoft SR,..).

Level: Year 5

AUTUMN

ISC04

Platform-oriented services

Objective:
- To know the current offer on the market of knowledge management platforms, collaborative work, educational games, management of documents in a networks environment.
- To gain knowledge of the functional role of platforms in the setting up of community and organizational networks.

Programme:
- Frameworks.
- Groupware.
- GED.
- Multi-agent platforms.
- Semantic Web.
- P2P platforms.
- AI and animation, animated conversational agents, avatars.

Level: Year 5

AUTUMN

ISC05

Communicational, cognitive and social dimensions of services

Objective:
- To assimilate the concepts and reference models which make it possible to understand the cognitive, communicational and organizational dimensions of
Level: Year 5

activities in socio-technical networks.

Programme:
- Communication theories and models.
- Computer mediatized information.
- Interpersonal relationships and services.
- Social and community networks.
- Cognitive models of complex activities.
- Ontology and knowledge.
- Socio-technical models of innovation.

AUTUMN

ISC06

Science and knowledge for service-oriented design

6 ECTS credits

Objective:
- To gain in-depth knowledge of multidisciplinary approaches for the study, the design and the implementation of services in complex organizations.

Programme:
- Foundations of Service Science, Management and Engineering (SSME).
- Strategic, market-oriented, ergonomic and operational analysis of services.
- Design, modeling and simulation of Service Systems, (SS).
- Analysis of customer journey, service interactions and customer experience.
- Application of approaches (SOMA, SOMF…) service-oriented languages and modeling tools.

AUTUMN

ISC07

Service applications

6 ECTS credits

Objective:
- To understand the stakes in services provided to the person and to organizations through the presentation of concrete examples. To identify the benefits and the limits of service-oriented design in different applicative contexts.

Programme:
- Web technologies for enterprises (enterprise 2.0 “lightweight technologies”)
- Services applied to healthcare.
- Services applied scientific professions (“Academia 2.0”) “Serious games” and online education.
- Representation, storage, indexing and information and document search.
- Forums.
- Mobile applications and “Location-based services”.
- Mobile services in mobile and nomadic environments.

AUTUMN

ISC08

Quality and assessment of Services

4 ECTS credits
Objective:

• To gain knowledge of the quality of services in terms of the quality of the infrastructure and of the tools on which these services are based (performance, service continuity) and of the quality of usage (usefulness, usability, quality of user experience, appropriation).

Programme:

• Network security.
• Simulation for the assessment of network performance.
• Testbed.
• Trust.
• Usability-oriented principles and methods of assessment.
• Usefulness, usability, acceptability, user experience and related metrics.

**Autumn**

KO00

Introduction to Korean language and culture

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Objective:

• To gain a basic knowledge of spoken and written communication in Korean
• To learn to communicate in simple daily life situations
• To discover the Korean society through its language and culture
• To prepare a one-semester exchange programme in Korea

Programme:

• To learn Hangeul, the Korean alphabet.
• Oral comprehension and expression, pronunciation, daily life conversations.
• Written comprehension and expression: reading and translation of simple documents.
• Discovery of the Korean culture: Hallyu.
• To understand the Korean society, Confucianism.

**Autumn-Spring**

IT00

Italian-Beginners’ level

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Objective:

• To learn the basis of oral and written communication
• To be able to express oneself in everyday situations

Programme:

• Oral comprehension and expression: pronunciation, daily conversation exercises
• Written comprehension and writing comprehension: reading and translation of simple daily life documents

**Autumn-Spring**

IT01

Italian-Elementary level/Basic structures

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**Autumn**
**IT02**

**Italian-Intermediate level**

**Objective:**
- To revise the Italian language's structures
- To be able to express oneself in many daily life situations
- To discover the specific language of newspapers or the language used in a professional context

**Programme:**
- Oral expression: debates, presentations of documents, listening and viewing of audiovisual documents
- Writing expression: writing of small essays, summary of articles, writing of descriptions and of argued documents
- To gain an increased knowledge of the Italian society

**AUTUMN**

**LC00**

**Modern Chinese language and culture - Level 1**

**Objective:**
- To communicate in a simple everyday situations.
- To be able to read short, simple texts; rudiments of writing.

**Programme:**
- Historical introduction to the Chinese language; introduction to the characters and writing.
- Elementary grammatical structure.
- Analytical reading of texts: grammatical translations and comments.
- Oral comprehension and expression, conversational exercises, phonetics.
- Required reading and writing.

**AUTUMN-SPRING**

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**LC01**

**Modern Chinese language and culture - Level 2**

**Objectives:**
- To be able to communicate in most daily situations.
- To be able to read and write simple texts.
Prerequisite: LC00
- To have a greater comprehension of Chinese society.
Programme:
- To build upon a basic grammatical comprehension.
- Comprehension and oral expression; conversational exercises (subjects of daily life); phonetics and pronunciation.
- Comprehension and written expression.
- Required reading and writing.

AUTUMN-SPRING

LC02

Modern Chinese language and culture - Intermediate Level
4 ECTS credits

Objectives:
- To obtain a fairly fluent level of oral expression and be able to compose short texts.
- To understand journalistic and literary texts.
- To study modern Chinese history.

Programme:
- Further deepening of grammatical comprehension and language structure.
- Oral comprehension and expression; conversational exercises; phonetics and pronunciation.
- Written comprehension and expression; analytical reading of texts.
- Required reading and writing.

AUTUMN-SPRING

LEM1

English-elementary level/preparation for the BULATS
4 ECTS credits

Objectives:
- Development of the lexical and grammar knowledge in English for the working world.
- Preparation for the BULATS written test.
- This course is reserved for students who are in the first year of the UTT Master and who have an A1 or A2 entry level in English.

Programme:
- To train in the skills needed to validate the B1 level, ie oral and written comprehension.

AUTUMN-SPRING
LEM2

English–Elementary level/Preparation for the BULATS

Objectives:
• To gain more in-depth knowledge of the English language in the same areas as in LEM1 for the validation of the NPML, ie lexical and grammar knowledge in English for the working world.
• Preparation for the BULATS written test.
• This course is reserved for students who are in the UTT Master and who have a certified A2 level in English or have passed the LEM1 course.

Programme:
• To train in the skills needed to validate the B1 level, ie oral and written comprehension.

4 ECTS credits

SW 51hrs
PW 60hrs

Prerequisite:
LEM1 or A2 level in English

S PRING

Back to list

LE00

English – Beginner’s level

Objectives:
• To learn the elementary vocabulary and structures.
• To be able to speak in daily life situations.

Programme:
• Oral expression: to be able to present him/herself, to get served in a bar or restaurant, to get directions in buildings and streets.
• Oral comprehension: weekly training.
• Writing expression: writing of simple texts.
• Written comprehension: reading of simple texts.

4 ECTS credits

SW 68hrs
PW 60hrs

AUTUMN-SPRING

Back to list

LE01

English – Elementary level/Basic structures

Objectives:
• Improvement of basic vocabulary and grammatical structures.
• To be able to express oneself in both everyday situations.

Programme:
• Oral expression: role playing, discussion in small groups, conversation in pairs.
• Oral comprehension: weekly preparation.
• Writing expression: writing short texts and grammar exercises.
• Written comprehension: work on contemporary texts adapted to the level of the student.

4 ECTS credits

SW 51hrs
PW 60hrs

Prerequisite
LE00 or placement test

AUTUMN-SPRING

Back to list

LE02

English – Intermediate level

4 ECTS credits
LE01

Objectives:
• To gain an increased knowledge of vocabulary and grammatical structure.
• For the student to improve their self-expression in English, in both everyday and professional situations.

Programme:
• Oral expression: role plays, discussions in small groups, oral presentations.
• Oral comprehension: weekly preparation.
• Writing expression: writing short texts and grammar exercises.
• Written comprehension: work on contemporary texts adapted to the level of the student.

Prerequisite
LE01 or placement test

AUTUMN-SPRING

Back to list

LE03

Objectives:
• To gain an increased knowledge of vocabulary and grammatical structure.
• For the student to improve their self-expression in English, in both everyday and professional situations.

Programme:
• Oral expression: role playing, short and improvised presentations, discussions.
• Oral comprehension: weekly training.
• Writing expression: writing exercises linked to professional life (reports, letters, e-mails...).
• Written comprehension: work on contemporary texts adapted to the level of the student.

Prerequisite
LE02 or placement test

AUTUMN-SPRING

Back to list

LE04

Objectives:
• Development of the oral production skills needed in a professional context
• Preparation for the BULATS oral test

Programme:
• Oral production, job interviews, professional meetings, negotiations, debates
• Training activities to prepare for the BULATS’ speaking test

Prerequisite
LE02

AUTUMN-SPRING

Back to list
LE08  
**English – Preparation for the B2+ level**  
4 ECTS credits

**Objective:**
- To acquire the necessary level to obtain the B2+ level.

**Programme:**
- To deepen lexical and grammatical knowledge of the English language and to acquire the vocabulary of work.
- Preparation of the necessary competences to obtain the B2+ level (oral and written comprehension and expression with respect to the Common European Framework of Reference for languages/Can-do statements).

**Prerequisite**
- LE03 or placement test

**SW** 51hrs  
**PW** 60hrs

**Opening of the subject depending on resources available.**  
AUTUMN-SPRING

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LE11  
**Practical English for scientific and technical communication**  
4 ECTS credits

**Objective:**
- To improve the student’s general scientific language.

**Programme:**
- Study of terminology.
- Practical use of the knowledge obtained in various scientific fields (computing, technology, energy, environment, etc.).
- Oral presentation.

**Prerequisite**
- B2+ level

**SW** 34hrs  
**PW** 60hrs

**Opening of the subject depending on resources available.**  
AUTUMN

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LE12  
**North American television culture**  
4 ECTS credits

**Objective:**
- To discover North-American culture and the American-English language through the television media.

**Programme:**
- Viewing of video documents.
- Comprehension and oral expression.
- Role playing.
- Study of vocabulary, idioms, regionalisms, neologisms.
- Initiation to American culture through various institutions, practices and traditions.
- Study and interpretation of cultural connotations.
- Production of a short video.

**Prerequisite**
- B2+ level

**Minor:** CIE

**SW** 34hrs  
**PW** 60hrs

**Opening of the subject depending on resources available.**  
AUTUMN

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Back to list
LE14  English skills 1

Objective:
• Reinforcement and practice of the acquired skills in writing and oral expression and written comprehension.

Programme:
• Study of different written and audio documents.
• Documents writing and presentation on labor world
• Development of oral skills in daily life and labor world.
• Oral and e-mail exchanges with anglo-saxons binomials

Opening of the subject depending on resources available.

AUTUMN-SPRING

Back to list

LE15  World Englishes

Context/Framework:
Study of the varieties of English spoken by native speakers over the world and as an international communication tool. Deepening of language skills in oral and written comprehension and production

Objectives:
• To consider the implication of using English as an international communication tool
• To become receptive to the varieties of English in the world, thanks to exchanges on-site and videoconferences with native speakers
• To master the lexical difficulties and pronunciation pitfalls of dominant models of English
• To be able to report the specific characteristics of a chosen English variety, through the writing of a report and an oral presentation

Opening of the subject depending on resources available.

SPRING

Back to list

LE16  Oral communication in English and cinema

Objectives:
• To improve speech, and comprehension of spoken language.
• To learn formal presentation techniques in the English language.

Programme:
• Study of 4 films in English.
• Oral comprehension: comments of filmed sequences, formal presentations made in English about a film.
• Writing expression: writing comments of one of the movies studied (test in the final examination).

Opening of the subject depending on resources available.

AUTUMN-SPRING

Back to list
**LE17**

**English for academic purposes**

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**Objectives:**
- Preparation to the C1/C2 levels for a semester of study in an English speaking country.

**Programme:**
- Identification of tests and exams needed to study in an English speaking country.
- Practice of needed skills in order to succeed at the test.
- Improvement of written and oral skills and performances.

*Opening of the subject depending on resources available.*

**Prerequisite:**
B2+ level

**Leaves:**
- **AUTUMN**

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**LE18**

**History of humanity**

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**Objectives:**
- To develop a terminology linked to patrimony through definitions and parameters as well as laws related to it.
- To favor the use of multimedia tools.

**Programme:**
- To acquire knowledge, think and debate on the following themes: worldwide, European and national patrimony, material and immaterial patrimony. Students will have the possibility to choose patrimony of their interest such as their fields, country, region of origin and so on.
- Evaluation made on oral presentation and the use of multimedia.

*Opening of the subject depending on resources available.*

**Minor:**
CIE

**Prerequisite:**
B2+ level

**Leaves:**
- **AUTUMN-SPRING**

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**LFT**

**French intensive course – Oral practice with theater**

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**Context/Framework:**
While improving pronunciation through an artistic project, theatre is used to understand how the use of the body can express thoughts and emotions.

**Objectives:**
- To detach from one’s culture by pretending to be someone else
- To read and understand a text, then interpret it on stage
- To explore and use the body language of a foreign culture
- To correct one’s diction, elocution and phonetic expression
- To acquire the necessary self-confidence to perform on stage
- To develop vocabulary skills through memorization work

**Degree-seeking students**
Available only during intersemester break

**Leaves:**
- **AUGUST-FEBRUARY**
French intensive course - A1 Level (discovery)  
4 ECTS credits

**Context/Framework:**
From the moment of their arrival, this course gives the basic expression means to foreign students that never took French classes, so that they can handle simple and concrete interactions in everyday life

**Objectives:**
- To master basic interactive communication: get in touch with someone, salute, present yourself, answer and ask simple questions, ask someone about himself, fix a date, etc...
- To understand and use stereotypical vocabulary and expressions used to give information about yourself, and deal with basic needs
- To understand slowly spoken information and instructions (given by an understanding person)

AUGUST-FEBRUARY

French intensive course - Introduction to A2 level  
4 ECTS credits

**Context/Framework:**
This intensive course allows students that already studied French but are not feeling at ease to develop their expression means and call them up through everyday life communication role-plays

**Objectives:**
- To be at ease in simple everyday life transactions: shopping, bank and administration procedures, trip planning, transportation use, etc...
- To be able to self describe, your future and past activities, while using adequate vocabulary and expressions
- To spot essential information in short audio extracts

AUGUST-FEBRUARY

French intensive course - Introduction to B1 level (threshold)  
4 ECTS credits

**Context/Framework:**
To master and call up your French knowledge during different oral communication situations. First module of a B1 level preparation course.

**Objectives:**
- To be able of actively interact about the news on familiar subjects, to express personal convictions within group meetings, for example through group project management
- To be able to gather information about a technical or abstract subject, to be able to explain why something is malfunctioning
- To describe procedures, and give detailed instructions
- To acquire the self-confidence necessary to course speak ups

AUGUST-FEBRUARY
LF04

French intensive course - Introduction to B2 level (independent user)  4 ECTS credits

Context/Framework:
- This course will have students develop their skills through particular communication sets: interviews, continuous speak up, surveys, etc…

Objectives:
- As defined by the CECRL for the B2 level, for example:
  - To be able to fluently participate in a debate, to efficiently conduct a reasoning around abstract subjects (societal problems, ethical choices, scientific conclusions, etc…)
  - To easily develop a logical explanation built on different subjects, general or professional
  - To be able to extract the informative of a long oral intervention (courses, conferences, radiophonic documents, TV reports, etc…) and recognize the orator’s attitude

Available only during intersemester break

AUGUST- FEBRUARY

Back to list

LF05

French: linguistic support  4 ECTS credits

Context/Framework:
This course is directed to French speaking students, and especially arab speaking persons, that wish to improve their writing skills by enriching syntax, vocabulary and orthographic resources.

Objectives:
- To know the different properties of syntax in a speech
- To build complex sentences in order to explain logical relations
- To master the use of articulators in order to give a text a logical coherence
- To conjugate verbs and master all the parameters of the French tense system
- To master phonetical and non-phonetical spelling
- To acquire grammatical reasoning useful to a good spelling

AUTUMN-SPRING

Back to list

LF10

French as a foreign language (oral) – Objective A2+  4 ECTS credits

Context/Framework:
This course completes LF02 and allows foreign students following a graduating program (TC, branch, master) to enhance their mastering of oral French to the A2 or B1- level.

Objectives:
- To develop oral interaction capacities through regular engagement in student organizations
- To acquire socio-cultural bearings useful to environment comprehending
- To explain the different experiences lived through the proposed projects
- To be able to rephrase heard facts, in order to ensure mutual understanding
- To understand oral speeches which are connected to studies (courses, news, etc…)

AUTUMN-SPRING

Back to list
**French as a foreign language (written) – Objective A2+**

**Context/Framework:**
Foreign students following a graduating program (TC, branch, master) will improve their vocabulary and grammatical knowledge in order to validate the written A2+ level in French at the end of the semester

**Objectives:**
- To build and string together well built simple sentences in order to talk about events and experiences of your personal life
- To learn to write a full text (journal) relating the activities shared through student organizations at UTT
- To understand short simple texts related to your centre of interests or you studies
- To master grammatical knowledge such as: usual interrogative structures, simple sentence syntax, use of the first tenses, etc…

**SPRING**

**Degree-seeking students**

Back to list

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**French as a foreign language – Objective B1**

**Context/Framework:**
This course will help the degree seeking students to work on the objectives of the B1 level (oral and written comprehension, oral and written expression)

**Objectives:**
- To integrate a project outside of the UTT in order to improve on’s oral communication with others
- To speak up for long periods of time in order to explain the advances of your project
- To be able to write a report of experiences using the syntax knowledge that are required for level B1
- To master the understanding of short newspaper articles or scientific popularization
- To know how to deal with vocabulary and grammatical learnings through the use of e-learning

**AUTUMN-SPRING**

**Degree-seeking students**

Back to list

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**French as a foreign language – Objective B2**

**Context/Framework:**
Degree-seeking students will receive complementary knowledge that will be useful to their development to level B2. Through an autonomous project,
students will get to apply this knowledge to real-life situations.

Objectives:
- To lead a societal survey about a contemporary project
- To know French press and master the reading of sociological articles
- To master difficulties of telephone conversation to organize meetings
- To conduct interviews: spot a problem, interrogate, reason, identify arguments that back up and oppose the points of view, react to exposed arguments, etc…
- To synthesize in a report the information and points of view received from the different sources of the survey.

AUTUMN-SPRING

LF20
Practical French for the course of mathematics

Context/Framework:
This course will introduce the non-French speaking degree seeking newcomers to the mathematical terminology.

Objectives:
- To master French diction of the main mathematical symbols
- To know basic vocabulary in diverse mathematical domains (geometry, arithmetic, algebra and analysis)
- To understand scientific wording (lectures, tutorials, practicals)
- To be able to read, analyze and write in French a scientific report (training report, article, practical report)

SPRING

LF21
Practical French for the course of physics

Context/Framework:
This course will introduce the non-French speaking, degree seeking newcomers to the physics terminology. This will ensure that practical experiments will happen successfully and safely.

Objectives:
- To know basic physics vocabulary
- To master the prepping of physics practicals (knowledge of: the tools, technical language, safety rules, report writing rules, etc…)
- To be able to read and analyze scientific popularization articles in French

SPRING

LF22
Practical French for the course of chemistry

Context/Framework:
This course will introduce the non-French speaking degree speaking newcomers to the chemical terminology. Their knowledge of the vocabulary will be tested in order to prepare them for the tutorials and practicals.

Objectives:
- To know basic chemical vocabulary
- To master the prepping of a chemistry practical (tools, technical language, writing rules for the report)
- To know how to write a practical report
- To be able to read and analyze, French chemical popularization articles
- To be able to follow and keep written proof of a course

SPRING
**LF23**

French as foreign language-Remedial phonetics course

**Context/Framework:**
This course is specifically designed for students having a hard time with French pronunciation. It can be followed as an add-on to another French course.

**Objectives:**
- To perceive and distinguish the various French sounds, in particular phonetical oppositions (hearing discrimination)
- To correct pronunciation mistakes through articulatory phonetics (corrective phonetics)
- To better master the prosodic parameters of oral expression (intonation, rhythm, syllabus)
- To know the use of mandatory and optional linking
- To use one’s phonetic knowledge through artistic activities (theatre, singing)

**Degree-seeking students**

AUTUMN-SPRING

**Back to list**

**LF24**

Tutoring in end-of-TN05 internship report writing and oral presentation preparation.

**Context/Framework:**
After the TN05 internship, this course will accompany foreign students through the redaction of their report and the prepping of their oral presentation. Help will only be provided through correcting expression and presentation of the report.

**Objectives:**
- To understand and apply rigorously organization, presentation and redaction rules of an internship report
- To interpret observations and testimonies to make information out of them
- To sort information by order of interest, to select and reword the most important in order to integrate them to the report
- To master linguistics that are particularly useful to describe experiences, to explain oneself and to analyze
- To develop the ability to autocorrect one’s mistakes
- To master the parameters for a fluent and synthetic oral presentation

**Degree-seeking students**

SPRING

**Back to list**

**LF30**

French as a foreign language – Language and culture

**Context/Framework:**
Through understanding French daily habits, this course will allow students to further their French knowledge, in order to reach level A1.

**Objectives:**
- At level A1, a student is able : 
- To understand urban information: names of businesses, administration, public services, as well as the main acronyms
- To master an elementary repertoire of words, expressions in order to be able to answer basic needs
- To be able to fill in administrative forms : numbers and dates, name, nationality, address, age, date of birth or of arrival in the country
- To be able to communicate through simple daily communication tools : texts, e-mails, postcards

**For exchange students**

**Back to list**
LF31

French as a foreign language – Language and culture

4 ECTS credits

Context/Framework:
Through discovering French culture and exposing them to intercultural experiences, this course will make students’ integration to their new environment easier. This course will allow students to master level A2.

Objectives:
• At level A2, a student is able:
  • To understand isolated sentences and frequently used expressions, linked with high importance domains such as: personal information, family situation, buyings, professional environment, close environment
  • To be able to communicate during simple and regular tasks that only need a small amount of interaction
  • To be able to describe one’s education, training and environment, and to talk about instant needs

LF32

French as a foreign language – Language and culture

4 ECTS credits

Context/Framework:
This course is built around written and TV documents, it will allow students to immerse in French news and improve their abilities in authentic contexts. This course does not fulfill the B1 requirements but is an excellent way to progress toward this objective.

Objectives:
• At level B1, a student is able:
  • To present a simple topic, related to one’s studies and be able to answer the questions it triggers
  • To follow a lecture about a familiar topic if the presentation is sufficiently clear
  • To understand numerous films that are mainly focused on action and image
  • To write small reports to transmit fact information
  • To follow the main topics of a long talk happening in his/her presence
  • To identify the main conclusions of an argumentative text when it is well organized

LF33

French as a foreign language – Language and culture

4 ECTS credits

Context/Framework:
This course gets students to take part into self-managed projects, while the teacher gives the necessary language proficiency. This course does not fulfill the B2
For exchange students

requirements but is an excellent way to progress toward this objective.

Objectives:
• At level B2, a student is able:
• To expose his/her opinions in an oral exchange while accurately defending them with explanation, arguments and comments
• To write an essay or a report that develops an argumentation by explaining the logical bonds between ideas
• To understand the main ideas during oral presentations about abstract or technical topics
• To understand articles and reports about society problems in which authors have a particular point of view

AUTUMN-SPRING

Back to list

LF40

French as a foreign language – UTSEUS – Level B1

4 ECTS credits

Context/Framework:
Built around an integration project in Troyes’ associative life, this course will allow UTSEUS students arriving in France to check their knowledge in French and to use them in real-life communication contexts

Objectives:
• To overcome the fears linked with the discovering of a new environment (linguistic and culture)
• To overcome the communication barriers in order to successfully deal with the tasks linked with a project: contacts, telephone meetings, understanding of proposals, accomplishment of missions, etc…
• To master grammatical techniques and codes in order to report for the advancement of one’s project
• To acquire a strong syntax, in order to be able to fully write a 15 pages report

AUTUMN

Back to list

LF41

French as a foreign language – UTSEUS – Level B2

4 ECTS credits

Context/Framework:
This course will give students the necessary linguistic assistance (resume, cover letter, job interviews prepping, etc…) to enhance their professional attractiveness, in order to get hired for their mandatory internship (TN09).

Objectives:
• To easily and efficiently drive a job interview
• To participate in a discussion on a familiar subject and understand in detail the facts put out by the interlocutor
• To understand and be able to exchange complex information and opinions on a large number of subjects related to one’s field of specialization
• To understand and give precise and detailed information or instructions
• To write correctly while avoiding mistakes that could lead to major misunderstandings

Back to list
LG00

German – Beginner’s level

4 ECTS credits

Objectives:
- To know how to communicate in simple everyday situations.
- To learn the principal vocabulary and structures of the language.

Programme:
- Oral expression: stress is laid on communication (dialogues, role playing...).
- Written expression: writing of various small dialogues and texts.
- Linguistic competence: revision of the fundamental structures, and progressive training in the principal structures of language.

SW 51hrs
PW 60hrs

LG01

German – Elementary level/Basic structures

4 ECTS credits

Objectives:
- To know how to communicate in simple everyday situations.
- To learn the principal structures of the language.

Programme:
- Listening comprehension: regular listening based on various documents.
- Written comprehension: work on varied texts and documents.
- Oral expression: stress is laid on communication (dialogues, role playing...).
- Written expression: writing of various small dialogues and texts.
- Linguistic competence: revision of the fundamental structures, and progressive training in the principal structures of language.

Prerequisite: LG00

SW 51hrs
PW 60hrs

LG02

German – Intermediate level

4 ECTS credits

Objectives:
- To know how to communicate in the majority of everyday situations.
- To review the principal structures of language.

Programme:
- Written and listening comprehension: regular work on various texts and documents.
- Oral expression: stress is laid on communication (opinion, dialogues, role plays...).
- Written expression: writing small essays.
- Linguistic competence: broad revision of the principal structures of language.
- 3 individual talks, in which 1 presentation from a recent German article.

Prerequisite: LG01 or placement test

SW 51hrs
PW 60hrs
LG03  
**German – Practical level**

4 ECTS credits

**Objectives:**
- To know how to communicate in a majority of situations.
- To have a deeper comprehension of German culture.

**Programme:**
- Improved comprehension and expression (written and oral) using different topics from various written documents, audio, and video.
- Revision and improvement on the structures of language and of communication situations (according to the needs for each group).
- Informal and semi-formal communication.
- 3 individual talks, in which 1 presentation from a recent German article.

**Prerequisite:**
LG02 or placement test

**SW** 51hrs  
**PW** 60hrs

_AUTUMN-SPRING_

Back to list

LG08  
**German – Preparation for the B2 level**

4 ECTS credits

**Objective:**
An intensive preparation for the B2 level examination, by consolidating and developing the necessary competences.

**Programme:**
- Consolidation and development of vocabulary and language structure.
- Written and listening comprehension (various texts and subjects).
- Oral expression: in particular, personal presentation, short presentation on a topic, information brainstorming and discussions.
- 3 individual talks, the last being a rehearsal for the oral examination.

**Prerequisite:**
LG10 or LG11 or placement test

**SW** 51hrs  
**PW** 60hrs

_AUTUMN-SPRING_

Back to list

LG10  
**German – Culture and Civilization**

4 ECTS credits

**Objective:**
- To improve both the knowledge of the German language as well as its culture and civilization.

**Programme:**
- Improvement of comprehension, written, and oral expression, using cultural topics (written, audio, and video documents).
- Themes: literature (classic authors, current...), cinema, history (great moments), politics..., the news can help to develop certain aspects...
- 3 individual talks, in which 2 from recent articles in German related to German culture and civilization.

**Prerequisite**
LG03 or LG08 or LG11 or placement test

**Minor:** CIE

**SW** 51hrs  
**PW** 60hrs

_AUTUMN_

Back to list
LG11  
**German – Professional level**  
4 ECTS credits  

**Objectives:**  
- To develop knowledge of the German professional world.  
- To use German in professional situations.

**Programme:**  
- Comprehension, written and oral expression, using professional topics illustrated by various written, audio, and video documents.  
- Themes: inter-cultural approach, candidature and recruiting, life of the company and the role of the trade unions, German industrial landscape...  
- 3 individual talks, in which 2 from recent articles in German related to work, company, economy...

**Prerequisite**  
LG03 or LG08 or LG10 or placement test

**Minor:** CIE

**SW** 51hrs  
**PW** 60hrs

**Back to list**

LI01  
**Writing workshop**  
4 ECTS credits

**Objective:**  
- In partnership with the “House of Writers”, tutorials (SW) are supervised by well-known and reputable writers: to learn to write in a playful and imaginative way, while using experiences of text.

**Programme:**  
- To loosen up the pen with various exercises.  
- To write well, is to think well.

**B2 level in French required**

**SW** 51hrs  
**PW** 60hrs

**Back to list**

LI03  
**Recitative art**  
4 ECTS credits

**Objective:**  
- To determine the place of comics and cinematographic recits in the literary domain and get knowledge and skills in those fields.

**Programme:**  
- Study of the comics: from the “early comic strips”, to the golden age of American comics and the Belgian school, through to the avant-garde comics.  
- Study done professional artists in comics and cinema  
- Production of personal and/or group projects and skills improvement in those fields (production of short film)  
- Creative development

**GROUP**

**SW** 42hrs  
**PW** 60hrs

**Back to list**
Literature, culture and society

Objective:
• Study of the links between paintings, literature and cinema.
• Study of the culture dissemination in our society through those 3 supports.

Programme:
• Knowledge dissemination from the 18th century to nowadays.
• From the emerging painting expositions in the 18th century to emerging museums.
• Link between culture, sociability and sociality life.
• The role of newspapers and mass culture.
• Evolution of the literature and its audience in the 19th and 20th centuries.
• The involvement of the artist in its literary, pictural and cinematographic work.
• Study of a theme through different written and visual supports (from text to TV, cinema, advertising, posters...).

B2 level in French required
Minor: CIE

Computing basics

Objective:
• To study the concepts and the basic tools in computer science for a methodical approach regarding programming applications.

Programme:
• Introduction – context of application development.
• Automaton and language – programming language and link with an automatic system.
• Computer architecture.
• Algorithmics – concepts and rules for algorithmics design.
• Introduction to C language – fundamentals.
• Data structures – spreadsheet, files, articles...
• Advanced programming – dynamic data structures and recursion.

Level: Year 3
Not for students who obtained NF04 and NF05

Principles of, and practice in object-oriented programming

Context/Framework:
The object of this course is the understanding and application of the object-oriented approach for the deployment of software projects. It is proposed that detailed design (in UML) and development of the same project (in Java) should be conducted in tandem.

Objectives:
• understanding concepts of the object-oriented approach and their translation into UML and Java
• knowledge and re-use of libraries and key functions of Java2 SE (Standard Edition)
• design of an object-oriented architecture on the basis of functional requirements
• knowledge and ability to incorporate elementary design patterns into the production of code
• API documentation using Javadoc

Level: Year 3
Prerequisite: Programming

AUTUMN
LO07
Web technologies

Objectives:
• To develop web dynamic applications in PHP.
• To develop synergies with SGBD.
• To study the technical aspects of web 2.0.

Programme:
• Web standards: browser, servers, HTTP/HTTPS protocols, CGI, SSI.
• Structures of HTML, XHTML, XML and CCS documents.
• The development of dynamic pages with Javascript, PHP and Java.
• Synergies with relational databases, implementation with MySQL.
• Context management with cookies and sessions.
• Web 2.0 concepts and presentation of AJAX, Prototype libraries, JQuery.
• Introduction to web applications security.

Level: Year 3

SPRING

Back to list

LO10
Design patterns for Service Oriented Architectures

Context/Framework:
Introduction to the functional aspects of service-oriented architectures (SOA) and associated design models. Deployment of different approaches (REST, SOAP) and their application to a project.

Objectives:
• selection of different service levels (SaaS, PaaS, IaaS), in accordance with requirements.
• design and deployment of service-oriented applications, in accordance with standard procedures and formats.
• selection of architecture as a function of organizational constraints (security, reliability, performance, upgrading).
• analyse an SOA on the basis of architectural design patterns.

Prerequisite:
LO02 or LO07

Level: Year 4/5

SPRING

Back to list

LO11
Programmable architectures

Objective:
• To understand the methods for modeling, checking and simulating the integrated circuits. To understand the integrated circuits internal architecture.

Programme:
• Digital circuits: technology, combinatorial and sequential logic, memories, processors, ASICs.
• Synthesis and simulation with VHDL.
• Core processor on FPGA.
• Peripheral circuits and interfaces (parallel, graphic, RS232...).
• Practical sessions on FPGA.

Level: Year 3

SPRING

Back to list
LO12

Artificial intelligence and applications

Context/Framework:
If the computer is meant to be a support for cognitive activities, artificial intelligence permits to reproduce some of them. This course has a main objective to explain how artificial intelligence can give reasoning capabilities to machines.

Objectives:
- To represent knowledge with logic
- To apply the resolution principle through the Prolog language
- To use different types of reasoning inside various platforms: rule-base systems and the expert system tool CLIPS; multi-agent systems using the MADKIT development platform; and case-based reasoning
- Represent uncertainty and vagueness in knowledge-base systems

Level: Year 3

LO13

3D computer graphics: theory and applications

Context/Framework:
3D infographics involve methods for the graphic representation of objects or images in 3D. There are numerous applications, from CAD through to scientific visualization.

Objectives:
- Defining a (continuous) mathematical model for 3D objects: Bézier surfaces, splines, NURBS
- Ability to generate a discrete model from a continuous model of 3D objects: geometric surface meshing
- Management of 3D visualization bases: linear conversions, viewing systems, perspective projections
- Knowledge of realistic 3D rendering: shader models, elimination of hidden areas, radiosity method, ray tracing
- Expertise in 3D infographics using the OpenGL graphics library

Level: Year 4/5

LO14

Operating systems architecture and administration

Objective:
- To acquire the necessary skills to manage all the various layers of operating systems.
- To acquire the knowledge and the practical skills of system administration, and thus the profession of the systems engineer.

Programme:
- Operating systems theory.
- Client/server architecture.
- Operating systems administration.
- Unix and Linux systems.
LO15
Product lifecycle management systems and collaborative engineering

6 ECTS credits

Context/Framework:
PLM and collaborative engineering approaches constitute a combination of methodological and technical solutions which are applied for the development of manufactured products. The object of this course is their application in a multi-site design project.

Objectives:
• understanding and description of collaborative methods for the development of manufactured products
• application of methods to a multi-site manufactured product design project
• understanding and use of professional PLM platforms
• identification and awareness of key difficulties associated with the deployment of a collaborative design procedure
• consideration of genuine case studies and industrial operating feedback on the deployment of collaborative engineering

LP00
Portuguese language and culture - Level 1

4 ECTS credits

Objectives:
• To learn to communicate in simple daily situations.
• To discover the culture of Portuguese speaking countries, and to prepare for a visit to one of these countries.

Programme:
• Exercises for casual conversation: auditory comprehension, oral expression, pronunciation.
• Reading and comprehension of written texts related to daily life.
• Exercises in written expression.
• Introduction to various aspects of the culture of Portuguese speaking countries.

AUTUMN-SPRING

LP01
Portuguese language and culture - Level 2

4 ECTS credits

Objectives:
• To develop the comprehension and use of both written and oral aspects of the
Prerequisite: LP00

- To improve grammatical competence and vocabulary.
- To deepen the comprehension of the culture of Portuguese speaking countries.

Programme:
- Auditory comprehension, and oral expression, using various original resources.
- Reading and comprehension of a variety of written texts.
- Further exercises in written expression.
- Study of society facts.

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LP02

Portuguese language and culture - Intermediate Level

Objectives:
- To encourage independence and ease in the use of both oral and written Portuguese.
- The students will carry out research on a theme linked to a Portuguese speaking country, write a report, and make an oral presentation on their work.

Programme:
- To use their comprehension and oral expression skills in real situations.
- To become familiar with journalistic language, and that of certain professional specialties.
- To carry out personal research, write a report, and make an oral presentation on the findings.

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LS00

Spanish – Beginner's level

Objectives:
- To study Spanish, in order to prepare for a semester or a training course abroad.
- To obtain a basic knowledge of vocabulary and grammar.
- To be able to speak.

Programme:
- Study of the everyday language using various supports, using oral communication.
- Spanish and Latin-American companies.
- Oral comprehension and expression.
- Written comprehension and expression.

AUTUMN-SPRING

LS01

Spanish – Elementary level/Basic structures

4 ECTS credits
**Objectives:**
- To have a more complete comprehension of the grammatical and lexical structures.
- To develop oral skills examination (short presentation).
- To improve written comprehension skills.

**Programme:**
- Study and practice of the daily language using various resources.
- Spanish and Latin-American companies.
- Oral comprehension and expression.
- Written comprehension and expression.

**AUTUMN-SPRING**

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**LS02**

**Spanish – Intermediate level**

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**Objectives:**
- To review grammatical structures and basic vocabulary.
- To acquire an intensive linguistic and cultural knowledge.

**Programme:**
- Study of everyday language using various resources.
- Spanish and Latin-American companies.
- Oral comprehension and expression.
- Written comprehension and expression.

**AUTUMN-SPRING**

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**LS03**

**Spanish – Practical level**

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**Objectives:**
- To reinforce knowledge obtained in earlier courses.
- To build on this knowledge in order to proceed to a practical level of Spanish, LS10.

**Programme:**
- Communication (work in pairs or in small groups).
- Development of written and oral ability (comprehension and expression).
- Phonetic correction.
- Cultural approach to Spanish-speaking countries.

**AUTUMN-SPRING**

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**LS08**

**Preparation for the B2 level**

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**4 ECTS credits**
SW  36hrs
Interview 1hr
PW   60hrs

Objectives:
• To intensively prepare to the B2 level examination.

Programme:
• Oral and written comprehension.
• Oral and written expression.
• Grammatical and linguistic competences.
• Exam simulations.
• Formal and informal correspondence.

LS10

Spanish – Autonomous level

SW  51hrs
PW   60hrs

Objectives:
• To deepen the knowledge of both the language and the Hispanic cultures learnt from LS00 to LS03.
• To reach the level of an independent speaker.

Programme:
• Study of the language in a current setting.
• Written and oral comprehension and expression.
• Communication activities (work in pairs or in small groups), debates.
• Phonetic correction.
• Exercises on formal and informal correspondence.
• Carrying out tasks in semi-autonomy (Internet, contacts with Spanish-speaking people...).

Prerequisite:
LS03
or placement test

LS11

Spanish – Professional level – “Spain” and "Latin-America"

SW  51hrs
PW   60hrs

Objectives:
• To increase knowledge of Spanish and Latin-American companies.
• To assist in a possible professional insertion (training course, daily life...).

Programme:
• Written and oral comprehension and expression.
• Phonetic correction.
• Case studies of large contemporary companies.
• Debates.
• Formal and informal correspondence.
• Communication activities.

Prerequisite:
LS10
or placement test
Minor: CIE

LX00

Language E-learning

PW   140hrs

Objectives:
• To improve knowledge of the vocabulary and of the grammatical structures
Prerequisite:
Depending on the targeted language: LP01 or LG01 or LS01 or IT01

- To learn and/or improve and/or gain in-depth knowledge of oral and written daily life and professional communication

Programme:
- Oral comprehension and expression: e-learning exercises to deepen the competences acquired for the BULATS test, use of the professional and technical vocabulary acquired during the studies at UTT.
- Oral comprehension: the final year project will be defended in English

LX10

English E-learning in

Objectives:
- To improve knowledge of the vocabulary and of the grammatical structures of a foreign language
- To learn and/or improve and/or gain in-depth knowledge of oral and written daily life and professional communication

Programme:
- Oral comprehension and expression: distant training sessions with native or bilingual speakers of the language studied, through the utilizable communication tools on a synchronous or asynchronous and basis, namely video conferences and video messages, weekly training exercises trough adapted softwares, production of email messages

MA02

Structures and physical properties of matter

Objective:
- To study of the physical properties of matter in connection with microscopic properties.

Programme:
- A description of matter, (atomic theory, thermal agitation, interatomic bonds, materials)
- From the microscopic to the macroscopic level, thermodynamic and statistical approach (statistical distributions, perfect gas, transport phenomena, foundation of the first and the second principle, changes of state)
- Properties of matter, (mechanical properties, electric properties, thermal properties)

MA02S

MA02 Support

Objective:
- To bring necessary physical elements to follow MA02' class

Programme:
- Notion of partial derived, of total differential, and equations of state
- Rudiments of potential, of probability and wave
- Notion of probabilities and kinetic gas theory
MA03

**Light-material interaction**

**Context/Framework:**
Interactive properties between radiation and materials are used for the structural characterization of materials, material processing and the development of new technologies (telecommunications, energy, displays, sensors, etc.)

**Objectives:**
- Understanding the fundamental properties of photons and electromagnetic waves over an extensive energy spectrum, ranging from very high energy (gamma radiation) to very low energy (radioelectric waves)
- Understanding and describing fundamental interaction processes between radiation and materials: propagation, reflection, refraction, diffraction, absorption, emission
- Understanding, deployment and application of methods for the structural characterization of materials: interferometry, refractometry, spectroscopies, X-ray diffraction

**Level:** Year 3/4

**Comment:** Necessary to follow OP01 and NM01

**Autumn**

MA03S

**Light-material interaction basis**

**Objective:**
- To initiate students to the necessary physics basis in science and materials in order to follow MA03S’ class

**Programme:**
- Waves and fields: waves equations and propagation, harmonic system and plane waves
- Energy, polarization, reflection and transmission, interferences
- Matter and waves: Drude Lorentz model, diffraction with a crystal
- Acoustics waves, vibrations in a crystal

**Autumn**

MA04

**Chemistry for materials**

**Context/Framework:**
Expertise in processes for the development, transformation and degradation of materials requires an understanding of fundamental chemical principles. These principles can be used to describe the reactivity of molecules, and the structure and properties of materials.

**Objectives:**
- Establishment of links between the structure of a molecule (bonding models, electronic effects, etc.), material synthesis (mechanisms, kinetics, etc.), molecular structure (tacticity, etc.), surface reactivity and properties
- Expertise in scientific and technical tools required for the synthesis and characterization of polymers, copolymers and composites
- Expertise in the synthesis of micro- and meso-porous materials, description of their structure and understanding their properties (adsorption, ion exchange, etc.), together with their applications (water purification, catalysis, hydrogen storage, etc.)

**Level:** Year 3

**Spring**

MA11

**Metallic materials**

**Autumn**
Metallic materials are a universal feature of our industrialized societies. This course teaches the fundamental principles of these alloys, their mechanical behaviour and their properties, which can be exploited in various ways.

Objectives:
- knowledge of the crystallographic structure of metals, structural defects and principles of diffusion
- ability to interpret binary diagrams and isothermal transformation diagrams
- ability to predict the microstructure of a given alloy on the basis of an equilibrium diagram or TTT/TRC diagrams, in the case of rapid cooling
- knowledge of customary thermal treatments
- knowledge of the key properties of the most common alloys, their production, their applications and relevant standards
- understanding these materials on the basis of dislocation theory

Level: Year 3/4

Basic knowledge of crystallography necessary

Objectives:
- To initiate students into the science of non-metallic materials by allowing them to acquire specific knowledge of these materials. In particular, studies will cover the polymers and the composites.

Programme:
- Polymers: definitions, from molecule to material, physic-chemical properties.
- Composite materials, calculation of laminated composites.

Level: Year 3/4

Comment:
Necessary to follow MQ05

Objectives:
- expertise in fundamental concepts of material mechanics: types of elastic and plastic stress and strain
- understanding the design of structures in consideration of different types of stress (tensile, torsional, bending and composite)
- understanding the design of structures on the basis of conventional elastic limit criteria
- understanding a law of elastic behaviour (Hooke’s law) and plastic behaviour
- understanding the elementary mechanisms of elastic strain, plastic strain and creep strain
- familiarity with concepts of ductility, fragility and damage

Level: Year 3

Spring
Context/Framework:
Electronics and advanced technologies exploit the unique properties of semi-conductors and certain materials which permit the execution of highly sophisticated functions, which are in increasingly widespread use.

Objectives:
- understanding and describing the functions and properties of semi-conductors and other materials used in electronics and advanced technologies (magnetism, superconductivity, photovoltaics, etc.)
- understanding processes and principles for the operation of semi-conductor components and issues associated with their constituent materials
- exchange, extraction and processing of technical information relating to the deployment of these materials and associated processes, in consultation with specialists or on the basis of technical documents

Level: Year 3/4

MA15

Non-metallic materials technologies

Objective:
- To provide a link between theoretical courses on materials and industries.

Programme:
- Polymers and composites: processing and forming.
- Glasses: characteristics, properties, forming and applications.
- Concretes: characteristics, properties, forming and applications.
- Woods: origin, characteristics, properties, forming and applications.
- Building and civil industry: the functioning of the markets, choice of materials, case study.
- Free project: to develop expertise in a material, a transformation process, forming…
- Ceramics: characteristics, properties, forming and applications

Level: Year 3/4

MA20

Materials analysis and microscopic characteristics

Objective:
- To provide a thorough grounding in the physical techniques used for microscopic analysis of materials. The student will be able to familiarize himself with material analyses according to the physical parameters that they want to know. This will enable students to select the right material in relation to specifications.

Programme:
- X diffraction and electrons.
- Traditional optical microscopy and confocal microscopy techniques.
- Electronic microscopy techniques.
- Local-probe microscopy techniques.

Level: Year 3/4

MA21

Materials analysis and macroscopic characteristics

Level: Year 3/4
**Objective:**
- To provide a thorough grounding in the physical techniques used for macroscopic analysis of materials. The student will be able to familiarize himself with material analyses according to the physical parameters that they want to know. This will enable students to select the right material in relation to specifications.

**Programme:**
- Spectroscopy (fluorescence, vibration, RPE, NMR, ellipsometry).
- Non-destructive tests (bleeding, magnetoscopy, ultrasonics).
- Standards and tests.

**MATH01**

**Mathematic basics for the engineer**

**Objectives:**
- To allow students to develop scientific reasoning skills.
- To acquire mathematical tools which are fundamental to engineering sciences.

**Programme:**
- Logic and main reasoning methods.
- Structures of real and complex numbers.
- Numerical functions, functions with one variable.
- Derivation.
- Limited development.
- Integration.
- Polynomial arithmetic.
- Linear differential equations from 1st and 2nd order.

**Level:** Year 1

**Context/Framework:**
Acquisition and mastery of mathematical concepts applicable in a variety of contexts: physics, engineering sciences, material sciences, etc.

**MATH02**

**Mathematic tools for the engineer**

**Objectives:**
- Detailed analysis of numerical sequences, acquisition of the concept of numerical series and the development of series analysis tools.
- Understanding of elementary results from Fourier series.
- Extension of analysis tools from single-variable to multi-variable functions.
- Development of multi-dimensional modelling methods for physical variables (vector analysis).
- Extension of concepts of integration to multi-variable functions.
- Basic principles of linear algebra and matrix computation.

**Prerequisite:**
MATH01

**Level:** Year 1

**Context/Framework:**
6 ECTS credits

**MATH03**

**Linear algebra**

6 ECTS credits
Context/Framework:
This course provides training in the basic principles of linear algebra and permits the
acquisition of matrix computation tools which will allow these formal principles to be
applied in a variety of contexts and situations encountered by engineers.

Objectives:
- understanding the concept of vector space and its potential geometrical
  representation
- understanding the basic principles of linear applications and their matrix
  representation
- understanding customary matrix operators
- ability to apply the concept of determinants for the resolution of linear systems
- acquisition of principles and tools for the reduction of an endomorphism
  (diagonalization)
- acquisition of basic concepts involving Euclidian spaces and familiarity with
  quadratic forms
- ability to use matrix tools for the resolution of linear differential equation systems

Level: Year 2

AUTUMN-SPRING

MATH04 Functions of complex variables and applications 6 ECTS credits

L 34hrs
SW 30hrs
PS 16hrs
PW 70hrs

Objectives:
- To acquire and master the fundamentals of complex analysis and functional
  convergence
- To know how to use the Fourier and Laplace transforms

Program:
- Functions of a complex variable
- Generalized integration (curve, residual values)
- Functional convergence (sequences, series, convergence categories)
- Fourier transform
- Laplace transform

Level: Year 2

SPRING

ME01 Environmental evaluation 4 ECTS credits

L 20hrs
SW 20hrs
PW 60hrs

Objective:
- To master the implementation of the main environmental evaluation methods.

Programme:
- Indicators of sustainable development.
- Ecological footprint and carbon wrap-up.
- Quantification of material and energy flows.
- Life-cycle analysis and life-cycle costing.

Level: Year 5

AUTUMN

ME02 Sustainable development management 4 ECTS credits
Objective:
• To learn the roll-out, monitoring and efficiency of environmental strategies.

Programme:
• Environmental management.
• Repository of sustainable management.
• Responsible management and leadership.
• Strategy, control, watch and perspective planning.
• Marketing and communication.

AUTUMN

ME05

Material, Substance and Waste Flow Analysis

Context/Framework:
• In this course, fundamental concepts, principles, key trends, policy and tools in material and waste flow analysis will be discussed. Students will obtain knowledge about the main challenges and strategies of the metabolism related to basic human activities (to nourish, to clean, to transport and communicate, to reside and work. The theory of the metabolism and its examination in space and time through material and waste flow will also be studied.

Objectives:
• To explain the role of key substances and materials in today’s societal metabolism and their potential interactions with the environment
• To define material flow analysis (MFA) systems that are adequate to reflect on practical problems and potential solutions
• To point out and reflect on strengths, limitations, and specific areas of application of different MFAs (including other industrial ecology tools that build on them) and to interpret the results in terms of their policy implications (e.g., judge the effectiveness of different interventions).

AUTUMN

ME09

Preparation to the essay in environment and sustainable development

Objective:
• To give students a methodology for attaining the objectives of an essay in environment and sustainable development

Programme:
• Document search and analysis and formulation of a relevant scientific issue
• Working out of the scientific and organizational project on which the essay is based: choice of the essay type, (with or without an internship), identification of the host structure, (if the internship option is selected) identification of the essay supervisor
• Drawing up of the essay’s work plan: identification of the general objectives and of the specific objectives, showing the subject in its context, definition of a methodology and of an appropriate schedule, drawing up of a detailed anticipated table of contents.

SPRING
**MI01**

**Introduction to industry environment**

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**Objective:**
- To discover by conferences and company visits, eventually by lectures, companies which have the same thematic field in common (like materials transformation) or which are in the same area (ex: NogenTech Pole).

**Programme:**
- 5 to 6 thematic days (considered as practical sessions) chosen among the different themes: forge, foundry, specific steel metallurgy, large dimension piece manufacture specific alloy pieces manufacture, surface treatments, plasturgy, wood industry...

**Level:** Year 4/5

**Autumn**

**MM01**

**Introduction to multimedia**

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**Context/Framework:**
Creating a website requires an expert grasp of issues relating to project organization, graphic design and interactive navigation, with the application of state-of-the-art Internet standards (HTML, CSS, JavaScript).

**Objectives:**
- development and execution of a web-based multimedia project
- planning and observation of the key phases of project management
- ability to accommodate technical constraints associated with a web-based project
- knowledge of legal issues associated with sources and publication activities

**Level:** Year 2

**Autumn**

**MO12**

**Near field Optics: theoretical and technological aspects**

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**Objective:**
- Through numerical and experimental seminars and scientific workshops, to enable the students to gain and deepen knowledge of nano-optics-related fundamentals.

**Programme:**
- Introduction, history and principles (the concept of the near-field and of evanescent waves).
- Signal, extraction, amplification (probe, polarizability of a nano-object).
- Plasmonics (local and nonlocal surface plasmons).
- Instruments, (scattering, near-field optical microscope).
- Applications (microscopy, spectroscopy, lithography, telecommunications, chemical detections…).

**Level:** Year 5

**Autumn**

**MO13**

**Optical spectroscopy**

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**Objective:**
- To give the theoretical background of the different types of optical spectroscopy.
- Foresee and interpret spectrums. To know the experimental devices in spectroscopy, their operation principles and their practical applications.
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<td></td>
<td>• Group theory basis. Principles of spectral analysis in the X rays, UV, visible and infra red domains.</td>
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<td></td>
<td>• Spectrums: selection rules, intensity, form and linewidth.</td>
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<td>• Absorption, luminescence.</td>
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<td>• Raman and IR Spectroscopy, time resolved spectroscopy.</td>
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<td>• Experimental aspects (sources, detection, dispersion), Fourier transform spectrometry.</td>
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<td>• Spatial and spectral filtering, ultra-short pulses.</td>
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**AUTUMN**

### MO23

**Numerical and mathematical methods in optics**

4 ECTS credits

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**Objective:**

• To introduce the different wave-matter interaction models used in optic for an application in near field optic simulation.

**Programme:**

• Group theory basis and applications.
• Dipole, Green methods, coupled dipoles method, multiple multipole methods.
• Diffraction grating methods (differential, integrated, coupled modes).
• Finite elements methods (FEM) and finite different time domain method (FDTD).
• Probe-sample interaction (passive and active probe cases), anisotropy and non linearity.

**Level: Year 5**

**AUTUMN**

### MP01

**Management of enterprises resources, SAP**

6 ECTS credits

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**Objective:**

• To provide training on ERP architectures, ERP customization and the implementation of these architectures in companies.

**Programme:**

• An introduction to ERPs.
• The Architecture of ERPs.
• SAP.
• The modules of an ERP.

**Level: Year 4**

**SPRING**

### MP02

**Collaborative engineering methods**

6 ECTS credits

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**Objective:**

• To learn the basis of technical information management and the functionalities of the PLMs.

**Programme:**
| Level: Year 5 | • Collaborative engineering and the extended company.  
• The process of technical information.  
• Data management and administration.  
• Implementation and integration of product lifecycle management in a technical information system.  
• Collaborative design of a product. |

| AUTUMN |  |

**MP03 Knowledge engineering, web semantics and Industrial Systems**

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**Objective:**
- To study a knowledge engineering approach within the framework of a project

**Programme:**
- A history of knowledge engineering and artificial intelligence
- Knowledge acquisition methods
- Knowledge modeling methods
- Representation of knowledge

**Level: Year 5**

| AUTUMN |  |

**MQ01 Strength of materials**

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<td>68hrs</td>
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**Objective:**
- To understand how to calculate parts and structure beam shapes, by introducing the concepts of mechanical constraints and deformations.

**Programme:**
- Constraints and plane deformations, linear elastic behavior.
- Study of simple strains (traction/compression, shearing, torsion, inflection).
- Study of hyperstatic systems.
- Study of complex strains.
- Taking into account geometrical irregularities: coefficient of stress concentrations.

**Level: Year 3**

| AUTUMN |  |

**MQ02 Introduction to solid continuum mechanics**

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**Context/Framework:**
- This course introduces the general tools and physical principles required for the calculation of stresses and displacements in mechanical components of complex geometry which are subject to complex stresses, the constituent material of which shows elastic behaviour.
MQ03

Dynamics and vibrations of mechanical systems

Objective:
- To be able to take into account the effects of mass, inertia, and strains of solid systems, on the movements and efforts of these solid systems.

Programme:
- Kinetics, balancing.
- Dynamic, radiant, discrete Lagrange equations.
- Discrete systems with or without damping, response in free and forced periodic oscillations.
- Vibrational damping, modal decomposition.
- Continuous systems, beams and plates, critical shaft speed.
- Shocks, random vibrations.
- Laboratory on models and laboratory on digital simulation.

MQ04

Properties of materials

Objective:
- To study the mechanical properties and behavior of various materials, with respect to the demands of their environment (metals, polymers, composites, ceramics).

Program:
- Microstructure of materials, crystallography, diffusion phenomena.
- Properties of materials: fatigue, rupture, creep, wear, corrosion and ageing.
- Calculation methods with respect to various properties.

MQ05

Choice of materials

Context/Framework:
This course allows students to acquire the basic knowledge required to manage the selection and application of various metallic and non-metallic materials.

Objectives:
**MQ06**

**Modeling structures using finite elements**

**6 ECTS credits**

**L** 34hrs
**SW** 30hrs
**PS** 12hrs
**PW** 68hrs

**Context/Framework:**
The dimensioning of mechanical structures involves the calculation of displacement fields, strain fields and stress fields, requiring the resolution of the issue of equilibrium. As analytical solutions cannot be obtained for complex geometries, the application of the finite element method (FEM) is therefore essential.

**Objective:**
- ability to formulate equations for the definition of equilibrium in a mechanical structure, in respect of linear elasticity
- knowledge of different methods for the resolution of various standard products
- knowledge of the weak integral form of equilibrium equations
- knowledge of the key stages of the FEM: geometric discretization, construction of a FE in a reference space, nodal approximation by sub-domains, weak elementary form, assembly, introduction of free fields, calculation of auxiliary fields
- ability for application to bar structures in space (lattices)
- ability for application to thin-walled beams, thick-walled beams and beam structures (gantries)
- ability for application to membranes (2D) and solid structures (3D)

**Prerequisite:**
MQ01, or MQ02

**Level:** Year 3

**Back to list**

**MQ07**

**Fluid mechanics**

**6 ECTS credits**

**L** 34hrs
**SW** 34hrs
**PS** 18hrs
**PW** 68hrs

**Objective:**
- To study the properties of fluids.
- To analyze and quantify their influences on mechanical systems.

**Program:**
- Fluid properties.
- Hydrostatics.
- Kinetics of fluids.
- Perfect fluid (non-viscous).
- Viscous fluid.

**Level:** Year 4/5

**Back to list**

**MQ06**

**Modeling structures using finite elements**

**6 ECTS credits**

**L** 34hrs
**SW** 30hrs
**PS** 12hrs
**PW** 68hrs

**Context/Framework:**
The dimensioning of mechanical structures involves the calculation of displacement fields, strain fields and stress fields, requiring the resolution of the issue of equilibrium. As analytical solutions cannot be obtained for complex geometries, the application of the finite element method (FEM) is therefore essential.

**Objective:**
- ability to formulate equations for the definition of equilibrium in a mechanical structure, in respect of linear elasticity
- knowledge of different methods for the resolution of various standard products
- knowledge of the weak integral form of equilibrium equations
- knowledge of the key stages of the FEM: geometric discretization, construction of a FE in a reference space, nodal approximation by sub-domains, weak elementary form, assembly, introduction of free fields, calculation of auxiliary fields
- ability for application to bar structures in space (lattices)
- ability for application to thin-walled beams, thick-walled beams and beam structures (gantries)
- ability for application to membranes (2D) and solid structures (3D)

**Prerequisite:**
MQ01, or MQ02

**Level:** Year 3

**Back to list**

**MQ07**

**Fluid mechanics**

**6 ECTS credits**

**L** 34hrs
**SW** 34hrs
**PS** 18hrs
**PW** 68hrs

**Objective:**
- To study the properties of fluids.
- To analyze and quantify their influences on mechanical systems.

**Program:**
- Fluid properties.
- Hydrostatics.
- Kinetics of fluids.
- Perfect fluid (non-viscous).
- Viscous fluid.

**Level:** Year 4/5

**Back to list**
MQ08  Dimensioning of structures by digital analysis and experimental stress analysis

6 ECTS credits

Context/Framework:
The dimensioning of mechanically-stressed structures in relation to their strength is a critical stage in the life cycle of any mechanical component. If it is to be executed correctly, this task requires the deployment of theoretical, numerical and experimental expertise in the analysis of stresses and strains induced in structures by external loads.

Objectives:
• ability for the analytical and numerical determination, using FE codes, of strains and stresses induced in structures by mechanical loads
• ability to analyse the elastic behaviour of structures of metallic and composite material construction
• ability for the experimental determination of mechanical fields using various optical methods: photoelasticimetry, speckle interferometry, Moiré geometry and image correlation
• ability to analyse the strength of mechanical structures using appropriate criteria for static loading and/or fatigue
• ability for the analysis of stress concentration problems
• ability for the dimensioning and optimization of structures, in respect of strength, by the application of various digital tools (ABAQUS, HYPERWORKS /Hypermesh, HYPERWORKS /OptiStruct)

Level: Year 4/5

Autumn

MQ09  Meshing and adaptation methods

6 ECTS credits

Context/Framework:
The resolution of the majority of physical problems formulated in terms of partial derivative equations is based upon the finite element method. As a spatial calculation medium, this method employs a mesh structure of the domain in which these equations are formulated. By its quality, this mesh structure is a fundamental factor which dictates the quality of the results of numerical calculations.

Objectives:
• knowledge of basic concepts in the finite element method: form functions and associated geometric elements
• ability for the geometric modelling of curves and surfaces: 2D models, 3D surface models and 3D volume models
• knowledge of general features of meshing: Triangulation versus Meshing – Meshing and Finite Elements – Error estimation - Adaptation of meshes and Applications
• expertise in conventional methods for the generation of meshes: Plane - Surface - Volume
• meshing in terms of scientific calculation: applications in solid mechanics, fluid mechanics and other numerical calculation disciplines

Level: Year 4/5

Spring

MQ10  Digital simulation of mechanical processes

6 ECTS credits

Objective:
• To digitally simulate various mechanical processes of manufacture.

Programme:
• Digital simulation in 2D:
- stamping and extrusion of complex structures.
- machining by chips removal.
- Digital simulation of thin structures:
  - stamping.
  - hydro-processing.
- Digital simulation of 3D structures.

**MQ12**

Materials and structure forming

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Objective:
- To understand the processes involved in the production of components.

Programme:
- Technological aspects of the production processes: forging, rolling, stamping...
- Introduction to less conventional processes: sintering, formed superplastic...
- Mechanical modeling of the production process using finite elements simulation software (Forge 2).

**MQ13**

Machines thermodynamics and thermics

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Objective:
- To master the concepts of thermodynamics and thermics.
- To apply those concepts to thermodynamic machines and thermal installations.

Programme:
- Energy transfer, phase change, transformation into open or close systems.
- Review of thermodynamics, 1st and 2nd principles.
- Thermodynamic cycles, efficiency, performance.
- Thermal transfer modes.
- Applications to thermal engines, turbines, heat transfer machines, recuperator.

**MQ21**

Shaping materials process and computing simulations

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Objective:
- To master numerically various shaping and making mechanical process

Programme:
- Technological aspects of conventional shaping process: forging, flattening, stamping
- Less conventional process and technological analysis in connection with a process: powder sintering, superplastic shaping, blasting.
- Reminder of the basic rudiments of non-linear mechanics and associate performance laws.
- Mechanical characterization and modelling for materials shaping
- Computing simulation of mechanicals process with softwares (Abaqus, PAM-Stamp and Forge)
- Innovative materials and adapted process.
**MS11**

**Physical measurement and instrumentation**

**6 ECTS credits**

**Objectives:**
- To acquire basic know-how of the measurement techniques used in laboratories and industry (physics, mechanics, chemistry, biology).
- To understand how to interpret measurements, to extract the maximum information from the measured signal, to choose the most appropriate device for a specific measurement that gives a result in accordance with the standards.

**Programme:**
- Results analysis, errors, uncertainties, standardized presentation of a measurement, measuring equipment (analog and digital devices).
- Analysis of a periodic signal, transport of information, noise.
- Sensors, measurement techniques.

**Level:** Year 1

**Autumn-Spring**

**Back to list**

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**MT11**

**Analysis and algebra revision**

**6 ECTS credits**

**Objective:**
- A revision of mathematics for students without a strong background in this subject, to bring everyone up to a common level.
- To master the basic techniques of algebra and analysis.

**Program:**
- Functions of several variables and limited developments.
- Curves and surfaces, vectorial analysis.
- Linear algebra: vector spaces, matrices and linear equation systems, diagonalisation.
- Integration: simple, double and triple integrals.
- Differential equations of the first and second degree with constant coefficients.
- Surface integrals.

**Revision course**

**Level:** Year 3

**Autumn**

**Back to list**

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**MT12**

**Mathematics for the engineer**

**6 ECTS credits**

**Context/Framework:**
Mathematical modelling is employed extensively in various fields of engineering. Mathematical techniques and numerical methods employed for the processing of problems are highly varied and sometimes complex. Good understanding is required to arrive at an effective resolution and the correct interpretation of results obtained.

**Objectives:**
- acquisition of basic theoretical principles and key direct linear methods for the resolution of linear systems
- understanding the influence of matrix conditioning
- ability to formulate a linear least-square problem and execute its numerical resolution (QR factorization)
- ability to characterize solutions to a non-linear optimization problem and the numerical determination of solutions by the basic (gradient) descent method
- understanding the principle of convolution and expertise in the application of the Laplace transform
- ability to apply the Laplace transform for the resolution of certain differential equations

**Level:** Year 3

**Autumn**

**Back to list**
MT13  
**Digital methods for the engineer**  
6 ECTS credits

**Context/Framework:**
In many engineering problems, the achievement of exact solutions is not possible, on the grounds of the complexity of the field of resolution and/or the non-linearity of equations for the problem concerned. The use of numerical methods is therefore essential for the achievement of approximate solutions.

**Objectives:**
- ability to formulate a physical problem in its strong form, and knowledge of the classification of elliptical, parabolic and hyperbolic problems
- knowledge of the finite difference (FD) method for the resolution of stationary EDPs and its application to 1D and 2D problems
- knowledge of the finite element (FE) method for the resolution of stationary EDPs and its application to 1D and 2D problems
- knowledge of methods for the resolution of linear problems: Gaussian method, LU decomposition, Cholesky, matrix conditioning
- knowledge of iterative methods for the resolution of non-linear problems: Jacobi method, Gauss-Seidel, Newton-Raphson, concept of convergence
- ability to apply all these methods to FE or FD problem resolution

**Prerequisite:** MATH03

**Level:** Year 3

MT14  
**Operational research**  
6 ECTS credits

**Context/Framework:**
Operational research is a discipline at the interface of applied mathematics and IT, and is used for the resolution of optimization issues and as a decision-making tool in economic and industrial activities.

**Objectives:**
- knowledge of optimization techniques based upon linear programming with continuous or whole-number variables, non-linear programming and dynamic programming
- modelling of common optimization problems in production and logistics
- encoding of a model and resolution in Excel

**Level:** Year 3

MTC01  
**Music, Technology and creation**  
4 ECTS credits

**Context/Framework:**
Technics related to creation, recording and listening to music are in constant evolution: digitizing of a signal, audio data compression, acoustics of a room are technical problems to deal with and to hide to the listener.

**Objectives:**
- To understand problems related to audio data digitizing (sampling, quantization)
- To obtain a background in audio data compression
- To obtain a background in acoustics
- To create a link between engineering studies and sound technics

**Level:** Year 3
NF02  General technology of computer systems  6 ECTS credits

Context/Framework:
The object of this course is to provide “basic” knowledge of the architecture and operation of computers, including key hardware components, from transistors through to virtual systems.

Objectives:
- understanding the benefits of the “layered” logic modelling of computers and networks
- understanding the purpose and operation of each layer, from transistors through to operating systems, in the case of computers, and from physical media through to E-mail protocols and web pages, in the case of networks
- understanding the key problems affecting computers and computer networks, and mechanisms for their resolution
- ability to conduct simple operations, involving intervention in the operation of a computer or a network

Level: Year 2

AUTUMN

NF04  Algorithmics  6 ECTS credits

Context/Framework:
In engineering, a structured approach is required to progress from a problem to the deployment of a solution. Stages of formal definition, specifications, analysis and the comparison of solutions are common to all problems in a variety of disciplines.

Program:
- formal definition of a problem and associated specifications
- structuring a process for the resolution of problems
- identification of recurrent elements in a resolution method
- management of database structures
- analysis of a complex problem, definition of sub-problems and stages of resolution
- translation of an algorithm into a programming language
- introduction to two languages: C and Visual Basic

Level: Year 1

AUTUMN-SPRING

NF05  Introduction to C language  6 ECTS credits

Context/Framework:
In engineering, it is necessary to describe the solution to a problem in the form of an algorithm, which is then translated into a program. This course involves familiarization with programming in C language which, together with its associated variants, is the most widespread language in use.

Prerequisite:
NF04

Objectives:
- understanding programming tools (syntax editor, compiler, debugger, etc.)
- ability to translate an algorithm into C language
- understanding the structure of a C program and basic features of language (types, operators, control structures, functions, pointers, tables, character strings, string lists, files)
- ability to use an algorithm for the production of a program in compliance with industrial requirements for the production of “good” softwares

Level: Year 2

AUTUMN
NF14

**Computer-aided management of industrial systems**

*6 ECTS credits*

**Context/Framework:**

NF14 involves the application, using various dedicated softwares for industrial management, of models and methods for the structuring of data, the planning of production and procurement, the management of stocks and maintenance.

**Objectives:**

- Analysis and implementation of a database using Access, generation of requests in SQL language and design of forms
- Use of a maintenance management software
- Conduct of a project for the implementation of ERP
- Application of the basic functionalities of ERP for production, and for logistics in general
- Calculation of requirements, knowledge of key stock management models and ability to apply ERP for their deployment

**Level:** Year 4/5

**Prerequisite:** GP06

**SPRING**

Back to list

NF15

**Advanced computer-aided design systems**

*6 ECTS credits*

**Context/Framework:**

Digital tools for the support of product design assist the engineer in the deployment of increasingly sophisticated digital prototypes. This deployment requires a detailed knowledge of tools and their operation.

**Objectives:**

- Knowledge and application of advanced 3D modelling methods (parametric approaches, skeletal approaches, 3D reconstruction methods)
- Understanding the limits of existing digital solutions (representations of curves and surfaces, approximations)
- Understanding a CAD data model and the development of a computer program for the fulfillment of an industrial requirement
- Consideration of genuine case histories and industrial operating feedback on the deployment of advanced computer-assisted design systems

**Level:** Year 4/5

**AUTUMN**

Back to list

NF16

**Databases**

*6 ECTS credits*

**Context/Framework:**

To understand and apply the fundamental concepts related to the creation and use of databases

**Objectives:**

- To model a database through the Entity Relationship approach
- To formalize the interrogation of databases by means of relational calculus and algebra
- To structure a relational database thanks to normalization
- To optimize requests, storage and access to data

**Level:** Year 3/4/5

**AUTUMN**

Back to list
NF18  
**PLM interoperability, Service and Virtualization oriented Architectures**  
6 ECTS credits

**Context/Framework:**
PLM platforms structure and host technical data for the description of a manufactured product. The deployment of these solutions involves issues of interoperability between heterogeneous platforms, and gives rise to the implementation of virtualized systems (for tests, developments and production).

**Objectives:**
- knowledge and application of stages for the deployment of a PLM solution in an industrial context
- knowledge of key PLM interoperability methods
- understanding and management of version changes on a PLM platform
- understanding and management of a virtualized PLM platform
- analysis of genuine case studies and industrial operating feedback on the deployment of virtualized PLM platforms

**Level:** Year 4/5

**Spring**

NF19  
**Administration and virtualization of systems and databases**  
6 ECTS credits

**Context/Framework:**
IT and information system engineers are regularly required to address the issue of system constraints. The object of this module is the communication of the basic principles of system administration (virtualization, operating systems, database administration).

**Objectives:**
- administration of a system in Linux (management of users, repetitive tasks, scripting)
- administration of a relational database management system (dimensioning and optimization of performance, back-ups and retrieval, security)
- application of a virtual infrastructure to data management

**Prerequisite:** Databases

**Level:** Year 4/5

**Spring**

NF20  
**Modeling and evaluation of complex systems**  
6 ECTS credits

**Context/Framework:**
Modeling and evaluating are key factors in the performance of computer systems. This module tackles graph-based modelling and associated efficient algorithms, together with the calculation of algorithmic complexity.

**Objectives:**
- To model problems using graphs, including spatiotemporal ones
- To solve problems applying efficient algorithms
- To identify the most appropriate data structures and algorithms for specific problems
- To compute asymptotic algorithm complexity (worst, best, average and optimum cases)
- To classify problems (P, NP, NP-complete, NP-hard) and solve them accordingly using relevant strategies

**Level:** Year 3

**Autumn**
NM01

Nanomaterials and nanotechnologies

Objective:
- To understand the characteristics and technologies associated with nanomaterials.

Program:
- To study the use of nanomaterials in nanomechanics (micro engines, microactuators, microchips...), nanoelectronics (electronic nanochips, material properties at the atomic and nanometric level, fullerenes, nanotubes...), nanoptics (optical effects on a mesoscopic scale...), biology (cell labelling, genetic sequencing, molecular reactions, laboratories on chips...), chemistry (atomic manipulation, auto-organization, nanomachines synthesis).
- Techniques for specific characterization (microscopes AFM, STM, SNOM...).
- Industrial assessment of the use of nano-materials and their potential applications.

Level: Year 4/5
Prerequisite: MA02, MA03

NR01

Regulations and conformity

Objective:
- To learn standards and regulations applied to companies regarding quality, environment, transport and safety.

Programme:
- Waste management: European regulations.
- Transport: strategy and solutions to material transportation.
- QSE: Quality-Safety-Environment, constraints and advantages for companies.
- EC regulations, ISO90XX, ISO140XX.

Level: Year 4/5
Prerequisite: TN09 Internship

NT01

Nanotechnologies and Industry

Objective:
- To present the principal physical effects (elementary excitations) associated with Nanosciences and to understand through seminars the technical stakes associated with Nanotechnological applications, (integration, large-scale Nanostructuration...).

Programme:
- Introduction: from elementary excitations to applications.
- Electronic confinement and semi-conductive nanostructures.
- Nanothermics.
- Nanomagnetism.
- Nanobiotechnology.
- Seminaries: glass processing, integration (for example in electronics) lighting and spintronics.

Level: Year 5

OB01

Basic scientific tools for the engineer

6 ECTS credits
Context/Framework:
Engineering frequently involves problems, the analytical resolution of which is highly complex, if not impossible. In this case, numerical simulation is a powerful tool, which provides a clearer understanding of the nature of the phenomena analyzed.

Objectives:

- identification of variables which play a key role in a physical phenomenon.
- establishment of a simple mathematical model (polynomial, differential equation, etc.) associated with the physical phenomenon under analysis
- computer simulation of the physical phenomenon concerned, using numerical calculation tools including interpolation, derivation and integration, or the resolution of differential equations
- investigation of the plausibility of a result, and ability to quantify errors associated with numerical calculations

Level: Year 3

OP01  
Optic and optoelectronic materials

Context/Framework:
Optics and optoelectronics are applied in key fields, including lighting, photovoltaics and telecommunications. The numerous materials involved have varying optical priorities, which are the subject of leading edge developments.

Program:

- understanding and describing the optical properties of dielectric, metallic and semi-conductor materials
- selection of materials or systems for the satisfaction of requirements identified in respect of the following: absorption, transmission, reflection, filtering, confinement, guiding, dispersion, emission, detection, polarization state
- practical skills: setting a laser, using a detector, connecting a source to an optical fibre, using a digital code to design a wave guide
- identification of manufacturers/suppliers of materials and systems for optics and optoelectronics

Level: Year 3

OS01  
Operational research basis and optimization

Objective:
• To give the operational research theoretical fundamentals and theoretical basics to tackle the optimization problems.

Programme:
• Mathematical modeling of optimization problems
• Linear programming and theory of the simplex method
• Duality theorem
• Integer linear programming and separation and evaluation processes
• Dynamic programming
• Nonlinear programming

Level: Year 5

OS02  
Decision and estimation: statistical approach

Objective:
• To be able to make a decision from measurements done on a system.
  Methods of unknown parameters estimation.

Programme:
Level: Year 5

- Reviews of probabilities. Basics of decision theory.
- Neyman-Pearson lemma. Bayesian test, the most powerful test, minimax test.
- Monotonous plausibility ratio, uniform most powerful test.
- Punctual estimation. Basics of estimation theory.
- Non-Bayesian estimation: moments method, plausibility maximum method. Comparison.
- Bayesian estimation and minimax. Estimation by interval.
- Applications: regression, Kalman filter, diagnostic, navigation.

Stochastic processes 4 ECTS credits

OS03

Objective:
- To understand the most common stochastic processes in the field of operating safety, production management and signal processing.

Programme:
- Markov chains.
- Skip-free markovian processes.
- Queuing.
- Renewal processes.
- Applications and practical examples

Most of the concepts will be used in operations safety applications.

Bayesian approach for inverse problems 4 ECTS credits

OS06

Objective:
- To understand the Bayesian approach and Bayesian calculation for ill-posed problems.

Programme:
- Resolution of inverse and ill-posed problems.
- Latent variables models: EM type algorithms and stochastic algorithms.
- Markov chain Monte Carlo methods (MCMC).
- Online Bayesian estimation: tracking with Kalman filtering and particular filtering.
- Mini-projects: time series prediction in econometrics; deconvolution/images soundproofing; moving targets detection and tracking.

Models and algorithms for production planning and scheduling 4 ECTS credits

OS10

Objective:
- To understand the main approaches for problems resolution in production planning and scheduling.
OS11

Models and algorithms for logistics and transport

Objective:
- To study the main resolution concepts, models and methods for supply chain and logistics optimization.

Programme:
- Supply chain: introduction to supply chain management, logistic network configuration, inventory management, information sharing and strategic partnerships, supply chain integrated planning.
- Transportation: pick-up and delivery rounds problems, exact methods (branch and bound, branch and cut), simple heuristics, metaheuristics, extra constraints (slack time for example).

Level: Year 5

OS13

Reliability and maintenance modeling

Objective:
- To understand the basics in systems reliability.

Programme:
- Probabilistic models on component service life.
- Stochastic processes in reliability and maintenance.
- Systems reliability with independent components.
- Markov models (restorable systems, with dependent components).
- Policy models in preventive maintenance.
- Dependent failures (with joint cause).
- Safety instrumented systems.
- Introduction to dynamic reliability.
- Mini-projects: application of the methods on operating safety softwares.

Level: Year 5

OS14

Pattern recognition and control applications

Objective:
- To understand the most recent pattern recognition methods and their implementation within a control context.

Programme:
Learning problems.
Adjustment.
Hilbert spaces
Reproducing kernel Hilbert spaces.
Least squares methods, support vector method.
Variables selection and parsimonious approximation methods.
Non-supervised learning techniques.
E-learning
Mini-projects in Matlab.

PC04
Joint project in environment
Objective:
To do some research in environment and sustainable development.
Programme:
Principles and methodologies of the research in environment and sustainable development.
Work based on scientific publications or research projects.
Applied research in environment and sustainable development.
Seminars with junior and senior researchers.

PH15
The rise of technology and the crisis of progressive ideas
Context/Framework:
Reflection on technical and technological development leads us to reconsider the modern idea of progress. Given its potential status as a threat to the environment and the human race, there are grounds for considering its ethical, political or legal limits.
Objectives:
making enlightened choices and adopting responsible decisions on the basis of systematic investigation and reflection
development, structuring and articulation of a reasoned and disciplined personal argument
confident assumption, confirmation and defence of a stance in the face of opposing protagonists
consideration and formulation of contemporary issues associated with the development of technologies
incorporating considerations of purpose and values in professional activity

PH19
Man: between nature and culture
Context/Framework:
Contemporary thinking has revolutionized relations between concepts of nature and culture, in response to advances in paleoanthropology, physical and biological sciences, and ethology. Today, the focus is no longer on the distinction between what is associated with one concept or another, but upon the determination, within a culture, of what can still be perceived or classified as natural.

Objectives:
- conduct of a debate or group discussion, accommodating a variety of viewpoints
- engagement in a personal and fundamental reflection, involving the potential querying of preconceptions
- formulation of a concept or a question
- integration and articulation of a scientific culture in personal thinking
- the confident adoption of a stance or position on an issue, which can then be defended with conviction

SPRING

**PH20**

**Introduction to scientific philosophy**

**Context/Framework:**
The philosophy of sciences investigates the origin and status of scientific knowledge, its specific characteristics, its purpose and application, through the analysis of certain concepts, including theory, experience, scientific truth, laws, measurement, etc.

**Objectives:**
- engagement in a personal and rational reflection, with the effective application of critical thinking and avoiding any dogmatism
- formulation of a concept or a question
- integration and articulation of a scientific culture in personal thinking
- contextualization and consideration of knowledge and expertise in perspective, identification of issues (philosophical, ethical or social) involved in scientific and technical practices
- adopting a reflexive approach to the scientific process

**AUTUMN**

**PHYS01**

**Physics basics for the engineer**

**Context/Framework:**
Many everyday objects function on the basis of electrical or mechanical processes of varying complexity, the basic principles of which are introduced in this course.

**Objectives:**
- analysis of the physical behaviour of simple electrical or mechanical systems
- modelling the behaviour of these systems
- application of an existing mathematical model (limiting conditions, fields of application, limits of the model, etc.)
- application of mathematical tools which are essential for physics
- establishing a link between electrical and mechanical processes

**Level: Year 1**

**AUTUMN-SPRING**

**PHYS02**

**Mechanics**

**Context/Framework:**

**Objectives:**

**Level: Year 1**

**6 ECTS credits**
Context/Framework:
Non-deformable solid mechanics can be applied for the understanding and
description of the operation of systems used in everyday life and in the industrial
world. This is an essential science for the design of mechanical systems.

Objectives:
• Exclusive consideration of equipment assemblies comprised of non-deformable
  solids:
  • modelling of mechanical actions (mechanical action torsor, contact force density,
    friction)
  • analysis of kinematics (kinematic torsor, acceleration)
  • determination of kinetic and dynamic variables (kinetic and dynamic torsors,
    kinetic energy, power)
  • consideration, equational expression and resolution of static and dynamic
    problems
  • interpretation of results obtained vis-à-vis the operation of the system modelled

Level: Year 2

PHYS03
Fields, waves, vibrations, and their spreading
6 ECTS credits

Context/Framework:
In engineering, fields and waves are involved in the characterization of materials,
telecommunications, mechanical engineering, metrology, electromagnetism, etc..

Objectives:
• physical and mathematical description of fields (static, damped, oscillating) and
  waves (scalar, vector, etc.)
• identification, expression and resolution of simple wave equations
• determination of solutions to wave equations as a function of limiting conditions,
  manipulation and exploitation of their key properties (propagation, dispersion,
  propagation in a guide, stationary waves, etc.)
• identification, awareness and exploitation of phenomena (interference, diffraction,
  etc.)
• establishment of links between mathematical expressions, physical properties
  and observable phenomena
• Interferences and diffraction
• Introduction to quantum mechanics

Level: Year 2

PHYS04
Thermics, energetics and thermodynamic machines
6 ECTS credits

Context/Framework:
In engineering, thermodynamic properties involve materials, devices and machines
for the production or use of energy, including transport, energy transformation,
heating or cooling systems

Objectives:
• understanding the concept of an equation of state, and the construction thereof
  for a gas
• understanding the concept of internal energy, determining the work of forces and
  quantities of heat exchanged in case of simple changes in closed systems
• identification of different forms of heat exchange and the application of
  elementary laws and associated equations (conduction, convection, radiation)
• understanding the concept of entropy and the operation of thermodynamic
  machines
• analysis of motor and generator cycles and calculation of their efficiency

Level: Year 2

Back to list
**PHYS05**  
**Conversion, transfer and transformation of electricity**  
6 ECTS credits  

| L  | 34hrs  | Context/Framework: Analysis of electromechanical and static energy converters (transformers, electric machines, photovoltaic panels, rectifiers, inverters) and their main industrial applications (generation and transformation of energy, speed variation, etc.).  
| SW | 34hrs  |  
| PS | 18hrs  |  
| PW | 68hrs  |  

**Level:** Year 2  

**Objectives:**  
- knowledge of physical principles applied for the conversion of energy in electric machines  
- understanding the operation of static and dynamic converters  
- establishment and resolution of equations associated with energy converters  
- knowledge of the characteristics of a three-phase electricity system  

**SPECIALIZATION**  

Back to list

**PO03**  
**Introduction to political life**  
4 ECTS credits  

| L  | 34hrs  | Objectives:  
| SW | 17hrs  | - To understand the fundamental ideological and sociological reference marks of current political life: advanced democracies (project, new challenges and limits), totalitarianisms...  
| PW | 60hrs  |  

**B2 level in French required**  

**Programme:**  
- Fundamental theories of political regimes (State, nation, citizenship, powers separation...).  
- Analysis of totalitarianisms and contemporary democracies.  
- French institutions and supranational democracies (political parties, role of the government, the laws and payments, role of Europe, UNO...).  
- New challenges to democracy (abstention, racism, civil society...).  

**AUTUMN-SPRING**  

Back to list

**PR01**  
**Metallic materials processing**  
6 ECTS credits  

| L  | 34hrs  | Context/Framework: Metallic materials assume a key role in the design of various products. Accordingly, for their application, it is necessary to understand not only their deployment (hardening, processing and protection) but also their behaviour in an aggressive environment (corrosion).  
| SW | 34hrs  |  
| PS | 20hrs  |  
| PW | 51hrs  |  

**Prerequisites:**  
- MA11  

**Level:** Year 3  

**Objectives:**  
- understanding mechanisms and procedures for the processing of metal alloys (forging, pressing, die-stamping casting and sintering)  
- understanding hardening mechanisms and processes (martensitic quench hardening, structural hardening, strain hardening)  
- understanding mechanisms and processes for mechanical surface modification (thermochemical treatments, mechanical surface treatments)  
- understanding degradation and surface protection mechanisms in a corrosive environment  

**SPECIALIZATION**  

Back to list
RE01  Corporate networks

Objective:
• To understand the essential concepts of corporate network fields.

Programme:
• Topologies, access techniques and various supports.
• Local networks: ethernet, token ring, token bus.
• Metropolitan networks.
• Broadband networks: fast ethernet, high speed token ring, LANE...
• PAN (Personal Area Networks), WLAN, bluetooth...
• Network interconnections.
• IP protocol, global addressing
• Ethernet IP relation

Prerequisite: NF02
Level: Year 3/4

AUTUMN

Back to list

RE02  Information transmission

Context/Framework:
This course addresses various transmission techniques and parameters, according to the media used.

Objectives:
• understanding the various stages involved in the digitization of an analogue signal
• understanding and implementing a digital communication chain
• ability to detect interference between symbols in baseband communications
• understanding and comparing different arrangements for digital modulation and demodulation
• understanding the principle of optical communications
• understanding the origin of attenuations and dispersion in optical communications
• proposal of technological solutions for the improvement of the performance of an optical communication chain

Level: Year 3

SPRING

Back to list

RE04  Internet networks

Context/Framework:
Internet networks employ a variety of transfer and control technologies. It is important to be familiar with the fundamental techniques of extensive networks, for the purposes of integration.

Objectives:
• knowledge of key network functions (transmission, commutation, routing, multiplexing)
• knowledge of basic definitions for the OSI model, for the purposes of subsequent reference to these definitions
• knowledge of the principles of TCP/IP architecture and network interconnection
• understanding resource management in the interests of service quality
• understanding the Internet nomenclature system, the DNS address resolution system and key services: messaging, web services

Level: Year 3/4

SPRING

Back to list
Security of internet networks

Context/Framework:
Internet networks use various transfer and control technologies. It is quite important to know the fundamental techniques used by wide area networks for further integration.

Objectives:
- To know the definitions and concepts of the OSI model
- To master the TCP/IP architecture and internetworking
- To understand the naming system of internet and main services: http, smtp
- To master the main network functions (transmission, switching, routing, multiplexing)

Level: Year 4/5

Enterprise telephony

Objective:
- To study the concepts, methods and techniques of enterprise telecommunications.

Programme:
- Voice coding.
- Telephony in switching mode (TDM, signaling, PABX, circuits emulation).
- Telephony services (SS7, Q931, intelligent network).
- Service quality.
- VoIP signaling: H323, SIP, IAX.
- Computer Telephony Integration (CTI).
- New networks generations for telephony (NGTN).
- Security.
- Evolution, migration strategy.

Level: Year 4/5

Network services

Context/Framework:
RE12 concerns the services deployed on network structures which are connected to the Internet. This course introduces elementary services, from concepts and protocol design principles through to standard implementations. IETF standardization is also addressed through the conduct of binomial projects.

Objectives:
- understanding and management of the functionalities delivered by higher layer protocols (transmission, session and presentation) and knowledge of current protocols for their implementation (e.g. TCP, UDP, SIP, ASN.1 and XML)
- knowledge and understanding of elementary network services (resolution of names, directories, web services and administration)
- deployment of elementary network service functions in standard implementations (Bind, OpenLDAP, Net-SNMP)
- knowledge of production technologies for the cloud service and OpenStack implementation

Level: Year 4/5

Mobile and wireless networks

Objectives:
- study of key concepts, methods and techniques of mobile and wireless telecommunications.
- understanding of various network service aspects: access networks, core networks and standardization bodies.
- knowledge and understanding of the architecture, protocols and technologies of 3GPP, 3GPP2, and WiMAX

Level: Year 4/5
**Objective:**
- To present a general overview wireless and mobile networks at different levels, the current technologies, those in development and the future technologies.

**Programme:**
- Physical layers of wireless and mobile networks.
- Ad hoc networks.
- Wireless networks mobility.
- Cellular networks: GSM, GPRS, UMTS.
- Introduction to 4G and IMS.
- Mesh networks and wireless sensors.

**Prerequisite:** RE04

**Level:** Year 4/5

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**RE14**

**IP networks**

- **6 ECTS credits**

**Objective:**
- To understand the architectural problems of IP networks (internet/intranet) and be able to implement and manage an enterprise network.

**Programme:**
- Hardware architecture of enterprise networks.
- Software architecture of enterprise networks.
- Segmentation (VLAN,...)
- IP addressing
- IP routing.
- Administration (NAT, ACL, VPN,...)
- IPv6.
- Possibility to take the CCNA Cisco certification

**Prerequisite:** RE01

**Level:** Year 4/5

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**RE15**

**Service quality networks and interconnection**

- **6 ECTS credits**

**Objective:**
- To understand the technical difficulties of the interconnection of heterogeneous networks while maintaining a quality of service from beginning to end.

**Programme:**
- Definition of service quality (QoS), indicators of QoS, metrology.
- SLA (Service Agreement Level)/SLS (Service Level Specification).
- Models of QoS at level 2 (ATM, Frame Relay, Ethernet 802.1p and 802.1q).
- IP structures for quality of service (IntServ/RSVP, DiffServ).
- MPLS structure (Multi-Protocol Switching Label).
- Management of QoS by politics.
- QoS in mobile networks.

**Prerequisites:**
- RE04

**Level:** Year 4/5

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**RE16**

**Network security**

- **6 ECTS credits**

**Context/Framework:**
- A variety of strategies must be combined in order to ensure the security of IT communications and infrastructures: in applications themselves, in the computer operating system, and in the network itself. RE16 focuses on the contribution of
Prerequisite: RE01

Level: Year 4/5

Objectives:
- ability to design or modify a network for the achievement of a sound logical structure, as a prerequisite for security
- understanding and deployment of tools for the administration and protection of the network infrastructure itself
- understanding and deployment of a strategy for the filtering of communications
- deployment of a firewall for filtering and IPSec interconnection
- understanding Radius architecture for the control of network access
- understanding and deployment of a certification architecture for the security of web-based communications

Possibility to take the CISCO “Network Security” test.

AUTUMN

RE20

Operators networks

6 ECTS credits

Objective:
- To understand the stakes of operators networks and know the associated technologies.

Programme:
- Operators networks architectures and different types of operators.
- Technology of high speed links.
- Collection technology.
- Public addressing.
- Operators internal routing: OSPF, IS-IS, iBGP.
- External routing: BGP.
- MPLS.
- Associated services for operators networks.

SPRING

RE21

Uses, services and ergonomics of terminals

6 ECTS credits

Objective:
- To understand the telecommunications uses/services/ergonomics link around communication terminals.
- To design services for mobile terminals by using user-centered design methods.

Programme:
- Services design and evaluation.
- New communicating objects.
- Acceptability of new services.
- Services design, marketing and implementation.
- Functional and surface ergonomics of the terminals.
- Development of Human-computer interaction (HCI) in Java for mobile applications.

SPRING

RE23

Network control and management

6 ECTS credits

Objective:
- To study the necessary basics in order to be able to manage, administrate, and control a network environment.

Programme:
Level: Year 4/5  
Prerequisite: RE04

- Management platforms: concept of domain, informational models, architectural models, communication models and functional models.
- Normalization and recommendation: CMIS/CMIP, SNMP, TMN.
- Various manufacturers’ products.
- Approach to the Web.
- Presentation of real cases from various companies.

**SPRING**

### SC00

**Introduction to communication**  
4 ECTS credits

**Context/Framework:**
Through the presentation of key theories of Information and Communication Sciences (ICS), this course equips students with the necessary scientific knowledge for the improved perception and analysis of interpersonal, organizational and social communication situations.

**Objectives:**
- understanding and effective management of communication: face-to-face, mass media, media-based communication using digital technologies, inter-cultural communication, etc.
- analysis of communicative texts, wordings and images: advertising, propaganda, logos, posters, tracts, forums, etc.
- critical analysis of the complexity of communications, and the consideration of individual and collective issues: relationships, power, influence, self-image, otherness, etc.

**AUTUMN-SPRING**

### SC01

**Corporate communication**  
4 ECTS credits

**Context/Framework:**
The instructors for this course are recognized specialists in corporate communications. They train students in key concepts and methods of communication within companies and organizations. In this training, the accent is placed on empirical case studies.

**Objectives:**
- management of corporate communications: in-house, event-related, crisis-related, external, institutional, environmental, public, local, communications with elected representatives, the media, etc.
- utilization of key communication tools according to the situation: development of a communication plan
- awareness of identity-related, social and human issues associated with corporate communications: information, transparency, motivation, lobbying, promotion, crisis management, etc.

**SPRING**

### SC02

**Communication and the media**  
4 ECTS credits

**Objective:**
- To learn to use the tools of speech analysis and the semiology of images to decipher how media communication functions.

**Programme:**
SC04

Communication, persuasion and social influence

4 ECTS credits

Objective:
• To understand the workings of human communication: nonverbal communication, group influence, theories of persuasion, etc.
• To use the theories and models presented to analyze situations of communication: interactions in groups, ads, collective decisions, etc.

Programme:
• Social psychology
• Conformism and submission to authority
• Group dynamics, social network
• Persuasion and manipulation
• Communication of emotions

Minor: COESO

B2 level in French required

SC05

Cognitive psychology and work psychology

4 ECTS credits

Objectives:
• To allow the future engineers to better react to individual mental activities at work (problems solving, information research, errors management…).
• To understand approaches of psychology on professional life (recruitment, conflicts)

Programme:
• Representation, memory and attention.
• Judgement and decision making.
• Reasoning and problem solving.
• Work conditions and their effects.
• Evaluation and orientation.
• Human reliability and human error.
• Activity analysis at work.

B2 level in French required

SC06

Use of communication and innovation technologies

4 ECTS credits
L 34hrs  |  SW 17hrs  |  Objectives:
- To understand the stakes of communication technologies design and use.
- To understand the problematic of technical innovation.
- To master different methodologies related to ICT and innovation

Minor: COESO
B2 level in French required

Programme:
- Rise of mobile phones and their uses around the world.
- The different communication technologies on internet (chat, forum, instant messaging).
- Emails and PowerPoint in professional environment.
- Different innovation approaches especially at technical level.

AUTUMN-SPRING

SC07

Communication and scientific and technological mediation
4 ECTS credits

L 17hrs  |  SW 34hrs  |  PW 60hrs
Objectives:
- To know how to pass technical and scientific elements on to non-specialists within their future company or organization both in writing and in oral
- To be able to exchange with the general public about scientific and technical strakes
- In a general way, to know how to submit a phenomenon, a result or a scientific or technical concept convincingly

Programme:
- Basic rhetoric rules, scientific journalism techniques, reflection on the relationships between science, technology and society
- Writing (popular scientific work) and oral (general public lecture, exchange with civil society or with research players) training
- Emails and PowerPoint in professional environment.
- Scientific mediation project management (fête de la science...)

AUTUMN

SD10

French expression and communication, and documents research
2 ECTS credits

L 14hrs  |  SW 14hrs  |  PW 20hrs
Objectives:
- Learning the basics of French speaking and writing techniques, and documents research

Programme:
- Basics of writing (synthesis)
- Oral presentation
- CV, letter of motivation, professional interviews
- Access to literature database.
- Literature synthesis.

AUTUMN

SE01

History of economic concepts
4 ECTS credits

L 34hrs  |  SW 17hrs  |  PW 60hrs
Objective:
- To understand the general currents of the economic thought.

Programme:
- The early history of economic ideas.
- Adam Smith, John Maynard Keynes.
- Is the triumph of liberalism (Friedrich Von Hayek, Milton Friedman) definitive?
- Uprising of the anti-globalization movement.
SE02

Basic economics for the engineer

Objectives:
• To study various economic mechanisms and their interactions.
• To understand the principal factors which influence economic agents and companies.

Programme:
• Main economic currents.
• Introduction to macro-economies.
• European economic and monetary politics.
• Sensitization of the financial markets.
• Study of topical subjects: future of the European Union, consequences of globalization and environmental risks.

Level: Year 5

SG11

Social and societal risks, economic intelligence, cybercrime

Objective:
• Risk sociological approach / violence sociology and social risks.
• Conflict geopolitics, social networks, economic intelligence

Programme:
• Social and environmental risks
• Cybercrime and societal influence
• Anticipation, political sociology, global strategy
• European institutions and the different political structures
• Global and transversal view on the contemporary threats

Level: Year 5

SG12

Human and goods security: safety policy and transversal concept

Objective:
• To define a security concept, the security role and actors.
• To elaborate a policy regarding prevention and internal security, case studies and presentation of the security local contract, city policies.
• To understand the role and status of the different security co-actors by having a transversal view.
• To define a safety economy and to present a factual and situational prevention

Programme:
• Security concept, diagnostic and evaluation.
• Policies regarding prevention and security.
• Safety: new transversal and global concept.
SG21

Security of private / financial / industrial places – 1st part

4 ECTS credits

Objective:
- To study the environmental problems.
- To study the regulation and the different standards regarding hygiene, requirements related to fire safety for governmental and private buildings, safety institutions and their roles, the different risk prevention councils and committees, risk prevention local policy.
- To present and understand the security expectations of social economic actors and governmental, industrial and commercial societies.

Programme
- Fire, hygiene and building safety standards / governmental, social, industrial and commercial societies and their security expectations.
- To understand the safety needs of the social economic actors and the governmental, industrial and commercial societies.

Level: Year 5

SG22

Security of private / financial / industrial places – 2nd part

4 ECTS credits

Objective:
- To present the security policy regarding defence, technology and the new forms of conflicts, new theatres of war and forces projection; the national defence concept, military recruitment, the major risks and the crisis communication and the stakes of security economy.

Programme
- Security and national defence / major and industrial risks / communication analysis and management.
- Security economy: stakes and mutation.
- To anticipate and set up crisis communication.
- To understand and manage risks, contingency plans, actors coproduction and complementarity, industrial risk, risk prevention and technology.

AUTUMN

SG31

Systems and networks security – 1st part

4 ECTS credits

Objective:
- To design, structure and evaluate the preventive and corrective system measurements.
- To understand the engineer methodology and the monitoring tools of operating safety systems.
- To study the engineer methodologies and the different emergency sciences approaches and the knowledge application.

Programme
- Systems analysis.
- Systems design and safety.
- Emergency sciences and knowledge management.

AUTUMN

SG32

Systems and networks security – 2nd part

6 ECTS credits

Objective:
- Information systems protection difficulties and strategies.
- Security and safety problems in urban environment, mapping creation,
Level: Year 5  

technology intake, systems modeling and comparison of urban policies.
- Professional orientation and adaptation to security technologies.
- Presentation of emergency exercise, visit of an intervention service and practical observation of emergency exercise, private security and video surveillance practical applications.

Programme:
- Information systems security / urban systems engineering.
- Professionalization and new security technological strategies.
- Safety and security systems applications.

AUTUMN

SG41  

Fundamentals of crisis management

Objectives:
- To describe and manage the main phases of a crisis, from planning to impact

Programme:
- Definitions and characteristics of a crisis, the main phases of a crisis, the shift from normal to crisis conditions.
- The impact of a crisis, from management to planning.
- The development of international structures, coordinated management and cooperation.
- Experience feedback and short and long rapidly spreading crisis.
- Authorities, actors and doctrines/theories.

AUTUMN

SI10  

Training in writing and oral communication

Objective:
- To perfect oral and writing communication, thanks to the acquisition of effective and rational methods.

Programme:
- Basics of writing communication (notes).
- Oral presentation
- CV, motivation letters, professional interviews.
- Access to documentary databases
- Production of documentary syntheses

AUTUMN-SPRING

SI11  

Writing and oral communication for the engineer

Objective:
- To study the essential techniques of written and oral communication for the engineer: search for use and specificities of business communication.

Programme:
- Preparation in techniques of animation and management for groups.
- To improve oral expression (structuring, argumentation, gesture, self-control).
- Oral expression in professional situations.
• Administrative and commercial correspondence, reports and scientific presentations.
• Scientific and technical communication.
• Graphic communication.
• Emails, telephone.

**S**

**Foreign language tutoring**

4 ECTS credits

**Objective:**
• To allow a student or a group of two students, having already reached a very good level in a foreign language, to consolidate and reinforce their assets.

**Program:**
• Personal work, followed by a lecturer-researcher in the selected foreign language (English, German or Spanish).
• SL will thus have to be defined jointly by the lecturer-researcher and the student(s) before being submitted to the jury for validation, using the same procedure as for the TPE course.
• The course will be evaluated on the basis of two operations: a written report, and an oral presentation, carried out in the selected foreign language.

**SM02**

**Advanced modeling of finite elements structures**

6 ECTS credits

**Objective:**
• To apply the Finite Element Method (FEM) on elastic structures like beams, plates and body structures with small strains in linear statics.

**Program:**
• Static equilibrium and associated dynamics formula (integral forms).
• Introduction to Finite Element Method.
• Formula for elements like thin beams, thin and thick plates and shells.
• Applications to 2D and 3D structure problems.
• Use of different finite elements softwares (Ideas, Catia Analysis, Abaqus).

**SM06**

**Design of torqued thermodynamic phenomena**

6 ECTS credits

**Context/Framework:**
In the design of mechanical systems, the engineer is required to undertake the dimensioning of systems which are subject to complex thermal and mechanical loads. The ability to formulate behavioural equations which take account of
interactions between various thermomechanical processes is therefore essential.

**Program:**
- knowledge of different modelling systems and the key assumptions applied in each of these modelling systems
- knowledge of infinitesimal transformation mechanics in continuous media (HPP): laws of conservation, thermodynamics in continuous media, the concept of state variables and the local state method
- applied knowledge for the behavioural modelling of thermo-elasto-(visco)-plastic solids
- applied knowledge for modelling of the interaction between ductile behaviour and damage, for the modelling of ductile failure
- ability for the identification of models by an inverse approach

**AUTUMN**

**SH01**

**Basics and models in sociology for the engineer**

**6 ECTS credits**

**Context/Framework:**
This course is primarily an introduction to sociology. It then goes on to deal with organizations, which are analyzed from different perspectives (power, etc.). Phenomena associated with working situations are then considered (motivation, etc.).

**Objectives:**
- ability to employ sociological categories of analysis for the improved understanding of current events
- ability to integrate in a professional environment, drawing upon and consolidating the experience derived from course TN05
- ability to use sociological analysis tools for the description and understanding of professional situations
- management of the interaction of motivation, stress, group dynamics and decision-making in an organization
- ability to undertake a structural diagnostic analysis of an organization
- ability to conduct and analyze a semi-directive interview

**SPRING**

**SO02**

**Social risks, the geopolitics of conflicts and an introduction to new risks**

**4 ECTS credits**

**Objective:**
To study the phenomena of individual or collective violence in a society.

**Program:**
- Social and societal risks and derived
- Construction of state models in globalization
- City, events, crisis, safety players
- Strategy, geopolitics conflicts initiation
- New risks/crisis management and paradoxes (organized crime, new forms of act and malevolence...)
- The place of the citizen, the state and public opinion
- New challenges for internal security and national defense
SO03

An introduction to economic intelligence and players’ strategy at global level

4 ECTS credits

L 34hrs
SW 14hrs
PW 60hrs

From a psycho-socio-political approach, to understand the big events having impacts on steps, fractures and relational mechanisms of democratic society.

Objective:
- Economic intelligence consists in the control and the protection of strategic information by any economic and institutional player.
- To grasp globalization and gain knowledge of participants in geostrategy.
- To identify the main threats on the collection of immaterial intelligence.
- To gain in-depth knowledge of the environment of Economic Intelligence players, to have references.

Program:
- To understand the « Global World » and changes in threats.
- A presentation of the players ‘main vulnerabilities.
- The synergy between the public and the private sector and networking at stake.
- National scheme, cartography and organization of company supporting networks.
- The protection of strategic information for any economic and institutional player.

Prerequisite:
SO02

B2 level in French required

SO04

Security, State and responsibility

4 ECTS credits

L 30hrs
PS 14hrs

Objective:
- Analyze and apprehend the juridical phenomena that could involve the responsibility of artificial and physical people at the adjudicator.
- Help for decision-making and understand the administrative mechanisms.

Program:
- Presentation of administrative contentious, administrative jurisdictions, influence of international and community standards regarding responsibility.
- Person’s administrative responsibility: concept, range and principles.
- Responsibilities in protected subjects: public health, protection of life.
- Responsibility regarding administrative policy, law and order: needs, restrictions and limits.

B2 level in French required

SO05

Risky sociotechnical systems management

4 ECTS credits

L 26hrs
SW 26hrs
PS 60hrs

Context/Framework: Understanding the operation of complex risk systems, incorporating technical, cognitive and organizational dimensions, is a key issue. This understanding is a prerequisite for the design and operation of resilient and error-tolerant socio-technical systems.

Objectives:
- understanding the development of viewpoints on the safety of systems
- analysis of explanatory factors for the reliability of risk systems (individual and collective cognition, structure of organizations)
- application of frames of reference for human error
- deployment of retrospective accident analysis methods and tools (FTA, CREAM, FRAM, etc.)

B2 level in French required
### SO08  Introduction to team management in companies

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**Objective:**
- To use the knowledge of professional environment acquired during an internship.
- To acquire the analysis tools of the professional situations in companies.
- Acquire team management tools.

**Programme:**
- Introduction to organizations and companies sociology.
- Analysis of professional situations experienced or observed in companies.
- Power relations between professionals within organizations.
- Relational effects of communication modalities.
- To understand the company constraints.

**French required**

**B2 level in French required**

**Autumn**

### SP01  Introduction to sports animation / coaching

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**Context/Framework:**
The lectures will approach the necessary concepts (project management and sport science) necessary to the design of athletic activity sessions.

During SW, the student is responsible for two training sessions, he becomes coach to other students and offers a sport animation.

**Objectives:**
- To create specification (animation project)
- To organize and manage work sessions
- To know and identify one’s expertise in the field of management (project and team)

**Autumn-Spring**

### SP02  Sports coaching

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**Context/Framework:**
The lectures will approach the necessary concepts (project management and sport science) necessary to allow the organization of an animation project and the coaching of a team sport.

For a few weeks, the student is responsible for a team and hosts sports sessions.

**Objectives:**
- To manage a team
- To communicate
- To manage a project, and optimize the performance of a team
- To plan, evaluate and analyze the performance of a team

**Autumn-Spring**

### SP03  Qualified coach

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**Context/Framework:**
This course will allow the student to get a level of competence in the field of training or animation. The qualification received is approved by a French Federation: sports
Prerequisite: coaching or referee.

Objectives:
- To manage a team
- To communicate
- To manage a project, and optimize the performance of a team
- To plan, evaluate and analyze the performance of a team
- Ministry of Youth and Sports training: federal or state diploma.
- Training in refereeing of the sport discipline chosen.

AUTUMN-SPRING

SP11

Sports performance project

4 ECTS credits

Context/Framework:
Performance related subjects (Anatomy, Physiology, Psychology, etc…) will allow the student to design a training project.
Several sports sessions will focus on the development of teamwork and development of physical condition.

Objectives:
- To organize a performance driven project.
- To know and understand the different parameters that can influence a performance (anatomy, physiology, diet, state of mind, etc…)
- To work as a team and cooperate
- To manage an effort and improve its performance
- To know how to manage emotions during a competition

AUTUMN-SPRING

SP20

Sports event organization

4 ECTS credits

Context/Framework:
This course will help the student in understanding the organization of a sporting event (market, communication, commercial relations, event-security). In this course, the student will be part of a team to design, organize and host a sporting event.

Objectives:
- To manage a team and project
- To build partnership requests
- To understand the particularities of the sporting world in various fields (marketing, communication, event security, budget, etc…)

SPRING

SY01

Introduction to probabilistic calculation and modeling

6 ECTS credits

Context/Framework:
The key focus is the presentation of definitions and properties associated with random variables and vectors.

Objectives:
Level: Year 2  

- familiarization with the concept of a random event and probability.  
- understanding and mastering the fundamental principles of probability calculation.  
- ability for the correct formulation of a problem based upon random data or information, in order to define the correct procedure for the execution of appropriate probability calculations and the generation of a solution.

AUTUMN

SY02  
Statistics for the engineer  
6 ECTS credits

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Context/Framework: This course introduces the basic statistical methods and tools which an engineer is required to master. This course therefore involves the presentation of theoretical elements (estimation, hypothesis testing, analysis of variance), and their application in SW and PS using the R free software environment.

Objectives:  
- identification and correct formulation of a problem involving random data, for the definition of statistical tools and approaches to be deployed  
- expertise in fundamental theoretical concepts for the accurate understanding and interpretation of the results produced by statistical calculations

Level: Year 3

AUTUMN

SY04  
Tools for networks design  
6 ECTS credits

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Context/Framework: The deployment of networks involves the modelling and evaluation of performance in the design analysis phase.

Objectives:  
- knowledge of the basic principles of graph theory, ability to use this tool for the modelling of network problems, and the ability to deploy basic algorithms (graph exploration, identification of connected and strongly-connected components, spanning trees, flow charts and stream graphs)  
- introduction to the theory of discrete time and continuous time Markov chains and their application in process modelling  
- use of simple queues and queue networks to determine network performance parameters

AUTUMN

SY05  
Tools for decision-making strategy  
6 ECTS credits

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Context/Framework: Decision-making theory involves the study and analysis of individual decisions. The object of game theory is the analysis and modelling of strategic interaction systems between rational individuals.
Prerequisite: MT14, SY01
Level: Year 4/5

Objectives:
• deployment of different support techniques for corporate decision-making
• understanding the benefits of additional information (from polls, surveys, etc.) for the application of the bayesian approach and decision trees
• familiarization with utility theory
• knowledge of different game categories and models (non-cooperative, zero-sum, non-zero-sum, dynamic, repetitive and cooperative)
• knowledge of conditions for the existence of pure strategy and mixed strategy (random) solutions for various categories of games
• ability to deploy a resolution method, where solutions exist

Spring

SY06

Signal analysis and processing

6 ECTS credits

Level: Year 4/5

Objectives:
• understanding basic methods for the transmission of information in telecommunications
• signal interpretation and selection of an appropriate representation space for the signal concerned
• understanding the rôle and functions of the constituent elements of an information-processing chain or diagnostic tool
• designing an information-processing tool

Spring

SY12

Automation and industrial control

6 ECTS credits

Level: Year 3

Objective:
• To study the methods of analysis and design of algorithms for logical automatic commands, and to model sequential operations and controls.

Program:
• Analysis and specification of automated systems.
• Technologies of automated systems (instrumentation, API, RII, SNCC).
• Control of the process by binary and fuzzy logic.
• Modeling of the processes and sequential control by Grafcet, RdP...
• Programming of real time control of the sequential processes.
• Information systems and supervision of the automated processes.
• Simulation and performance analysis of the flexible systems in automated practice.
• Practical experiment on an automated industrial flexible manufacturing system.

Autumn

SY13

Automatic control

6 ECTS credits
The control of industrial systems is key to the satisfaction of performance and production requirements. In this course, different types of control are analyzed and summarized.

**Objectives:**
- modeling of continuous linear systems (differential equations, transfer functions, status models, etc.)
- characterization of system performance (stability, speed, accuracy, etc.)
- synthesis and deployment of industrial control functions (PI, PD, PID, etc.)
- application of a simulation environment/Matlab modelling/Simulink/ Real-time control

**Context/Framework:**
Support for decision-making in complex systems requires appropriate procedures, not limited to conventional cartesian approaches, but of the systemic type, i.e. global, both qualitative and quantitative, derived from engineering, human and social sciences.

**Objectives:**
- understanding fundamental concepts for the construction of global procedures for the analysis of complex systems
- deployment of a systemic procedure involving successive iterations, applied to a specific complex system
- determination and organization of relevant parameters for the construction of one or more models of a complex system
- selection of appropriate model(s) for the resolution of a given issue in a complex model

**Context/Framework:**
Simulation is a process which involves the modelling of an actual system, and the conduct of experiments on this model for the purposes of its performance evaluation, in order to permit the formulation of decisions concerning the actual system.

**Objectives:**
- ability to apply the principal laws of probability for the description of stochastic phenomena, and the deployment of algorithms for their simulation
- modelling of the operation of a discrete event system, and the formal definition of its evolutionary dynamic
- definition of an algorithm for the functional simulation of an industrial system
- application of the MONTE CARLO method
- ability to apply principles for the simulation of continuous systems
- ability to construct a simulator for a simple system in ARENA.
- ability to apply optimization methods using simulation

**Prerequisites:**
- NF14, SY01

**Context/Framework:**
To know the theoretical and practical tools for digitally processing and analyzing signals and images
Prerequisites: SY06
Level: Year 3

**Program:**
- Introduction to digital signals and systems
- Discrete Fourier transform
- Z transform
- Digital filtering
- Introduction to digital images
- Images recovery
- Images segmentation
- Images referencing

**SPRING**

**SY17**

**Production systems design**

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**Objective:**
- To study advanced methods of the design and analysis of production systems.

**Program:**
- Balancing of the production lines.
- Gauging (number of machines, stocks number...).
- Group technology, methods and algorithms of classification.
- Intra- and inter-cellule fitting arrangements.
- Methods for decision-making in production systems design.

**Level: Year 4/5**

**SPRING**

**SY18**

**Modeling and performance evaluation tools**

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**Objective:**
- To study the tools for modeling systems with discrete events, very common in the production industry, logistics and automation.

**Program:**
- Models and algorithms based on graphs.
- Petri networks.
- Markov chains and processes.
- Waiting queues.
- Practical work using Excel (VBA) software.

**Level: Year 3**

**SPRING**

**SY20**

**Manufacturing intelligence**

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**Context/Framework:**
- New Information Technologies represent a great opportunity to transform manufacturing organizations and to leverage their overall performance.

**Objectives:**
• Becoming aware of performance potentialities offered by data analysis and processes synchronization
• Being able to manage industrial data exchange and processing
• Being able to correlate material, information and financial flows
• Mastering the basics of industrial control, MES (Manufacturing Executive System) and collaboration strategy between MES and ERP (Enterprise Resources Planning)
• Being able to use the right software components to connect parts of an information system and to automate and trigger data exchange routines

SY22

Wireless systems

Objectives:
- To study the wireless communication from the signal to the technology.

Programme:
- Signal digital treatment.
- Analog and digital modulations.
- Antennas technology.
- Radio transmission (waves propagation...).
- GSM/GPRS/EDGE, Wi-Fi, Wimax.
- Satellite communication (signal treatment of a NOAA weather satellite).
- Bluetooth, Zigbee.
- RFID.
- Practical sessions with Scilab and in C on an embedded system.

SY23

Embedded systems

Objectives:
- To understand the embedded systems.
- To know how to implement embedded technology in order to solve a specific problem.

Programme:
- Embedded systems electronics.
- Programming in Java and C.
- Embedded operating systems (Linux, Android).
- Driver under embedded Linux.
- Communication bus (USB, CAN, I2C).
- Embedded systems with neuronal processors.
- Embedded systems lifecycle.

SY24

Information processing and security

Objectives:
- To get the information processing tools for secure systems development

Programme:
- Images and videos coding and compression
**Prerequisite**
SY06, SY16

**Level:** Year 4/5

- Computer vision
- Biometric identification techniques: digital fingerprints, hand geometry, retina, iris, face, voice and signature
- Digital supports tattooing
- Imaging systems security: images security in medical imaging and 3D objects tattooing
- Steganography and steganalysis

**Sensors networks**

**SY25**

**L** 34hrs
**SW** 34hrs
**PS** 20hrs
**PW** 50hrs

**Objectives:**
- To analyse a network architecture of wireless sensors
- To analyse transport protocols in sensors networks
- To develop applications for sensors networks
- To analyse the vulnerabilities and security solutions

**Programme:**
- Introduction, architecture and applications
- Operating systems for sensor networks
- Energy saving and fault tolerance in sensors networks
- Security in sensors networks
- Routing protocols for sensors networks

**Prerequisite**
SY16

**Level:** Year 4/5

**Smart embedded systems**

**SY26**

**L** 34hrs
**SW** 34hrs
**PW** 24hrs

**Objectives:**
- To acquire necessary knowledge to the understanding of smart embedded systems
- To be able to make a pertinent technological choice of embedded system to solve a problem

**Programme:**
- Theoretical approach of neuron networks
- Neuron networks' integration on FPGA
- Neuronal processors cards
- Neuronal technologies applications
- Neuro-inspired solutions

**Prerequisite:**
SY16, LO11

**Level:** Year 4/5

**Technological and scientific investigation**

**TITS**

**PW** 150hrs

**Context/Framework:**
The TITS technology course, supervised by a permanent teacher, involves the acquisition of knowledge on a technological subject. The TITS research course, supervised by a PhD student, involves the investigation of a research topic, together with the operation of a laboratory.

**Objectives:**
- ability to define objectives on the basis of a scientific subject and conduct a bibliographical search
- capability for the establishment of a research schedule and compliance with that schedule
- ability to develop an illustration and an experiment, and to summarize knowledge acquired
- ability to conduct an oral presentation of work completed

**Level:** Year 4/5

**6 ECTS credits**

**Back to list**
TMA01  
Advanced material behavior model  
4 ECTS credits

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Objectives:
- Development of advanced material behaviour models at different scales

Programme:
- Behaviour models
- A reminder: advanced materials
- Characterization techniques at different scales (micro-meso-macro-nano)
- Applications
- Damage and breaking

Level: Year 5  
AUTUMN

TMA02  
Advanced methods for experimental characterization  
6 ECTS credits

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Context/Framework:
The aim is to gain some knowledge about characterization techniques for materials and to be able to implement a rigorous and reliable experimental protocol. Lectures and Drills are completed by a project on a specific technique.

Objectives:
- To understand the fundamentals of metrology for experimental characterization: calibration, uncertainty analysis, traceability to fundamental standards, statistical tests…
- To plan a characterization protocol (Designs of Experiments) and data analysis (least squares regression, model fitting…).
- To know various specific characterization techniques (X-ray diffraction, residual stress measurement, nano-indentation, photomechanics, numerical microscopy, surface topography…)

Level: Year 5  
AUTUMN

TMA03  
Design and processing technologies  
6 ECTS credits

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Objectives:
- To gain knowledge of advanced design and of new material processing

Programme:
- An introduction to advanced material manufacturing
- Design and dimensioning
- Advanced material End-Of-Life
- Advanced design methodology
- Manufacturing-advanced technique
- Processing simulation
- Processing of polymers and of composite materials
- Applications

Level: Year 5  
AUTUMN

TMA04  
Advanced numerical methods  
6 ECTS credits
Objectives:
• A presentation of advanced numerical methods and development of numerical models for advanced materials

Programme:
• A reminder of the FE methods
• Models of mechanical behaviors for advanced materials
• Numerical simulation for advanced material
• Numerical resolution techniques

Level: Year 5

AUTUMN

TMA05  Mechanics of the surface

Objectives:
• To enable the students to understand internal constraints, new surface treatment techniques and the related industrial applications

Programme:
• SMAT (Surface Mechanical Attrition Treatment)
• Shot blasting
• Ceramic coating
• Residual constraints (MA)
• Tribology
• Contact-attrition
• Measurement techniques (nanoindentation)

Level: Year 5

AUTUMN

TMA06  Durability of materials and structures

Objectives:
• To study the life expectancy of mechanical parts made with advanced materials, to optimize and design lasting structures under complex stress conditions

Programme:
• A reminder about fatigue
• The mechanical model
• Life expectancy calculation
• Quality
• Dimensioning and optimization
• Lasting design of structures

Level: Year 5

AUTUMN

TMA07  Advanced materials

Objectives:
• To make a general presentation of the different materials, their micro and meso structure, their behavior and their specific applications
Level: Year 5

Programme:
- Composite polymers: reminder
- Functional materials
- Biomaterials, Nanomaterials
- Foams and composites
- Advanced materials for nuclear applications
- Applications, packaging, civil engineering
- Ageing and recycling
- Textile

AUTUMN

TN01
Introduction to the definition and manufacture of a technical object
6 ECTS credits

Context/Framework:
- During the system design phase, 3D models are used which are then converted into 2D plans for production operations in the workshop. The operation and effectiveness of this conversion process will depend upon the technological options selected for consideration.

Objectives:
- representation of a product using technical drawing standards
- analysis and understanding of a system on the basis of schematics and general arrangement drawings
- use of a CAD code (Creo) for the definition of a component and a system
- knowledge of standards for the designation of materials and alloys, essentially of metallic composition
- knowledge of functions and designation of various mechanical components (e.g.: screws, nuts, rolling bearings, keys, circlips, gears, etc.)
- introduction to manufacturing processes, with and without the removal of material (e.g.: turning, milling, casting, die-stamping, etc.)

Level: Year 1

AUTUMN-SPRING

TN02
Technology and introduction to mechanical design
6 ECTS credits

Context/Framework:
- This course involves the analysis, selection and deployment of basic technical elements and mechanical functions required by a mechanical design engineer.

Objectives:
- capability for the dimensioning of mechanical components
- investigation of connector technology
- ability to understand functional clearances, leak-tightness, lubrication, static solid mechanics, tensile-compressive bar loading
- modelling of power transmission
- completion of a CAD operation in the form of a mini-project

Prerequisite: TN01

Level: Year 1/2

SPRING

TN04
Multi-technique productions
6 ECTS credits

Context/Framework:
- In the workshop, the design and production of an object, whether of personal or of stipulated design, in wood and/or metal requires discipline and organization. Constraints involving the finished result, time, cost, working environment, etc. must
be taken into consideration.

Objectives:
- accurate definition of a multi-disciplinary object or system, taking account of workshop constraints and personal ability for the acquisition and deployment of skills
- management of costs and contacts with various suppliers for the procurement of certain components
- planning and production of the object or system, in consideration of constraints concerning quality, time, the terms of the production order, personal safety and the safety of others, and the use of machines
- management of the delivery of a high-quality product within the stipulated lead times

AUTUMN-SPRING

TN4B

Advanced multi-technique design and production

Context/Framework:
The object of this course is the application of the basic knowledge acquired during the first semesters of theoretical training for the design or improvement of an electrical, hydraulic or mechanical engineering system

Objectives:
- investigation and analysis of an existing prototype or a new prototype, in relation to a specific objective
- design of tests, trials and measurements involving the deployment of skills acquired for the analysis and improvement of the existing situation and the evaluation of the final result
- conception, design and implementation of improvements, on the basis of an action plan
- analysis and critical review of results
- ability to manage a project and a group project

AUTUMN-SPRING

TN05

One month technical training period

Objectives:
- To develop contact between the engineer’s training and their professional life.
- To discover a company, its organization, its methods of operation.
- To give the student a first taste of professional life.
- To present a written report and an oral presentation of their activities in the organization, and also a self-evaluation.

Programme:
- The nature of these training courses is very varied but work must correspond to a particular station of execution or of production, without having to exert there any responsibilities other than those directly related to the personal task to be carried out.
- Administration or distribution positions are not appropriate for this training course.
- The company visited must have manpower of at least 50 people.

AUTUMN-SPRING

TN07

Experience abroad (4 ECTS credits)

4 ECTS credits
**Context/Framework:**
Students will organize and spend a month working for a firm or a non-governmental organization.

**Objectives:**
- To be able to build a problematic and define strategies to investigate a subject in a foreign country
- To understand and organize the logistics of a four-week stay abroad
- To collect relevant and authentic information through surveys or other techniques
- To show analysis capacities through the analyzing of personal experience
- To write a detailed report in French and hold an oral presentation in the language of the chosen country

**Prerequisite:**
B1 level

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**TN08**

**Introduction to matter working**

**6 ECTS credits**

**Context/Framework:**
Engineers are regularly involved in the use of materials. On a variety of scales, it is necessary to understand material structures, in order to understand material properties and apply options for their use and processing.

**Objectives:**
- Knowledge of key material categories
- Understanding the impact of composition upon properties
- Understanding key material properties
- Analysis of different types of mechanical characterization and the mechanical behaviour of materials
- Development of a project-based analytical methodology (economic, environmental and technical)

**Level:** Year 2

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**TN09**

**Industrial work placement**

**30 ECTS credits**

**Objective:**
- To know what is the company environment
- To apply and improve the knowledge and know-how acquired at UTT
- To produce some personal work in a specific field using different techniques
- To choose a professional career and specialization

**Programme:**
- The subject proposed is subject to the approval of the UTT.
- The subject must match the professional projects of the student.
- Each student is followed-up by a lecturer at the UTT.
- This training course will be subject to a written report and an oral defence in front of a jury.
- This subject must be successfully completed to obtain the final degree.

**Level:** Year 4

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**TN10**

**Final Year Project**

**30 ECTS credits**

**Objective:**
- To work as an engineer with respect to the professional career
- The work has to be in accordance with the specialization and knowledge of the
Compulsory for all Major students

- The student must manage a project, make proposals, be autonomous and take responsibilities

Programme:
- The subject proposed is subject to the approval of the UTT.
- The subject must match the professional projects of the student.
- Each student is followed-up by a UTT teacher.
- This industrial project will be the subject to a written report and an oral defence in front of a jury.
- This subject must be successfully completed to obtain the final degree.

AUTUMN or SPRING

**TN12**

**Engineering and design**

Context/Framework:
- Students must be capable, on the basis of a specification, of producing a set of functional specifications for the design and comprehensive definition of a simple mechanical system which is compatible with costs and production resources.

Objectives:
- Knowledge and ability for the deployment of the following elements:
  - Power transmission (construction and dimensioning of belt and chain drives)
  - Speed variation (gearbox, epicycloidal gear train, etc.)
  - Rotation guide systems (construction and dimensioning of rolling bearings)
  - Connections (different types and options)
  - Frame structures (different types and dimensioning of girder structures)
  - Dimensioning (dimensional and geometric)

**TN14**

**Initiation into C.A.D.: geometric modeling**

Objectives:
- To study the techniques of geometrical modeling using Computer-aided design (CAD).
- To become familiar with the software of industrial CAD Pro/Engineer and Catia V5 through mini projects.

Programme:
- General context of the design tools and computer-aided manufacture (CAM).
- Materials and software used.
- Different types of modeling (surface and volume).
- Mathematic techniques of surface and volume modeling.
- Visualization methods for geometrical models (projection, shade...).
- Introduction to data exchange standards and systems of technical data management.

**TN15**

**Standard manufacturing techniques**
Objective:
• To study the various techniques of traditional manufacture in order to produce machine elements that correlate with their design.

Programme:
• The choice and influence of cutting parameters.
• Surface roughness and geometrical defects.
• Sample capture.
• Numerically controlled machine.
• Control, conditions of product acceptance, and measurement uncertainties.
• Forge, foundry, sheet metals, welding.

AUTUMN

TN16
Concurrent engineering and CAD/CAM support

Context/Framework:
Digital engineering involves the deployment of IT solutions to support the work of parties involved throughout the life cycle of the product concerned. This deployment requires expertise in the working context, tools and associated technical data.

Objectives:
• understanding whole-company and collaborative issues
• knowledge of working methods and their benefits in product development
• identification of softwares involved in the product life cycle
• management and handling of technical data
• execution of data exchanges between heterogeneous systems
• expansion of personal viewpoints by the consideration of industrial operating experience from genuine case studies on various aspects of digital engineering

Prerequisite: TN14

Level: Year 4/5

SPRING

TN17
Manufacturing technology and methods tools

Objective:
• To study the practical use of different methods tools, the preparatory work on machining possibilities and the manufacturing tools.

Programme:
• Studies in the form of projects.
• Preparation of machining (range of machining options, manufacture, adjustment).
• Machining assembly.
• CAD/CAM link (programming of numerically controlled machines).
• Management and follow-up of tools.
• MSP.

AUTUMN

TN19
Purchasing techniques and cost reduction

6 ECTS credits
**Objective:**
- To present a general approach to buying techniques and cost reduction.

**Programme:**
- General introduction to the methods of breaking down costs.
- Breaking down the costs of materials and components.
- Cost studies in function of the economic and geographical contexts of the suppliers.
- Analysis techniques of the costs stability during the life of a product.
- Economic evaluation of a replacement technique, analysis technique of the applied value to the selection of technical solutions.
- Optimizing the costs of mass production.
- Reducing costs in the context of economy globalization.

**Level:** Year 4/5

**Programme:**

- General introduction to the methods of breaking down costs.
- Breaking down the costs of materials and components.
- Cost studies in function of the economic and geographical contexts of the suppliers.
- Analysis techniques of the costs stability during the life of a product.
- Economic evaluation of a replacement technique, analysis technique of the applied value to the selection of technical solutions.
- Optimizing the costs of mass production.
- Reducing costs in the context of economy globalization.

**Level:** Year 4/5

**TN20**

**Analysis and dimensioning of mechanical systems**

**Objective:**
- To study the techniques for analyzing and measuring the principal technological functions used in mechanical systems design.

**Programme:**
- Modeling, theory of mechanisms, theory of contact.
- Transmission by belts and gears.
- Mechanical joints by surface and interposition of rolling elements.
- Assemblies by shrinking, threaded elements, obstacles, and gluing.
- Hydrodynamic and hydrostatic guiding.
- Measuring with fatigue.

**Prerequisite:**
- MQ01, or MQ02

**Level:** Year 3

**Programme:**

- Modeling, theory of mechanisms, theory of contact.
- Transmission by belts and gears.
- Mechanical joints by surface and interposition of rolling elements.
- Assemblies by shrinking, threaded elements, obstacles, and gluing.
- Hydrodynamic and hydrostatic guiding.
- Measuring with fatigue.

**Prerequisite:**
- MQ01, or MQ02

**Level:** Year 3

**TN30**

**Master's thesis**

**Objective:**
- To give the student their first professional experience with activities and responsibilities they will have in the future (enterprise or laboratory).

**Modalities:**
- The subject proposed is subject to the approval of the UTT.
- The subject must match the professional projects of the student.
- Each student is followed-up by a lecturer at the UTT.
- This industrial project will be the subject to a written report and an oral defence in front of a jury.
- This subject must be successfully completed to obtain the final degree.

**Level:** Final semester of degree

**Compulsory for master’s students**

**TN31**

**Specific placement in environment and sustainable development**

**Objective:**
- To have an interdisciplinary integration by applying knowledge in real professional situations.

**Modalities:**
- The subject proposed is subject to the approval of the UTT.
- The subject must match the professional projects of the student.
- Each student is followed-up by a lecturer at the UTT.
• This master project will be the subject to a written report and an oral defence in front of a jury.
• This subject must be successfully completed to obtain the final degree.

**SPRING**

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**TN32**

**Essay in environment and sustainable development**

**12 ECTS credits**

**4 months**

**Objective:**
• To make a diagnostic on a sustainable development or environmental problem.
• To set up a multidisciplinary planned action or critical analysis.
• To write an essay from a personal study.

**Modalities:**
• The subject proposed is subject to the approval of the UTT.
• The subject must match the professional projects of the student.
• Each student is followed-up by a lecturer at the UTT.
• This essay will be the subject to a written report and an oral defence in front of a jury.
• This subject must be successfully completed to obtain the final degree.

**AUTUMN**

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**TN33**

**Internship and essay in environment and sustainable development**

**18 ECTS credits**

**4 months**

**Objective:**
• To make a diagnostic on an environmental problem in a real professional environment.
• To write a document with contingency plan or a critical analysis integrating sustainable development multidisciplinarity.
• Apply know-how to project management.

**Modalities:**
• The subject proposed is subject to the approval of the UTT.
• The subject must match the professional projects of the student and must be linked with the TN32 essay
• Each student is followed-up by a lecturer at the UTT.
• This essay will be the subject to a written report and an oral defence in front of a jury.
• This subject must be successfully completed to obtain the final degree.

**AUTUMN**

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**TN40**

**Laboratory project for exchange student**

**30 ECTS credits**

**Prerequisites:**
Bachelor level
1 semester internship
Level: Year 4/5

**Objective:**
• Allow an exchange student to participate in a research project in a laboratory at the UTT.

**Modalities:**
• Subject is proposed by a professor from the UTT and validated by the home institution.
• The subject must comply with the professional project of the exchange student.
• Each student is supervised by a professor from the laboratory.
• This project will be the subject to a written report and an oral defence in front of a jury.
Work-study program 1

Objective:
- To get his/her first professional experience within the same conditions of the professional life.

Modalities:
- The student will sign a professionalization contract with the host company. This company would have previously signed an agreement with the UTT.
- The subject proposed is subject to the approval of the UTT.
- The subject must match the professional projects of the student.
- Each student is followed-up by a lecturer at the UTT.
- This project will be the subject to a written report and an oral defence in front of a jury.
- the 2 work-study programs have to be completed in order to graduate.

Work-study program 2

Objective:
- To get his/her first professional experience within the same conditions of the professional life.

Modalities:
- The student will sign a professionalization contract with the host company. This company would have previously signed an agreement with the UTT.
- The subject proposed is subject to the approval of the UTT.
- The subject must match the professional projects of the student.
- Each student is followed-up by a lecturer at the UTT.
- This project will be the subject to a written report and an oral defence in front of a jury.
- the 2 work-study programs have to be completed in order to graduate.

Industrialization and advanced technologies

Objective:
- To be able to master the industrialization of one's conceptions with CAD models to real pieces

Modalities:
- Making process ( Digital Control machines, equipments, machining assembly)
- Advanced making process (High speed machining, laser cutting process, plasma, water jet, electroerosion)
- Project studies: FAO project ....
- metrology and control on three-dimensional measure machine
- statistical control of the process

Systems security

Objective:
- To be able to master the industrialization of one's conceptions with CAD models to real pieces

Modalities:
- Making process ( Digital Control machines, equipments, machining assembly)
- Advanced making process (High speed machining, laser cutting process, plasma, water jet, electroerosion)
- Project studies: FAO project ....
- metrology and control on three-dimensional measure machine
- statistical control of the process
### SPRING

#### TS02 Industrial risks management

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**Context/Framework:**
The safety of systems involves technical aspects (accident and risk analyses, operational reliability, safety of installations), human aspects (human factors, ergonomics) and social aspects (regulations).

**Objectives:**
- evaluation, structuring and management of preventative and corrective measures for the safety of industrial systems
- description of stages for the analysis of accidents
- knowledge of regulations in force

**Level:** Year 4/5

#### AUTUMN

#### TX Laboratory project

| PW | 120hrs |

**Objective:**
- To introduce students to the processes of creation and experimentation, under the direction of a lecturer-researcher, by defining, creating, and implementing one or more technical devices.

**Programme:**
- To plan the study and the implementation.
- To spend time on the work which is needed.
- To hand in a written report and the produced model.
- To present the work to a jury of two lecturers.

TX can be recorded in a student’s profile in the category "Techniques and methods", with prior agreement of their degree supervisor.

**Level:** Year 4/5

#### AUTUMN-SPRING