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PUBLISHED WITH SPONSORSHIP OF THE LLP – Lifelong Learning Programme- of the European Union
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 postgraduate degrees (at Master's level) including some that lead to Ph.D. studies.
2. **Who’s who at the UTT?**

<table>
<thead>
<tr>
<th>Role</th>
</tr>
</thead>
</table>
| President / Vice-Chancellor | Christian LERMINIAUX  
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  - Fax: +33 (0) 3 25 71 85 49
3. **The academic year**

The university year is divided into 2 **semesters** of 17 weeks each, separated by a 4-week **intersemester** break in February during which an intensive French language course takes place. An other intensive French language course is offered in August, prior to the fall semester.

The **first (fall) semester** usually runs from the first week of September until the end of January and the **second (spring) semester** from the end of February until the end of June.

Please refer to the “Information brochure for visiting students” or our website ([www.utt.fr](http://www.utt.fr)) for the exact dates.

The **intersemester** period is an opportunity for students to take part in cultural or educational activities which, due to their nature, cannot take place during the semester.

The UTT has also adopted a cumulative credit course ("**Unité de Valeur**") system. A credit course usually represents an average of 130 hours of work, (personal and/or supervised). **Generally speaking, one credit course is worth 4 or 6 ECTS** (European Credit Transfer System).
4. Master of Engineering (Diplôme d’Ingénieur)

4.1. Curriculum structure

4.1.1 Arborescent structure

The standard French engineering curriculum lasts 5 years and is the equivalent of a Master's degree. Education at the UTT is designed as an arborescent structure: **Common Core Curriculum, followed by the Common Core of Major studies, and finally the Major with its chosen specialization** so that the students can gradually build up their own curriculum.

4.1.2 Common Core Curriculum (TC - Tronc Commun)

The **Common Core Curriculum** takes up the first two years of the engineering cycle. Its objective is to provide a solid academic background and a common basis for the Major studies (years 3-5).

This Common Core Curriculum ensures:
- A general background enabling students to enter any of the engineering Majors taught at the UTT. It includes scientific subjects such as mathematics, physics, chemistry, and technical subjects such as computer science, technical drawing, and manufacturing.
- The ability to improve written and oral communication skills, both in French and in a foreign language. This dimension is emphasized by specific teaching methods and tutoring (training and placements, scientific and/or technical studies).
- A background in social sciences, which will become increasingly useful for future engineers.
- The opportunity of a progressive apprenticeship in an autonomous activity within the university through integration in one of the various students’ associations and outside the university through short training periods.

The Common Core Curriculum allows students to discover the world of industry and technology and to prepare for the engineering Majors taught at the UTT. It enables them to confirm their motivation and helps them in the choice of a Major (branche).

4.1.3 Common Core of Major studies

Progressively, students begin to receive teaching more geared towards the Major they have chosen:

- Industrial Systems (SI)
- Informatics and Information Systems (ISI)
- Systems, Networks and Telecommunications (SRT)
- Mechanical Systems (SM)
- Materials Science and Technology (MTE)

4.1.4 Majors (Branches)

The Majors represent the final years of the engineering curriculum, leading to the “Diplôme d'ingénieur”.

Each Major includes various *specializations* and all students must select a specialization during the second half of their Major studies.

When students have professional career plans that do not correspond to a specialization then, they may propose a tailor made course ("filière libre"). Such a course cannot be accepted unless it is coherent and follows the general principles of the UTT engineering education.

The Majors are described as follows.
Industrial Systems
SI (Systèmes Industriels)

To manage industrial system, its costs and optimize its performances

The optimization of an industrial processus depends on the technical and financial requirements and constraints: quality assurance, the human as active and decisional element, the environment, innovation and the competitive context.

The Industrial System engineer is trained at the design, management and maintenance of manufacturing systems, at taking into account the environmental impact and risks as well as at the implementation of manufacturing techniques processes.

Core courses in Industrial Systems:
- Company management and strategy, project management
- Mathematic tools: statistics, operational research, optimization
- Informatics, simulation
- Technology, automation
- Quality, industrial excellence

Competences of the Industrial Systems Engineer
- To pilot an industrial manufacturing system by integrating the socio-economical and human factors
- To implement scientific methods of industrial management
- To use and to master the software tools for industrial management
- To audit the industrial processus performances
- To audit and improve an industrial processus

Specializations (Filières):

Production Systems Management:
Optimized design and management of production systems or production lines
Specific competences:
- Flow management and logistics
- Production planning and scheduling
- Forecasting methods and stocks management
- Production systems design
- Tools for decision making
- Industrial Information Systems: Computer-Aided Management and Manufacturing, Enterprise Resource Planning (ERP)

Supply Chain Management:
Cost management and quality improvement for supply chain, taking into account flows and product lifecycle
Specific competences:
- Supply chain analysis, flow management
- Transportation
- Warehouse management
- Information systems in logistics, ERP

Operational safety, Risks and Environment:
Management of infrastructures with risks, prevention of major industrial accidents and sustainable development
Specific competences:
- Operational safety, systems reliability and experiment feedbacks
- Systems security
- Industrial risks management
- Environmental analysis
- Industrial systems monitoring and diagnostic
- Maintenance and integrated logistic support
Related laboratories:

- LOSI: Industrial Systems Optimization
- LM2S: Systems Modeling and Dependability
Informatics and Information Systems
ISI (Informatique et Systèmes d’Information)

To design, integrate and optimize computer solutions for information management in companies

The informatics are the core of the company. The collection, processing and memorization of the digital data are very strategic. The Informatics and Information Systems engineer is the link between the users and technicians implementing the solutions.

He/she analyses, designs, evaluates and manages methods for secured information collection, storage and exchange in companies or companies networks

Core courses:
- Informatics
- Information systems architecture
- Processus modeling
- The main applications of information systems
- Knowledge engineering
- Information systems security

Competences of the Informatics and Information Systems engineer:
- To define the functional architecture of an information system
- Implement the methods and tools for enterprise risks management
- Design and implement collaborative applications

Specializations (Filières):

Information Systems Management
The main information systems applications
Specific competences:
- Information systems management and modeling
- Knowledge engineering
- Decisional architectures
- Organizations sociology
- Information systems security

Softwares’ Management
Implementation of softwares’ components in information systems
Specific competences:
- Iterative design
- Rapid prototyping of softwares
- Software quality
- Services oriented architecture
- E-commerce

Information Risk’s Management
Design, methods and techniques for security management in information systems
Specific competences:
- Regulation and legal aspects of information systems security
- Security management
- Information management and design
- Software quality

Related laboratories:
- Tech-CICO (Co-operation Technology for Innovation and Organizational Change): informatics for human and social purposes
- ERA (Autonomous Networks Environments): networks analysis and modeling
To manage enterprises or operators networks, by implementing mobile technologies and information security

The wired or mobile telecommunication networks must be customized for enterprises for they have effects on the organizations structures: logistics, e-commerce, collaborative processes with partners, network enterprises.

The SRT engineer is the project owner in this field. He/she analyses what already exists, writes down the needs and gives the solutions. He manages the delays and costs.

Core courses:
- Fixed, wireless and mobile networks
- Corporate networks
- Embedded systems
- Systems and networks security
- Information systems
- informatics

Competences of the Systems, Networks and Telecommunications engineer:
- to analyse and manage networks administration tools
- to define an administration strategy
- to measure the performance and if it fits the needs
- to define and implement a security management policy
- to design networks solutions integrating mobiles technologies
- to assure the systems and networks security

Specializations (Filières):

Networks integration
Implementation of enterprises networks with the help of operators’ technologies and networks.
Specific competences:
- IP networks
- Networks administration
- Mobile networks
- Networks security

Mobile technologies and embedded systems
Applications and uses of mobile technologies and embedded systems, content optimization depending on the communication constraints.
Specific competences:
- Mobile networks and embedded systems
- Sensors networks
- Robotics
- Applications to position determination technology

Systems security and communications
Security of computer systems in order to assure users authentication, protect information access and keep the data confidentiality and integrity, etc.
Specific competences:
- Information processing tools
- Cryptography
- Systems and networks security
- Modeling of information systems security

Related laboratories:
- ERA (Autonomous Networks Environments): networks analysis and modeling
- LM2S: Systems Modeling and Dependability
Mechanical Systems
SM (Systèmes Mécaniques)

To design complex mechanical systems by optimizing the performance, the implementation delays and the production costs.

The design of mechanical systems is becoming more and more complex due to the constant technology innovations. The Mechanical Systems engineer manages the design and production process of those systems and integrates innovative technologies. The Mechanical Systems engineer is able to integrate diversified technologies in a mechanical system such as: informatics, automation, innovative materials.

Core courses:
- Solids mechanics
- Mechanical properties and choice of materials
- Project management and functional analysis
- CAD/CAM
- Automation and control
- Digital simulations and finite elements calculations

Competences of the Systems, Networks and Telecommunications engineer:
- To design mechanical systems
- To model and simulate digitally mechanical systems behaviors
- To integrate operating devices
- To choose wisely the materials and manufacturing modes
- To manage design projects with Computing Aided Engineering

Specializations (Filières):

Integrated mechanical design
Complex systems design and management by interacting with all the design process participants.
Specific competences:
- Complex systems design
- Actuators, sensors and commands
- Advanced Computer aided design
- Comparison between experiments and digital simulations
- Fluids mechanics

Production systems design
Implementation of complex production systems with broad competencies in mechanics, manufacturing and control processes, automation, industrial engineering…
Specific competences:
- Manufacturing technology and methods tools
- Automation, robotics and actuators
- Production management and organization and ergonomics

Information technology for mechanical engineering
Creation and development of innovative computing solutions for mechanical designers. The double competency mechanics/informatics covers technical data modeling, simulation and management.
Specific competences:
- Advanced computer aided design
- Data structure and databases
- CAD/CAM administration
- Computer aided systems and computer graphics

Digital simulation in mechanical engineering
Digital simulation especially structures calculations and material forming for mechanical design and manufacturing/
Specific competences:
- Advanced structure meshing
• Modeling of materials behavior
• Digital simulation of forming processes
• Comparison between experiments and digital simulations

Related laboratories:
• LASMIS: Mechanical Systems an Concurrent Engineering
  o Example of research activity: link between design and eco-design tools, product lifecycle management by integrating environmental constraints
Materials Science and Technology
MTE (Matériaux: Technologie et Economie)

To integrate the materials into the design processes and implement them with respect to environment and cost management.

80% of the production companies’ budget is spent for buying materials: steels, plastics, components… The sources for supply are very diversified and economic, technical and environmental problems are all linked together. Product design depends on the physical-chemical and mechanical properties of the materials. Simultaneously, product design depends as well on associated costs, standards and recycling. The Materials Science engineer is the multidisciplinary link between offices. He/she improves companies quality, reliability and productivity for better performance, sustainable development and costs management.

Core courses:
- Knowledge of different kinds of materials: structure, physical-chemical properties, processing, processes
- Materials characteristics and choice, design, sensors
- Materials economics and flows
- Scientific tools for engineering
- Project management and social sciences

Competences of the Materials Science engineer:
- To choose the adequate material for a specific industrial application
- To buy wisely this material depending on the market with a “eco-responsible” approach
- Follow and manage its processing
- To know the recycling regulations and methods
- To be able to encourage innovation policy

Specializations (Filières):
Materials economics and environment
Environment and regulations (eco-design and sustainable development, clean technologies, recycling, standards…). This specialization trains engineers in eco-design. They control the materials lifecycle and acts on production effects on environment with regards to standards.
Specific competences:
- Design and eco-design
- Recycling
- Environment management and quality regulations

Technology and trade of materials and components
Trade and purchase and costs reduction techniques. Beside having competences in technologies and economy, these engineers master the purchase and costs reduction techniques.
Specific competences:
- Information and communication technology, e-business
- Materials trade
- Purchase techniques

Transformation and quality of materials
Broad knowledge in science and materials engineering oriented to metallurgy, plasturgy, structure and microstructure, advanced materials properties, surface treatments and sustainable development.
Specific competences:
- Materials forming and transformation
- Processes and materials
- Manufacturing technologies
- Metallurgy, plasturgy
Related laboratories:
- LNIO: Nanotechnologies and Optical Instrumentation
  - Example of research activity: new hybrid nanomaterials for nanophotonics, prototype of miniaturized optical spectrometer
4.1.5 Technology and Social Sciences (minors)

TSH (Technologie et Sciences de l'Homme)

While each Major is coordinated by a specific academic department, the UTT also has a transversal cross disciplinary department called “Technology and Social Sciences” (TSH) which deals with all the courses related to social sciences. All students select a certain number of credit courses within this field.

Overview of the teaching given in TSH:

The goal of the TSH department is to provide students with complementary knowledge in the following three sectors:

1) The acquisition of linguistic knowledge and skills: the teaching of foreign languages and the techniques of written and oral expression.

2) The knowledge of the economic, administrative and legal environments in which future engineers will apply their technological competences.

3) Culture and Technology: this field aims at developing curiosity, culture, critical thinking, creativity and initiative. To do so, courses are offered in arts, culture, sports and social sciences.

Minors

During their Major, students may undertake a minor in a field related to Technology and Social Sciences by selecting a coherent group of credit courses, which will deepen their knowledge and give them a second specialization.

The minors currently offered are:

- Communication, business and society (COESO)
- Entrepreneurship
- Environment and Sustainable Development (EDD)
- International Culture and Business
4.2. Engineering degree requirements

Credit categories for the engineering degree

Every credit course is classed in one of the categories that appear below.

The number of credits obtained by students in each category determines their “educational profile”.

To obtain the engineering degree (5 years), students must pass a minimum number of credit courses in each of these categories plus other credit courses from the categories of their own choice.

Scientific Knowledge (SC) - 6 ECTS credits
For the Common core studies, this category includes fundamentals like mathematics, physics, chemistry…. These credits aim to provide the scientific knowledge required to follow the specialized studies in each of the Majors.
For Major studies, this category provides the essential scientific tools and languages to facilitate the acquisition and implementation of specialised knowledge

Technique and Methods (TM) - 6 ECTS credits
For the credits within this category, the emphasis is put on methods – for work, investigation, calculation and presentation. Amongst them are all the credits providing techniques and methodology to help the students to develop a practical approach and acquire know-how.

Language and Communication skills (EC) - 4 ECTS credits
The credits in this category aim to improve the students’ competence in expression and communication in French or another language. Common core students must take SI10 (Training in oral and written communication) while in their first year of studies at the UTT.

Culture and Technology (CT) - 4 ECTS credits
The objective of these credits is to give students the ability to understand the important evolutions of society (historic, sociological, and political), to reflect on the consequences of their actions on the world around them, both as citizens and human beings (ecology, philosophy, ethics), and to learn to express their thoughts in an efficient, sensitive, and personal manner (communication, writing workshop).

Business Management (ME) - 4 ECTS credits
The objective of these credits is to provide the students with a good basic comprehension of how organizations function. It is essential for a future engineer to have some comprehension of the accountancy and financial factors which govern a business, as well as the economic and legal context in which it operates.
Studies assessment

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

Each credit course in the Engineering degree is worth 4 or 6 ECTS.

The evaluation policy is continuous assessment. This may take different forms according to the wishes of the person-in-charge of each credit course: tests and exams, essay(s), report(s), oral presentations, practical work, implementation / creation, and usually, a final examination.

There is no “catch up” or second examination session in any given semester. When students fail a course they have to do it again the following semester.

Engineering degree: requirements

The Engineering degree (Diplôme d'Ingenieur) is awarded to students who have successfully completed the requirements listed below. This is known as the “minimum education profile”.

Table 1: “minimum education profile” for students arriving at Baccalaureat level

<table>
<thead>
<tr>
<th></th>
<th>Scientific Knowledge</th>
<th>Techniques and Methods</th>
<th>Internships</th>
<th>Language and Communication skills</th>
<th>Culture and Technology</th>
<th>Business management</th>
<th>Electives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Studies</td>
<td></td>
<td>30 credits*</td>
<td>30 credits</td>
<td>European B2 level in a foreign Language + 20 credits</td>
<td>32 credits of which at least 8 must be in each category</td>
<td></td>
<td>26 credits</td>
</tr>
<tr>
<td>Common Core of Major Studies</td>
<td>54 credits*</td>
<td>30 credits</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common Core</td>
<td>48 credits</td>
<td>24 credits</td>
<td>6 credits</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The “Major Studies” and “Common Core of Major Studies” combine for a total of 84 credits of which at least 30 must be obtained in the “Scientific Knowledge” category, and 30 in the “Techniques and Methods” one.

Table 2: “minimum education profile” for students arriving in the 3rd year

<table>
<thead>
<tr>
<th></th>
<th>Scientific Knowledge</th>
<th>Techniques and Methods</th>
<th>Internships</th>
<th>Language and Communication skills</th>
<th>Culture and Technology</th>
<th>Business management</th>
<th>Electives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Studies</td>
<td></td>
<td>30 credits*</td>
<td>30 credits</td>
<td>European B2 level in a foreign Language + 12 credits</td>
<td>16 credits of which at least 4 must be in each category</td>
<td></td>
<td>8 credits</td>
</tr>
<tr>
<td>Common Core of Major Studies</td>
<td>54 credits*</td>
<td>30 credits</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The “Major Studies” and “Common Core of Major Studies” combine for a total of 84 credits of which at least 30 must be obtained in the “Scientific Knowledge” category, and 30 in the “Techniques and Methods” one.

When this “minimum education profile” has been achieved, the engineering degree is delivered to students who have obtained for the whole university curriculum:
- 300 ECTS credits (or 180 ECTS credits for students who arrived in the 3rd year)
- 2 internship periods for 60 ECTS credits
- a foreign language level (European B2 level)
### 4.3. Study sequence for the Common Core Curriculum and Major studies

The following charts show a standard suggested sequence for the credit courses, as the students go through their studies at the UTT.

The sequences that follow indicate only the Scientific Knowledge (CS) and Technique and Methods (TM) courses specific to the Common Core Curriculum and each Major.

In order to obtain the “minimum education profile”, students must also select courses in other categories such as Language and Communication skills (EC), Culture and Technology (CT) and Business Management (ME) (refer to section 4.2).

#### STUDY SEQUENCE LEGEND:

**Semester:** A (Autumn), S (Spring)

**TC:** Common core

**MAJORS:**

<table>
<thead>
<tr>
<th>SI: Industrial Systems</th>
<th>Specializations:</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCL: Supply Chain Management</td>
<td></td>
</tr>
<tr>
<td>SFeRE: Operational Safety, Risks and the Environment</td>
<td></td>
</tr>
<tr>
<td>GSP: Production Systems Management</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>ISI: Informatics and Information Systems</th>
<th>Specializations:</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSI: Information Systems Management</td>
<td></td>
</tr>
<tr>
<td>MPL: Software Projects Management</td>
<td></td>
</tr>
<tr>
<td>MRI: Informational Risk Management</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>SRT: Systems, Networks and Telecommunications</th>
<th>Specializations:</th>
</tr>
</thead>
<tbody>
<tr>
<td>IR: Networks integration</td>
<td></td>
</tr>
<tr>
<td>TMSE: Mobile Technologies and Embedded Systems</td>
<td></td>
</tr>
<tr>
<td>SSR: Systems and Networks Security</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>SM: Mechanical Systems</th>
<th>Specializations:</th>
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</thead>
<tbody>
<tr>
<td>CMI: Integrated Mechanical Design</td>
<td></td>
</tr>
<tr>
<td>CSP: Production Systems Design</td>
<td></td>
</tr>
<tr>
<td>SNM: Digital Simulation in Mechanical Engineering</td>
<td></td>
</tr>
<tr>
<td>TIM: Information Technology in Mechanical Engineering</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>MTE: Materials Science and Technology</th>
<th>Specializations:</th>
</tr>
</thead>
<tbody>
<tr>
<td>EME: Materials, Economics and the Environment</td>
<td></td>
</tr>
<tr>
<td>TCMC: Technology and Trade of Materials and Components</td>
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<td>TQM: Transformation and Quality of Materials</td>
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Semester
Common Core (TC)

The following tables show the different courses that the students need to take during the first 2 years.

Core compulsory requirements

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February               TN05               One-month technical training period

General additional competences

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Industrial Systems (SI)

Common core (3rd year)

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Semester 7: TN09 Industrial work placement

Specialization courses (4th and 5th year)

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Semester 10: TN10 Final Year Project
# Informatics and Information Systems (ISI)

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### Semester 7: TN09 Industrial work placement

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### Semester 10: TN10 Final Year Project
# Systems, Networks and Telecommunications (SRT)

## Common core (3rd year)

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## Semester 7: TN09 Industrial work placement

## Specialization courses (4th and 5th year)

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<td>TM</td>
<td>RE20</td>
<td>Operators networks</td>
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<td>TM</td>
<td>RE21</td>
<td>Uses, services and ergonomics of terminals</td>
<td>S</td>
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<td>TM</td>
<td>SY22</td>
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<td>SY23</td>
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## Semester 10: TN10 Final Year Project
### Mechanical Systems (SM)

#### Common core (3rd year)

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<td>EA01</td>
<td>Automation and control</td>
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<td>CS</td>
<td>MQ00*</td>
<td>Modeling, kinematics and statics of mechanical systems</td>
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<td>Strength of materials</td>
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<td>Introduction to solid continuum mechanics</td>
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<td>CS</td>
<td>MQ03</td>
<td>Dynamics and vibrations of mechanical systems</td>
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<td>MQ04*</td>
<td>Properties of materials</td>
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<td>Digital methods for the engineer</td>
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<td>TM</td>
<td>CS03</td>
<td>Project management</td>
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<td>TM</td>
<td>MQ06</td>
<td>Modeling structures using finite elements</td>
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<tr>
<td>TM</td>
<td>TN12</td>
<td>Engineering and design</td>
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<td>TN14</td>
<td>Initiation into C.A.D.: geometric modeling</td>
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<td>Standard manufacturing techniques</td>
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#### Semester 7: TN09 Industrial work placement

#### Specialization courses (4th and 5th year)

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<tr>
<td>CS</td>
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<td>3D computer graphics: theory and applications</td>
<td>S</td>
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<td>Principles of, and practice in object-oriented programming</td>
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<td>TM</td>
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<td>Advanced computer-aided design systems</td>
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<td>PLM interoperability, Service and Virtualization oriented Architectures</td>
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<td>Advanced modeling of finite elements structures</td>
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<td>Concurrent Engineering and CAD/CAM support</td>
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<td>TN18</td>
<td>Advanced production techniques</td>
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#### Semester 10: TN10 Final Year Project
**Materials Science and Technology (MTE)**

### Common core (3rd year)

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<td>Interaction between materials and electromagnetic waves</td>
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<td>Chemistry for materials</td>
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<td>MA12</td>
<td>Non-metallic materials</td>
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<td>MA13*</td>
<td>Material mechanics</td>
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<td>CS</td>
<td>MA14</td>
<td>Materials for electronics</td>
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<td>Project management</td>
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<td>Design and the human senses</td>
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<td>MA15</td>
<td>Non-metallic materials technologies</td>
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<td>MA20*</td>
<td>Materials analysis and microscopic characteristics</td>
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<td>MA21</td>
<td>Materials analysis and macroscopic characteristics</td>
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<td>OB01</td>
<td>Basic scientific tools for the engineer</td>
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<td>PR01</td>
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**Semester 7: TN09 Industrial work placement**

### Specialization courses (4th and 5th year)

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<tr>
<td>CS</td>
<td>NM01</td>
<td>Nanomaterials and nanotechnologies</td>
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<td>CS</td>
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<td>Optic and optoelectronic materials</td>
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<td>TM</td>
<td>CL01</td>
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<td>Flow and economics of materials</td>
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<td>Environmental analysis: basic methods and tools</td>
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<td>Materials life cycle management</td>
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<td>Quality assurance and control</td>
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<td>MI01</td>
<td>Introduction to industry environment</td>
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<td>Materials and structural formation</td>
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<td>Regulations and conformity</td>
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<td>TM</td>
<td>TN18</td>
<td>Advanced production techniques</td>
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**Semester 10: TN10 Final Year Project**
5. **Master of Science, Health and Technologies**

**Admissions and formation profiles**

The UTT Master of Science, Health and Technologies offers three different emphases: Mechanics and Physics, Information Technology and Communication Sciences, and Engineering and Management. Each of them is then divided into three different specializations (see section 5.1 for more details). These emphases have been chosen according to the specific competence of UTT, either in the research or the business field.

**Admission to the program**

Students are admitted to the first year of the Master if they have 180 ECTS credits in a Science and Technology field, or if they have obtained an equivalent degree in one of these fields.

Students are admitted to the second year if they have received a Bachelor’s degree in Science and Technologies.

**Master of Science, Health and Technologies degree requirements**

To be awarded the Master of Science, Health and Technologies degree, you must:

- Get 120 ECTS credits, if you start in the first year or 60 ECTS credits if you start in the second year, according to the following formation profiles
- Have a minimum level in a foreign language taught at UTT (other than your own mother tongue)

**Formation profiles**

**Entrance in the 1st year of the Master**

Students entering in the first year of the Master have to complete the following formation profile to get a total of 120 ECTS credits:

- 18 ECTS credits in the EC (language and communication), ME (business management), and/or CT (culture and technology) categories (see the following pages for a full list of the courses available in the different categories), of which at least 4 credits in the ME category, and at least the SD10 course;
- 72 ECTS credits in the CS (science knowledge) and/or TM (techniques and methods) categories;
- 30 ECTS credits for an internship within a laboratory or an enterprise;
- Get the B1 level in a foreign language (minimum required level in a foreign language)

**Entrance in the second year of the Master**

Students entering in the second year of the Master have to complete the following formation profile to get a total of 60 ECTS credits:

- 6 ECTS credits in the EC, ME, and/or CT categories, including at least SD10;
- 24 ECTS credits in the CS and/or TM categories;
- 30 ECTS credits for an internship within a laboratory or an enterprise;
- Get the NPML (minimum required level in a foreign language).
Students undertaking the UTT Engineering degree and the UTT Master’s degree (double degree profile)

In this case, the degree seeking students will be automatically granted 8 ECTS credits in the elective course category for the engineering degree, and 4 ECTS credits in the EC/ME/CT category of the Master’s degree. The students can also be granted an additional 4 to 8 ECTS credits in the CS/TM category, according to the equivalence table below.

Thus, the Master’s degree formation profile is as follows:
- 2 ECTS credits in the EC category (SD10);
- Between 16 and 24 ECTS credits in the CS/TM category;
- 30 ECTS credits for the internship.

The Master’s degree internship can also count as an equivalent to the final year internship project of the engineering degree, provided that the topic and the work done are recognized by both degrees’ supervisors.

Table of equivalence between the engineering and the Master’s degrees

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</table>

The NPML (minimum required level in a foreign language)

To obtain the Master’s degree, students have to get the NPML (minimum required level in a foreign language) in a modern language taught at UTT, other than their own mother tongue:
- For students entering in the first year of the Master’s program, the NPML is obtained with a score of 50 at the BULATS test (or a corresponding score at another recognized test);
- For students entering in the second year of the Master’s program, the NPML is obtained by making noticeable progress in the learning of the foreign language.
Master’s emphases and specializations:

5.1. Mechanics and Physics emphasis

The Mechanics and Physics emphasis reflects the tradition of academic excellence at UTT either in research or teaching in the fields of mechanics, physics and their related materials. The purpose of this formation is to give learners knowledge, tools and techniques directly linked to mechanics, nanotechnologies and new materials. It proposes three different specializations: Optics and Nanotechnology, Mechanical Systems and Materials, and Agro-Resources and Composite Materials engineering.

Optics and Nanotechnology specialization (ONT)

Objectives
The "Optics and Nanotechnologies" specialization trains students for the activities of research and development in the field of nanotechnologies. This programme is based on the study of various techniques and methods, mainly optical, which make it possible to manufacture nanostructures and materials, to characterize their physical and chemical properties and to understand the associated phenomena.

Research into miniaturization of mechanical, electronic, optical, chemical, and biological, devices has seen a huge rise in the last fifteen years, thanks to the development of new microscopes called local probe microscopes.

The goal of these new probe techniques is to characterize and help to build miniaturized objects, and thus to develop future technologies, on the nanometre scale (nanotechnologies), or even the atom scale.

The "Optics and Nanotechnologies" specialization offers training mainly in the field of optical local probe microscopy and a familiarisation with other microscopic techniques (Atomic Force Microscopy AFM, Scanning Tunnelling Microscopy STM).

The principal research topics covered are geared towards nanosciences. They tackle the problems of nanodetection of molecular, crystalline or nanostructured objects, but also those of modelling electromagnetic fields on the same scale, with the aim of understanding and interpreting the observed experimental results.

Generally speaking, this speciality is based on an "optical" approach i.e. to use a transverse discipline to explore a multi-disciplinary and developing field, which is nanotechnologies.

Prerequisites
For the first year, admission is offered to holders of a European degree in physics, chemistry, physical chemistry, biochemistry, applied mathematics, and to the students who can provide evidence of a diploma equivalent to 180 ECTS credits in one of these disciplines. For the second year, admission is offered to the holders of a Bachelor's degree in physics, physical sciences, chemistry, physical chemistry, biochemistry, EEA, or applied mathematics, and to the holders of a MST, or engineering students in the final year of their degree if their course contains a basic training in physics (materials, optics...), physico-chemistry or mathematics. Admission is also possible for the holders of equivalent foreign degrees (240 ECTS credits). Final admission is decided by a jury who evaluates the applications.

Potential Careers
Nanotechnology, or the control of matter on the elements scale which constitutes it, requires knowledge and a know-how which is increasingly valuable to engineers and researchers. The programme offered will enable the students to become familiar with the techniques, from an experimental point of view, as well as a theoretical and numerical one. The knowledge acquired will enable to consider new outlets in organizations or laboratories, which can be found in sectors as varied as biology, physics and chemistry of materials, optoelectronics and photonics.
**Course director:** Gilles Lerondel

**Contact**
Master S & T - Spécialité "Optics and Nanotechnologies"
Université de technologie de Troyes
12 rue Marie Curie - BP 2060 - 10010 Troyes cedex
Tel: +33 3 25 71 58 74
Email: master.ont@utt.fr

### Semester 1 Autumn

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<td>MA03</td>
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<td>Interaction between materials and magnetic waves</td>
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<td>MT12</td>
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<td>Mathematics for the engineer</td>
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<td>Digital methods for the engineer</td>
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### Semester 2 Spring

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<td>MA14</td>
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<td>Introduction to research</td>
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<td>TM</td>
<td>MA15</td>
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<td>Non-metallic materials technologies</td>
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<td>TM</td>
<td>MA20</td>
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<td>Materials analysis and microscopic characteristics</td>
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### Semester 3 Autumn

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<td>Optical spectroscopy</td>
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<td>Numerical and mathematical methods in optics</td>
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<td>Nanomaterials and nanotechnologies</td>
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### Semester 4 Spring

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<td>30</td>
<td>Master’s thesis</td>
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* compulsory subject for the master’s degree
Mechanical Systems and Materials specialization (SMM)

Objectives
The SMM specialization aims to train engineers, through research, towards the development of the necessary numerical, geometrical and experimental models for the development of tools for the integrated design of components and/or mechanical systems. This multi-disciplinary approach to mechanical design needs to be strongly directed towards concurrent engineering and depends on:

- Experimental mechanics: for the characterization of behaviours, damage and rupture of materials, and mechanical components under complex demands;
- Theoretical mechanics: to transpose experimental phenomena in integral mathematical models in software structure calculation;
- Numerical modelling: to clearly identify (in space and time) continuous equations, and to develop resolution diagrams adapted to strong geometrical and material non-linearities. Optimization algorithms of technological solutions are also developed;
- Geometrical modelling: for spatial location of parts in their initial configuration, within the framework of the finite element method. Meshing or adaptive meshing during digital simulation is also developed;
- Integration: concurrent engineering uses various tools to develop design methodologies for parts and mechanical systems, with the objective being to integrate all the functional data related to a system in the design process.

Prerequisites
In the first year, applications are invited from holders of a European degree in mechanics, applied mathematics or physics. Students giving proof of a level equivalent to 180 ECTS credits in these disciplines can be admitted at the discretion of the admissions committee.

In the second year, applications are invited from holders of a Bachelor in mechanics, physics, or applied mathematics, the holders of a MST, or any engineering degree whose syllabus contains basic training in mechanics. Engineering students from UTC, UTBM and UTT in their final year, as well as holders of equivalent foreign degrees with at least 240 ECTS credits can also apply.

Potential Careers
Students in this program are well-prepared in both the methods of fundamental research and industrial research. This provides graduates who are well-adapted to technological realities, allowing them to find positions in organizations, laboratories and companies involved in mechanical design technologies. Those who wish to continue towards a doctorate can be integrated into a research laboratory in theoretical, numerical or experimental mechanics. In particular:

- The Laboratory of Mechanical Systems and Concurrent Engineering (LASMIS) at UTT;
- The Laboratory of Mechanics and Manufacturing Processes (LMPF) of the ENSAM/CER Châlons.

Course director: Abel Cherouat
Tel: 03 25 71 56 74

Contact
Master S & T - Spécialité "Mechanical Systems and Materials"
Université de technologie de Troyes
12 rue Marie Curie - BP 2060 - 10010 Troyes cedex
Tel: 03 25 71 56 51
Fax: 03 25 71 56 75
Email: master.smm@utt.fr
## Semester 1 Autumn

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<td>Digital methods for the engineer</td>
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<td>Project management</td>
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<tr>
<td>TM</td>
<td>MQ08</td>
<td>6</td>
<td>Theoretical and experimental stress analysis</td>
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<tr>
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<td>Introduction to CAD : geometric modeling</td>
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## Semester 2 Spring

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<td>MQ02</td>
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<td>Introduction to solid continuum mechanics</td>
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<td>Introduction to research</td>
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<td>Materials analysis and microscopic characteristics</td>
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<td>MQ05</td>
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<td>Choice of materials</td>
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<td>TM</td>
<td>MQ06</td>
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<td>Modeling structures using finite elements</td>
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<td>Advanced modeling of finite elements structures</td>
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## Semester 3 Autumn

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<td>Advanced design methods</td>
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<td>SM05</td>
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<td>Pre-stressing engineering</td>
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<td>CS</td>
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<td>Design of torqued thermodynamic phenomena</td>
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<td>CS</td>
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<td>Product design and technical data exchange/management</td>
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<td>Elasto-plastic structures calculations by finite element method</td>
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<td>Structures dimensioning under complex stresses</td>
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## Semester 4 Spring

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<tr>
<td>ST</td>
<td>TN30</td>
<td>30</td>
<td>Master's thesis</td>
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* compulsory subject for the Master’s degree
Agro-Resources and Composite Materials engineering (IAMC)

The IAMC program offers students scientific tools and techniques in the new field of composite agro-materials originating from vegetable resources. This formation is shared between three French partner universities, and takes place on different sites: Université de Technologie de Troyes, Université de Reims Champagne-Ardenne, and Université Picardie Jules Vernes.

Objectives
The objective of this formation is to learn how to create, shape, characterize, and recycle materials originating from natural resources. This formation includes the knowledge of experimental and digital tools as well as the following fields:

- the experimental physics, mechanics, and chemistry needed for the characterization of composite agro-materials’ basic components;
- the digital simulation used for the modelling of the shaping processes, and for the dimensioning and the calculation of agro-material structures.

This formation offers courses relating to:

- the development of composite agro-materials with thermoplastic and mineral matrix, and with vegetable reinforcement;
- the physical, chemical and mechanical characterization of ago-materials;
- the necessary tools to design finished agro-material products;
- CAD, modelization, prototyping;
- The new standard tests.

Prerequisites
In the first year, applications are invited from holders of a European degree in mechanics, physics, chemistry, biology and/or materials. Professionals in the field of agro-materials can also be admitted.

In the second year, applications are invited from holders of a Master in mechanics, physics, chemistry, biology, materials, or any engineering degree whose syllabus contains basic training in one of these fields. Engineering students from UTC, UTBM and UTT in their final year, as well as holders of equivalent foreign degrees with at least 240 ECTS credits, and professionals in the field of agro-materials can also apply.

Potential carrers
Currently, the media and populations’ pressure for sustainable development is creating new markets for agricultural products, especially for agro-resources in non-food uses. In addition to biofuels, agro-materials with a great potential for recycling are now entering the wrapping and packaging market.

The setting up of the worldwide competitive IAR center (Industry – Agro-Resources) in Champagne Ardenne and Picardie, and the important number of member businesses have naturally imposed the existence of high-flying and innovating formations leaning towards a future which is closely linked to the promotion of renewable natural resources. The IAMC specialization is clearly meant for the development of non-food agro-resources.
Semester 1 Autumn

Courses are taught at Université Picardie Jules Verne in Amiens

Semester 2 Spring

Courses are taught at Université Reims Champagne-Ardenne in Reims

Semester 3 Autumn (at UTT)

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<td>IAMC02*</td>
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<td>Behavior laws – formulation and identification</td>
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<tr>
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<td>EV12</td>
<td>6</td>
<td>Eco-design, &quot;clean&quot; technologies and recycling</td>
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<td>Regulations and conformity</td>
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Choose 2 among the 3

Semester 4 Spring

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<td>Master’s thesis</td>
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</table>

*compulsory subject for the Master’s degree

** different category from the engineering degree
5.2. Information Technology and Communication Sciences (STIC)

The rapid growth of the information society over the past few years has led to a major spreading of the Communication and Information Technologies (TIC) in all fields of activities and has created important training needs. UTT wishes to address these needs with the STIC emphasis and wants to train specialists in the technologies using computer science and modeling, which are the driving force behind technological innovation.

The STIC emphasis is based on the information and communication sciences and technologies’ fundamental competences, which are divided into three fields of study: Systems’ Optimization and Security (OSS); Information Systems Security (SSI); Information Technologies for the Management of Knowledge and Networks (TICOR).

Systems Optimization and Security (OSS)

Objectives
This program aims to give students the means to carry out a search for quality, either industrial or university based, in fields relating to the control of industrial processes. The topics developed are reliability of complex systems (reliability, monitoring and maintenance), and production optimization and distribution systems. Based on a coherent methodological base, the OSS program is organized around two main themes:

- The optimization of the industrial processes: these courses are based on the modelling of production and distribution systems, with the objective of optimizing production and logistic flow management;
- Information processing and decision-making for system monitoring and safety: these courses aim to give students the tools and methods that will enable them to identify and characterize the running of a system, to assess its performance and to forecast, detect and control the appearance of random events (failures), and finally, to decide on the appropriate responses to the system.

Prerequisites
In the first year, are admitted holders of a European degree in EEA, data processing, statistics, applied mathematics, or physics (or other degrees accepted by the admissions committee) awarded with at least 180 ECTS credits.

In order to apply to the second year, students should be in their final year at the Universities of Technology (UTT, UTC, UTBM) or other engineering schools, holders of a Bachelor's degree in EEA, data and information processing, statistics, applied mathematics, or physics (or other Masters accepted by the admissions committee), graduates of IUP in industrial engineering, information systems, electric engineering, industrial information systems, mechanical engineering, and computer-integrated manufacturing, as well as holders of equivalent foreign degrees with at least 240 ECTS credits.

Potential Careers
For students wishing to continue towards a doctorate, in order to integrate research and development departments within high-tech companies, research organizations or higher education, this research Master will be a compulsory prerequisite. For those who wish to follow an industrial career, this Master’s program will initiate them to industrial research and technology transfer. The industrial goal of this program is clear as the courses in the “System Optimization and Security” (safety and monitoring of systems, computer-integrated manufacturing, logistics...) specialization cover essential fields for many branches of the industry (energy, transport, automotive and aeronautical engineering, services...)

Course director: Christophe Bérenguer

Contact
Master S & T - Spécialité "System Optimisation and Security"
### Semester 1 Autumn

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<td>Information theory and coding</td>
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<td>CS</td>
<td>SY14</td>
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<td>Analysis and dynamics of systems</td>
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<tr>
<td>TM</td>
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<td>Project management</td>
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<td>TM</td>
<td>IF14</td>
<td>6</td>
<td>Knowledge engineering methods for information systems audit</td>
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<td>TM</td>
<td>IF20</td>
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<td>Integrated management and process modeling</td>
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<td>Lxxx*</td>
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<td>Introduction to literature search</td>
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<td>ME</td>
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### Semester 2 Spring

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<td>Production planning and scheduling</td>
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<td>Management of computer-based projects</td>
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<td>EC</td>
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<td>CS</td>
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<td>Decision and Estimation: Statistical Approach</td>
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* = compulsory subject for the master's degree
Information Systems Security (SSI)

Objectives
Companies must face new stakes regarding information security. Actually, they often have to open their information systems. The omnipresence of micro-computers, distributed information systems, and network interconnections have modified considerably the risks regarding company information security and increased the number of problems. Information, being or becoming the most important for companies, is being more and more hunted.

In such a context, any company has to conscientiously take risks. They need to identify and evaluate the risks, estimate prevention costs (by taking into account the company’s budget), make decisions, and take into account residual risks. All of this means that they have to manage risks and therefore be trained to do so.

Potential careers
The objective of this Master's is to meet company requirements. This Master's aims to enable students to acquire knowledge in information systems security, to know the concepts, methods and techniques of security and risk management, and to keep up with evolutions. It is for example to give students skills in cryptology, in order to set up networks, and transactions securisation technologies which are more and more based on cryptology systems. It trains experts able to design, set up, evaluate information systems security and/or advise decision makers in this field.

Potential careers with this Master's are in:
- Security management;
- Auditing, project management (projects including security);
- Information Systems Security management;
- Risk management.

Prerequisites
Entrance in the first year is offered to holders of a bachelor’s degree in computing science, networks, and telecommunications, or any equivalent degree including 180 ECTS credits in one of these fields.

Entrance in the second year is offered to holders of an engineering or science degree in computing, networks, or telecommunications, or any equivalent degree which comprises 240 in one of these fields. This Master's is also available in continuing education.

Course director: Philippe Cornu

Contact
Master S & T - Spécialité "Sécurité des Systèmes d'Information"
Université de technologie de Troyes
12 rue Marie Curie - BP 2060 - 10010 Troyes cedex

Secretariat:
Tel: 03 25 71 56 89
Email: master.ssi@utt.fr
### Semester 1 Autumn

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* = compulsory subject for the master’s degree
** = different category from the engineering degree
Technologies for the Management of Knowledge and Networks (TICOR)

Objectives

This program aims at teaching students the methods and concepts that will enable them to use Information Technologies. They should therefore be able to manage knowledge and communities within organisations and deal with the software and networks infrastructures which are becoming more and more innovating.

Even though this field of studies is mainly concerned with computer science and networks, it also involves social sciences, information and communication sciences, sociology, and management which are all essential to the understanding of the managerial and cognitive implications of introducing the NIT within networks and organisations.

The TICOR program teaches students in three fields of excellence: the management of autonomous networks within and internet context; the management of knowledge; and the management of communities. Therefore, the program offers scientific teaching in computer science and networks as well as social science classes in knowledge engineering and in CSCW (Computer Supported Cooperative Work). The uniqueness of the TICOR program relies on the possibility for the students to built up their own curriculum by combining knowledge in the new networks technologies, in the representation, storage and information search methods, and in the development of new cooperative applications.

Prerequisites

Admission to the first year is offerd to students who have a bachelor’s degree in any of the following disciplines: computer science, information systems, communication, The Internet and multimedia, management, mathematics applied to social sciences, linguistic sociology, or psychology. Students giving proof of a level equivalent to 180 ECTS credits in these disciplines and professionals acting in a connected field can also be admitted at the discretion of the admission jury.

Second year admission is offered to holders of a 240-ECTS-credit degree in any of these disciplines, or an engineering degree where the syllabus contains basic training in computing, and engineering students from UTC, UTBM and UTT in their final year.

Potential Careers

The prospects of this specialization are numerous:

Potential fields:
- Telecommunications and networks;
- Computer science;
- Consulting and auditing;
- e-commerce, e-marketing.

Potential positions:
- Doctorate in networks and knowledge engineering;
- SSII consultant;
- Networks, telecommunication, and R&D engineer;
- Computer networks manager;
- Networks and systems manager;
- Networks designer;
- Information systems manager.

Course director: Dominique Gaïti

Contact
Master S & T - Spécialité "Networks, Knowledge, and Organisations"
Université de technologie de Troyes
12 rue Marie Curie - BP 2060 - 10010 Troyes cedex
Tel. Dominique Gaïti: +33 3 25 71 56 85
Email: master.ticor@utt.fr
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* =compulsory subject for the master’s degree
5.3. Engineering and management (IM)

The final objective of this formation is to provide future decision-makers and project managers from the private or public industry with knowledge, methods and tools, along with a certain ethic, addressing three domains with currently decisive stakes: Environment, Security, and Sports.

This emphasis deals with managing the complexity of the socio-technical systems. The complementary competences provided by Engineering Sciences, Management and Social Sciences are meant to optimize the management of businesses and services, and facilitate the development of innovative projects in these three fields.

Sustainable and Environmental Management and Engineering (IMEDD)

Sustainable development needs to disjoin the economic and social dynamism from the continuous increase of matter and energy flows at the planet scale. This division between economic growth on one side and the intensive use of resources and the growing impacts on environment on the other side is one of the major stakes of the 21st century.

The Sustainable and Environmental Management and Engineering program (IMEDD) trains specialists on strategies of economic activities’ dematerialization that allows companies and territories to take advantage of the division between financial and physical flows due to industrial ecology, eco-design and ecotechnologies.

Objectives
To give through an adapted pedagogy (projects, company visits, tutoring, 24-week internship, contacts with professionals) a real know-how for future technical managers in the environment, experts in dematerialization (eco-design and industrial ecology).
To develop the soft skills (personal and managerial) in order to improve their adaptability, and to sensibilize the students to enterprise creation (eco-innovation).
To open the studies towards prospective developments and research.
To get a strong international vision (recruitment, languages, mobility, double-degree).

Prerequisites
- International program:
The international program, organized with the University of Sherbrooke in Canada, is open to students with a Bachelor’s degree (preferably with honours). Students having a professional experience can be accepted by equivalence and can apply through continuing education.
Success in this Master’s validates a double degree: one from North America and one from Europe. The number of students accepted each year in the program is limited. The selection is done at the UTT and the University of Sherbrooke by a jury made of scientists and professionals. Candidates are required to have a certain English level.
The procedure implies that the students register to both institutions, by mentioning their participation in the double degree.
- National program:
Students holding a Bachelor level with 180 ECTS credits have the possibility to enter in the first year of the national program. Students holding a degree equivalent to 240 ECTS credits have the possibility to enter in the second year. In both cases, a degree with honours is preferable.
Students having a professional experience can be accepted by equivalence and can apply through continuing education.
The number of students accepted each year in the program is limited. The selection is done by a jury made of scientists and professionals. Candidates are required to have a certain English level.

Course director: Sabrina BRULLOT
International program

Semester 1 Autumn
Courses are taught at the University of Sherbrooke in Canada.

Semester 2 Spring
Part 1 - Courses are taught at the University of Sherbrooke in Canada.
Part 2 – 4-month internship (May to July)

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Semester 4 Spring

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Part 2 – 2-month internship (July and August)

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* =compulsory subject for the master’s degree
**= different category from the engineering degree
National program

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Semester 3 Autumn

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Semester 4 Spring

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Applied Civil Security and Safety (IMSGA)

Objectives
Guarantee against risk is part of the modern world’s biggest stakes. It is the reason why the University of Technology of Troyes (UTT) and the Institut National des Hautes Etudes de Sécurité (INHES) work hand in hand to train people to new professions in security. Lectures cover all the security aspects and propose a global approach: the security of people and goods taking into account urbanism, environment, networks, ecology, and crises. Because of the problems of security and safety, which are rising, a new professional approach has appeared: engineering and management in global applied security. This allows setting up the basics of an efficient cooperation between management methods of people and goods’ security, of living areas’ safety, economics, industrial and commercial protection, and of systems’ safety and communication networks.

Assets
- Global view of security;
- Original cooperation between the Institut National des Hautes Etudes de Sécurité affiliated to the Ministry of Interior, and the University of Technology of Troyes especially training engineers;
- Innovative degree combining human and social sciences, engineering sciences and the experience of several professionals;
- Excellent preparation to understand and prevent risks: from the environment to people and goods’ security, from infrastructures’ security to crises management, and from facilities’ safety to economical intelligence.

Potential careers
The students who get this Master’s are able to bring solutions and face risks. They are able to identify the critical points, make a diagnosis and come up with solutions. Furthermore, their managerial skills enable them to take actions. Finally, they are not only advisors towards decision makers, but also managers capable of finding solutions in order to reduce and manage risks. Such professionals can receive offers: from local governments’ offices, organizers of major events, urban project managers, industrials, services organizations, security companies, transport companies, banks, insurance companies, professional unions, superstores, etc.

Academic team
The academic team of this Master’s is pluridisciplinary. They deal with the problems of risks and security through sciences, technology and through human and social sciences. Composed of professors and scientists from universities, senior officials, executive officers and corporate executives, the team is complementary and transverse.

Teaching locations
University of Technology of Troyes (UTT)
Institut National des Hautes Etudes de Sécurité (INHES), Paris

Prerequisites
Entry in first year: holders of a bachelor’s degree or by equivalence of professional experience (VAP)
Entry in second year: holders of a degree with 240 ECTS credits or by equivalence of professional experience.

Course director: Patrick Laclemence

Contact
Master S & T - Spécialité "Ingénierie et Management en Sécurité Globale Appliquée"
Université de technologie de Troyes
12 rue Marie Curie - BP 2060 - 10010 Troyes cedex

Secretariat:
Tel: 03 25 71 56 51
Fax: 03 25 71 56 75
Email: master.imsga@utt.fr
## Semester 1 Autumn

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## Semester 4 Spring

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* = compulsory subject for the master's degree  
**= different category from the engineering degree
Sports, Management and Engineering: Security and Events Logistics (SMI-LES)

Objectives
A sector as transversal as sport needs the synergy of multiple and very high level competencies and considers that sport's economy needs the most powerful engineering and management tools. The SMI-LES Master's is for students with good knowledge in sciences, management and/ or techniques. This Master's gives specific professional training to sports professions in 5 sectors:

- Sport's services: local sports steering committees, youth, holiday camps, leisure, sports tourist agencies, “fitness” sector, federations and sports clubs
- Sports events: agencies, managers of welcoming facilities, marketing or communication organizations, communication services in big organizations
- Associative administrations: associations, leagues, state committees, steering committees at sports local offices…
- Distribution and sales of sports equipments (specialized or general shops with different sizes)
- Manufacturing and design of sports equipment (infrastructures, heavy and light sports equipment, sports goods, sports gears…)

Prerequisites
Admission to the first year is offered to students who have a bachelor’s degree in any of the following disciplines: sports, sciences (computer, design, biology…), management, economics, economical and social administration, sociology information and communication. Students giving proof of a level equivalent to 180 ECTS credits in these disciplines can also be admitted at the discretion of the admission jury.

Second year admission is offered to holders of a 240-ECTS-credit degree in any of these disciplines. Lifelong learning education: this master is also open to candidates with professional qualifications (technical managers, holders of educator's degree, advisors in development, project managers, administrative directors, sports office directors, information officers…).

Potential careers
Potential careers in any sports sectors, and services (information and organization systems, human resources, education, communication, marketing, quality, management, etc.):

- Sports services (governmental, paragovernmental or private sectors):
  - Director of sports services in local government's office;
  - Director of youth, sports, or leisure service;
  - Director of sports and leisure infrastructures;
  - Management of sports tourist agency;
  - Director of spa centre;
  - Consulting;
- Event organization:
  - Project manager for sport events;
  - Manager of welcoming facilities for sport events;
  - Marketing or communication organizations;
  - Information offices using sport as a communication tool;
  - Director of safety for major events or professional structures (stadiums, clubs, associations…);
- Associations:
  - Directors within leagues, associations, committees and sports clubs;
  - Directors of local sports offices;
  - Information officer;
  - Marketing director;
  - Development manager;
- Distribution and sales of sports equipments
  - Specialized stores;
  - General or specialized superstores;
- Manufacturing and design of sport equipments
  - Design of infrastructures (gymnasiums, stadiums, swimming pools, ice skating arenas…);
  - Heavy and light sports equipment;
  - Sports goods (bikes, boats…);
  - Sports gears (shoes, clothes…).
Partners:
ESC Troyes group, DDJS de l'Aube, ESTAC, Fédération Française de Football, Fédération Française de basketball, Fédération Française de Tennis, Fédération Française des Sports de Glace, Fédération Française de Motocyclisme, Centre Technique National Fernand Sastre, Centre Sportif Départemental de l'Aube, @nnimé, Takamaka, Nanouk Diffusion, Carrefour, Crédit Agricole Champagne Bourgogne, ANDIS, Cycleurope, Aigle Nouansport.

Contact
Stéphane Goudry
Master - Spécialité "Ingénierie et Management du Sport"
Université de technologie de Troyes
12 rue Marie Curie - BP 2060 - 10010 Troyes cedex

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Semester 3 Autumn

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**= different category from the engineering degree
6. **Doctoral School (PhD)**

Within the framework of post-graduate programmes at UTT, the Doctoral School "Sciences of Technological and Organizational Systems" offers Doctoral degrees in 5 specialities.

The programmes offered by the Doctoral School correspond to the scientific fields covered by the laboratories at the UTT. This allows young researchers, in addition to their research work in the laboratories, high level scientific training and an excellent preparation for their future professional life.

The specialities of Doctorate (Ph.D.) are as follows:

- Systems Optimisation and Dependability (OSS)
- Networks, Knowledge, Organizations (RACOR)
- Mechanical Systems and Materials (SMM)
- Optics and Nanotechnologies (ONT)
- Sustainable Development (DD)

Each speciality offers high level scientific modules (hourly volume: 21h per module). The Doctoral School also offers a certain number of transverse modules, directed in particular towards professional preparation (“SHIP”).

Finally the student can validate modules taken in other specialities at UTT, or even other institutions or organizations. The students choose their modules after discussion with their research supervisor (when one has already been chosen).

The organization of the students’ programmes is common to all specialities of the doctoral school.
7. **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 1st of June for the Autumn semester and the 1st of December 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.

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<td>B</td>
<td>Very Good</td>
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<td>(30%)</td>
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<td>(10%)</td>
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<td>Fail/FX</td>
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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.
8. **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.

- This icon means that the course will be part in French and part in English
- This icon means the course is completely in English

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9.  **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:
  
  L: lectures  
  SW: supervised work  
  PS: practical sessions  
  PW: personal work.

**COURSES ARE LINED UP IN ALPHABETICAL ORDER BY CODE**
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### Arts

**Communication and knowledge**

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<th>Spring</th>
<th>Category</th>
<th>Level</th>
<th>ECTS credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>TN01</td>
<td>Introduction to the definition and manufacture of a technical object</td>
<td>X</td>
<td>X</td>
<td>TM</td>
<td>Yr 1</td>
<td>6</td>
</tr>
<tr>
<td>TN02</td>
<td>Introduction to mechanical design</td>
<td>X</td>
<td>X</td>
<td>TM</td>
<td>Yr 1/2</td>
<td>6</td>
</tr>
<tr>
<td>TN04</td>
<td>Multi-technique productions</td>
<td>X</td>
<td>X</td>
<td>TM</td>
<td>Yr 1</td>
<td>6</td>
</tr>
<tr>
<td>TN08</td>
<td>Introduction to matter working</td>
<td>X</td>
<td>TM</td>
<td>Yr 2</td>
<td>6</td>
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<tr>
<td>TN12</td>
<td>Engineering and design</td>
<td>X</td>
<td>TM</td>
<td>Yr 3</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>TN14</td>
<td>Initiation into C.A.D.: geometric modeling</td>
<td>X</td>
<td>TM</td>
<td>Yr 3</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>TN15</td>
<td>Standard manufacturing techniques</td>
<td>X</td>
<td>TM</td>
<td>Yr 3</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>TN16</td>
<td>Concurrent engineering and CAD/CAM support</td>
<td>X</td>
<td>TM</td>
<td>Yr 4/5</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>TN17</td>
<td>Manufacturing technology and methods tools</td>
<td>X</td>
<td>TM</td>
<td>Yr 4/5</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>TN18</td>
<td>Advanced production techniques</td>
<td>X</td>
<td>TM</td>
<td>Yr 4/5</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>TN19</td>
<td>Purchasing techniques and cost reduction</td>
<td>X</td>
<td>TM</td>
<td>Yr 4/5</td>
<td>6</td>
<td></td>
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<tr>
<td>TN20</td>
<td>Analysis and dimensioning of mechanical systems</td>
<td>X</td>
<td>TM</td>
<td>Yr 3</td>
<td>6</td>
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</tbody>
</table>

**Technology and safety**

<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>
</tr>
</thead>
<tbody>
<tr>
<td>TS01</td>
<td>Systems security</td>
<td>X</td>
<td>TM</td>
<td>Yr 4/5</td>
<td>6</td>
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</tr>
<tr>
<td>TS02</td>
<td>Industrial risks management</td>
<td>X</td>
<td>TM</td>
<td>Yr 4/5</td>
<td>6</td>
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**Individual work (TPE)**

<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>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>Personal choice study</td>
<td>X</td>
<td>X</td>
<td>CS</td>
<td></td>
<td>6</td>
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<tr>
<td>AV</td>
<td>Multi-media production</td>
<td>X</td>
<td>X</td>
<td>EC</td>
<td></td>
<td>4</td>
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<tr>
<td>ER</td>
<td>Documentary research and surveys</td>
<td>X</td>
<td>X</td>
<td>CT</td>
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<tr>
<td>SL</td>
<td>Foreign language tutoring (TPE-EC)</td>
<td>X</td>
<td>X</td>
<td>EC</td>
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<td>4</td>
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<tr>
<td>TX</td>
<td>Creation and experimentation</td>
<td>X</td>
<td>X</td>
<td>TM</td>
<td></td>
<td>6</td>
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</tbody>
</table>

**Practical and project work**

<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>
</tr>
</thead>
<tbody>
<tr>
<td>TN05</td>
<td>One month technical training period</td>
<td>Feb</td>
<td></td>
<td>Yr 1</td>
<td>6</td>
<td></td>
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<tr>
<td>TN07</td>
<td>Experience abroad</td>
<td>Feb</td>
<td>July</td>
<td></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>TN09</td>
<td>6 month work placement</td>
<td>X</td>
<td>X</td>
<td>Yr 4</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>TN10</td>
<td>Industrial project</td>
<td>X</td>
<td>X</td>
<td>Yr 5</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>TN30</td>
<td>Master’s thesis</td>
<td>X</td>
<td>X</td>
<td>Yr 5</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>TN31</td>
<td>Specific placement in environment and sustainable development</td>
<td>X</td>
<td></td>
<td>Yr 4</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>TN32</td>
<td>Essay in environment and sustainable development</td>
<td>X</td>
<td>Yr 5</td>
<td>12</td>
<td></td>
<td></td>
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<tr>
<td>TN40</td>
<td>Laboratory project for exchange student</td>
<td>X</td>
<td>X</td>
<td>Yr 4/5</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>Credit Course</td>
<td>Autumn</td>
<td>Spring</td>
<td>Category</td>
<td>Level</td>
<td>ECTS credits</td>
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<tr>
<td>TN51</td>
<td>Work-study program 1</td>
<td>X</td>
<td>X</td>
<td></td>
<td>Yr 5</td>
<td>18</td>
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<tr>
<td>TN52</td>
<td>Work-study program 2</td>
<td>X</td>
<td>X</td>
<td></td>
<td>Yr 5</td>
<td>18</td>
</tr>
</tbody>
</table>
COURSES ARE LINED UP IN ALPHABETICAL ORDER BY CODE

AC

Personal choice study

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

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AM

Music

SW 34hrs

Prerequisite:
A high standard of competence in instrumental practice or singing.

There are 3 levels AM01, AM02, AM03 (from a good level to a higher level)

Objectives:
• To improve on and develop the musical, instrumental or vocal practice which is already of a good level.
• To gain more musical culture.
• To achieve a personal project.

Programme:
• Improvement classes in the student’s particular specialty, in partnership with the Conservatoire National de Troyes, and Aube Musiques Actuelles.
• A project or research work, in a field chosen by the student, in agreement with the person in charge of the course.

AUTUMN-SPRING

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AP01

Painting, writing or drawing

SW 51hrs

PW 60hrs

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

Group restricted to 16 max

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.

SPRING

Back to list
AP02  
**Artistic creation**  
4 ECTS credits  

<table>
<thead>
<tr>
<th>SW</th>
<th>PW</th>
<th>51hrs</th>
<th>60hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisite:</td>
<td>To have already studied art within an identified structure.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Objectives:  
- 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.

Group restricted to 16 max

**SPRING**

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AP03  
**Art and technology**  
4 ECTS credits  

<table>
<thead>
<tr>
<th>SW</th>
<th>PW</th>
<th>51hrs</th>
<th>60hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisite:</td>
<td>To have already studied art within an identified structure.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Objectives:  
- 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.

Group restricted to 16 max

**AUTUMN**

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AT  
**Theatre**  
4 ECTS credits  

<table>
<thead>
<tr>
<th>SW</th>
<th>PW</th>
<th>51hrs</th>
<th>60hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisite:</td>
<td>Previous practical theatrical experience in a structured situation.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Objectives:  
- 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.

**SPRING**

Back to list
Multi-media production

Prerequisite: MM01

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.

AUTUMN-SPRING

Internet and networks development

Objective:
• To understand the rising complexity and the diversity of Internet and of networks in general from a service quality and protocols point of view.

Programme:
• Service quality in fixed and wireless networks
• Internet and its developments
• Services convergence
• Developments of wireless and mobile networks
• Introduction to Distributed Artificial Intelligence in networks protocols
• Autonomous networks
• Intelligent routing protocols
• Networks management and autonomous control

AUTUMN

Knowledge engineering and electronic documents

Objective:
• To discover the field of knowledge engineering and its new documentary and participatory trends.
• To learn about research and transfer in this field.

Programme:
• Basics (terminology, ontology, semantic web, experience)
• Knowledge engineering facing semeiology
• New prospects (documents, collection, reliability)
• Study cases (communities of interest, scientific communities)

AUTUMN
CC03

Agent technologies: applications to networks

Objective:
• Study and applications of agent technologies

Programme:
• Basics of Distributed Artificial Intelligence
• Artificial Intelligence technique for decision-making
• Multi-agents architectures (reactive, cognitive, hybrid)
• Multi-agents communication, cooperation and deal
• Example of applications: agents for autonomous networks: simulation, control and management
• Agents for games, animated conversational agents, avatars and advanced applications.

Level: Yr 5

4 ECTS credits

AUTUMN

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CC04

Cognitive sciences for Computer Supported Cooperative Work

Objective:
• To understand the main research areas in Cognitive Sciences and Cognitive Supported Cooperative Work (CSCW)

Programme:
• Cognitive approach of information knowledge management
• New paradigms of situated and distributed cognition, cognitive sociology and ethnomethodology
• Organizational learning (limited rationality, typology of rationality forms in organizations…)
• Theory of communicational transactions and coordination forms through action documents
• CSCW methods and tools

Level: Yr 5

4 ECTS credits

AUTUMN

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CC10

Information systems fundamentals

Objective:
• Understand the Information System concept, learn the fundamental knowledge on modeling for Information System design, bases of wide area networks, web development fundamentals.

Programme:
• Definition, history and typology of Information Systems.
• Overview of the actors and works of Information Systems.
• Information Systems design: three-tier architecture / review on databases design / object modeling for web application design.
• Internet, how does it work? Communication protocols, design of an internet website.

Level: Yr 5

4 ECTS credits

AUTUMN

Back to list
CC11  Methods and tools for knowledge management and cooperation  

Objective:  
- To understand the many concepts of knowledge management and Computer Supported Collaborative Work.  
- To understand the actual market regarding platforms for knowledge management, collaborative work and network environment.  

Programme:  
- Panorama of concepts and methods of strategic knowledge identification and of knowledge acquisition and representation.  
- Panorama of the different existing platforms (editor, Software and computer services company) in content and knowledge management and in collaborative work.  

Level: Yr 5  

Programme:  

AUTUMN

Back to list

CC21  Organizations science and innovation for virtual communities  

Objective:  
- To master the actual approaches in sociology and management for virtual communities supported by ICT.  

Programme:  
- Presentation of community of practice concept and instrumentation modes.  
- Presentation of contemporary organization forms in network (clusters…) and associated strategic stakes.  
- Learning of organizations study management and of networking in order to set up ICT (intranet, KM, portal, gropware, GED…).  
- Link between community and innovation problematics.  

Level: Yr 5  

Programme:  

AUTUMN

Back to list

CC22  Mediated communication, ergonomics, information search  

Objective:  
- To know the principal theories of communication and language in order to analyze and design the processes of interpersonal and computer-mediated communication.  

Programme:  
- Models and theories in information and communication sciences: introduction to information and communication sciences, models of communication (from telegraphic model to ethnographic model).  
- Analyze the communication texts and speeches: communication semiology, linguistics and speech analysis, conversational analysis and interactionnist approach.  
- Computer-mediated communication (CMC): CMC specificities, virtual communities, orality and CMC, CMC and interculturality.  

Level: Yr 5  

Programme:  

AUTUMN

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CC31

Internet services, project management and modeling methods

6 ECTS credits

L  40hrs  
SW 20hrs  
PW 60hrs  
Level: Yr 5

Objectives:
- To get used with customer relation, e-business, human services, telecommunications, strategic analysis approach, marketing and operational analysis approaches, marketing and services operational approaches
- To acquire the methods to manage successfully a system integration project such as a knowledge management portal or cooperative work portal.

Programme:
- Presentation of main e-business, CRM and services strategies.
- Analysis of the human services sector and audit methodologies.
- Knowledge and cooperation in e-business modeling (CRM, market places, logistics) and the e-services
- Services oriented modeling

AUTUMN

CHMA01

Matter structure and process

6 ECTS credits

L  34hrs  
SW 34hrs  
PS 20hrs  
PW 68hrs  
Level: Yr 1

Objectives:
- To get an overview on matter structure
- To acquire the general fundamentals of chemical process

Programme:
- Matter state and transitions
- Solids and fluids descriptions
- Periodic table, the atom structure and the different types of linkages
- Isotopes and radioactivity
- Chemical reaction (values, equilibrium, degree of conversion)
- Oxidation-reduction reactions
- Acid-base reaction

AUTUMN-SRING

CHMA02

Chemistry of industrial processes

6 ECTS credits

L  34hrs  
SW 34hrs  
PS 24hrs  
PW 68hrs  
Level: Yr 2

Objectives:
- To get important examples on chemistry of industrial processes (metallurgy, agroresources, petrochemistry)
- To deepen knowledge in reactivity for real study case applications

Programme:
- Dry oxidation-reduction
- Thermochemistry (binary diagrams, distillation, Ellingham…)
- Example with iron and zinc in metallurgy
- Industrial chemistry of oxides
- Chemical catlysis
- Applications with agroresources and petrochemistry

AUTUMN
CHMA03  Structure and properties of solids

Objectives:
- To get to know the structure of the different categories of solids (metals, polymers...)
- To know their reactivity
- To know some important applications of the solids reactivity

Programme:
- Crystallography and metals
- Oxidation-reduction properties (corrosion...)
- Polymers (compounding, degradation, applications...)
- Examples of biologic matter (calcites, apatite, lignin...)
- Application to electrochemical energy storage

Level: Yr 2

6 ECTS credits

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CHMA04  Chemical analysis, safety and environment

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

Programme:
- Physical-chemical aspects of safety (gaz reactivity)
- 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)

Level: Yr 2

6 ECTS credits

Back to list

CL01  International trade and logistics

Objective:
- To learn the basic tools of international logistics.

Programme:
- Context and trends of globalization and international logistics development.
- Large international trade organizations or institutions.
- Logistics export, design and planning of operations.
- Financing of operations, insurance.
- Maritime and air Transport.
- Customs law.

Level: Year 4/5

6 ECTS credits

Back to list
CL02  Packaging, materials handling and warehousing  
6 ECTS credits

L  34hrs  Objective:
SW  34hrs  • To understand the organizational techniques of warehouse management.
PW  40hrs  Programme:
Level: Year 4/5
• Management of incoming deliveries.
• Choice of warehouses configurations.
• Choice of handling methods.
• Management of handling.
• Packing and conditioning of goods.
• Preparation of outgoing deliveries.

AUTUMN

CL03  Logistics of transportation and distribution  
6 ECTS credits

L  34hrs  Objective:
SW  26hrs  • To understand the field of “external” logistics, its principal problems, as well as
PS  8hrs  the methods of analysis, decision-making and optimization to solve them.
PW  24hrs  Programme:
Level: Year 4/5
• Location problems for factories, warehouses and hubs.
• Implementation, optimization and scrutiny of goods flow in transport networks.
• Vehicle routing problems for pick-up or delivery.
• Management of the resources (drivers, vehicles, hubs).
• Information systems and software for transportation.

SPRING

CL04  Design and management of supply chain  
Customer-supplier coordination  
6 ECTS credits

L  34hrs  Objective:
SW  34hrs  • To understand the models, concepts, and methods, to design, control, exploit and
PS  8hrs  manage supply chains.
PW  68hrs  Programme:
Level: Year 4/5
• 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.

SPRING

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CL07  
Integrating logistics support and customer services

Objective:
• To study the logistics of maintenance support during all the different phases of the life cycle of systems, and to study the organization of industrial facility maintenance.

Programme:
• Maintenance and subcontracting operation management.
• Operating safety requirements allocation and maintenance engineering.
• Methods and analysis tools of Integrated logistics support and Computer Aided Management.
• Experience feedback, configuration management, life cycle.
• Planning, job scheduling and resources allocation during maintenance.
• Evaluation models for maintenance costs and possession costs.

Level: Year 4/5

Prerequisite: Major level

ECTS credits: 6

Schedule: AUTUMN

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CS01  
Value analysis and functional analysis

Objective:
• To analyze the value of a product by optimizing the need-solution ratio.

Programme:
• Introduction to the concepts of Value and Value Analysis.
• 7 steps of Value Analysis.
• Introduction to the concepts of Function, Functional Modeling, Functional Analysis.
• Methods and tools for Functional Analysis.
• Application of Value Analysis to the design or the improvement of a product.

Level: Year 3/4

ECTS credits: 6

Schedule: AUTUMN-SPRING

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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

ECTS credits: 6

Schedule: AUTUMN

Back to list
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-SPRING

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

SPRING

DI02

Methods for diagnosis of industrial systems

Objective:
- To understand all the methods making it possible to identify and automatically detect the operating mode of a system, to detect a possible failure and to locate its origin.

Programme:
- Role of diagnosis in system reliability and supervision of systems.
- Validation of data and diagnosis.
- Diagnostics from models (analytical redundancy, equations of parity).
- Statistical approach to monitoring (tests of hypotheses, probability ratios, detection/isolation of breakdowns).
- Application of recognition methods of forms in diagnosis.
- Diagnostics and artificial intelligence.

Level: Year 4/5

AUTUMN
**DS01**

**Design and the human senses**

**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.

**Level:** Year 3

**For students >TC2**

**6 ECTS credits**

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

**Back to list**

**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

**L** 34hrs  
**SW** 34hrs  
**PS** 20hrs  
**PW** 68hrs

**Back to list**

**EA02**

**Implementation of automatic systems**

**Objective:**
- To be able to define, choose and implement the automatic materials used in mechanical systems.

**Programme:**
- To study the various technologies of actuators and sensors (mechanical, electric, pneumatic, hydraulic...) and their commands.
- Power electronics.
- Robotics.
- Digital control (acquisition, conversion, processing).
- To implement various materials in a project group, or to study an existing system (machining centre, motor vehicle...).

**Prerequisites:**
- EA01

**Level:** Year 4/5

**L** 34hrs  
**PS** 42hrs  
**PW** 42hrs

**Back to list**
EA03  Actuators

L  34hrs
SW  25hrs
PS  18hrs
PW  30hrs

Objective:
- To describe and learn how to use the various types of actuators used, for example, within automated production systems.

Programme:
- Review of mechanics, electromagnetism and thermals.
- Rotary and linear actuators, available technologies (electromagnetic, hydraulic, piezoelectric).
- Automatic, control, actuator direction.
- Coupling actuator-load.
- Peripheral actuators (sensors, couplings, brakes, reducers...).
- Mechanical and thermal aspects of the actuator implementation (Forge 2).

Level: Year 4/5

EA04  Sensors and measurement

L  34hrs
PS  12hrs
PW  34hrs

Objective:
- To become aware of the problems related to the physical measurements of industrial systems and their environment.

Programme:
- Basics of metrology (units - uncertainties - standards).
- Different types of sensors, for example: chemical sensors, integrated sensors and microsensors, fibre-optic sensors, intelligent sensors, sensors and industrial environment...

Prerequisites:
SY01, SY13

Level: Year 4/5

EC01  Eco-design

L  34hrs
SW  17hrs
PW  51hrs

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 oriented management system.
- Application of European law regarding products
- Eco-innovative design methodology.
- Design strategies around the 5R (Refuse/Reduce/Reuse/Reform/Recycle).

Level: M2

SPRING

Back to list
EE06  Organizations in international and European contexts  4 ECTS credits

L  26hrs  Objective:
SW  26hrs  • To understand the new rules, risks of international trade, and the role of Europe.
PW  60hrs  Programme:
• Historical background of the globalization of the economy.
• Business entreprises opposite to the World Trade Organization.
• Role of the European Union.

SPRING  Back to list

EG01  Workstation ergonomics  6 ECTS credits

L  34hrs  Objective:
SW  34hrs  • 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.
PS  18hrs  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.

AUTUMN  Back to list

EG23  Human-Computer interaction and ergonomics  6 ECTS credits

L  34hrs  Objective:
SW  12hrs  • To design and create Human-Computer interaction (HCI), by taking into account the software ergonomics and the characteristics of future users.
PS  34hrs  Programme:
PW  50hrs  • Methods of information collection.
• Methods of HCI design.
• Methods of HCI analysis.
• Ergonomy of software.
• Cognitive sciences.
• Presentation of the development tools for the HCI: DELPHI.

SPRING  Back to list
### EI01  Industrial ecology

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<td><strong>L</strong></td>
<td>34hrs</td>
<td><strong>Objective:</strong></td>
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<tr>
<td><strong>SW</strong></td>
<td>17hrs</td>
<td></td>
<td>To present the stakes, the principles, the methods, the industrial ecology tools as well as the environment territorial management principles.</td>
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<td><strong>PW</strong></td>
<td>51hrs</td>
<td><strong>Programme:</strong></td>
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<td><strong>Level:</strong></td>
<td>M2</td>
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<td>General introduction and historic approach to industrial ecology.</td>
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<td>Principles of eco-reorganization of the industrial society.</td>
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<td>Principles of implementation of industrial ecology: approaches typologies, methodologies, tools, etc.</td>
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<td>Feedbacks on industrial ecology approaches in France and internationally.</td>
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<td>Institutions operations.</td>
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<td>Territorial planning mechanisms and national planning and development</td>
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<td>Networks leadership and principles of environment national planning.</td>
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### EN01  Analog electronic circuits

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<tr>
<td><strong>SW</strong></td>
<td>34hrs</td>
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<td>To understand the basic functions and components in analog electronics.</td>
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<td><strong>PS</strong></td>
<td>16hrs</td>
<td><strong>Programme:</strong></td>
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<td><strong>PW</strong></td>
<td>50hrs</td>
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<td>Revision of the principal theorems used for circuit calculations.</td>
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<td><strong>Prerequisites:</strong></td>
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<td>Behaviour of circuits in harmonic and unspecified modes, use of the Laplace transformation.</td>
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<td>PS22</td>
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<td>Characteristics of the basic components (diodes, transistors).</td>
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<td>Calculation and representation of transfer functions, construction and use of Bode diagrams.</td>
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<td>Studies of the operational amplifier and associated basic assemblies.</td>
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<td>Electronic functions of amplification and filtering - principles and use.</td>
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### EN03  Digital electronics

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<td>24hrs</td>
<td><strong>Objectives:</strong></td>
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<tr>
<td><strong>SW</strong></td>
<td>24hrs</td>
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<td>To understand the behavior of analog and digital electronic systems.</td>
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<td><strong>PS</strong></td>
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<td>To understand the problems linked to electronic systems implementation.</td>
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<td><strong>Programme:</strong></td>
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<td>Energy management and conversion.</td>
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<td>Energy of unattended electronic systems.</td>
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<td>Fixed communication.</td>
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<td>Wireless communication.</td>
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<td>Conversion analog-digital and digital-analog.</td>
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<td>Digital integrated circuits (microprocessors and ASICs).</td>
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**EP01**

**Company ethics and performance**

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**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.

**AUTUMN-SPRING**

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**ER**

**Documentary research and surveys**

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

**Programme:**
- The work will concern a subject of general culture corresponding to a topic of interest to one of the research lecturers.
- Students who have not taken the SI10 credit course will have to follow a preliminary 4-hour course on documentary techniques.
- The course will be evaluated on two elements: a written report and an oral presentation.

**AUTUMN-SPRING**

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**EV00**

**Sustainable development scenarios**

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**Objective:**
- To study the major environmental problems and the principal social and political solutions.

**Programme:**
- Introduction to environmental stakes and to dematerialization strategies.
- Global change and precaution, global warming example.
- Environmental prospective, evolution scenarios of contemporary difficulties.
- Energy and natural resources geopolitics (water, petrol...).
- Sustainable development political scenarios, models epistemology.

**AUTUMN-SPRING**

**Back to list**
EV01  Scientific basics in environment  4 ECTS credits
L  51hrs  PW  34hrs
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.

AUTUMN-SPRING

EV02  Environmental economics  4 ECTS credits
L  51hrs  PW  34hrs
Objective:
• To study the tools of environmental economic regulation.
Programme:
• Interaction between economic system and natural system.
• Introduction to microeconomics and governmental economics.
• Theory of external effects, public goods, property right.
• Environmental public politics tools.
• Evaluation of ecosystems and ecological services.

AUTUMN-SPRING

EV03  Environmental law  4 ECTS credits
L  34hrs  SW  17hrs  PW  51hrs
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.

AUTUMN-SPRING
EV04

Environmental risks: management and controversies

4 ECTS credits

Objective:
• To analyze the jurisdiction of social risk management.

Programme:
• Democracy, public debate and precaution.
• Agreement economy and choices irreversibility.
• Public choices and environmental controversies.
• Strategic interactions between participants.
• Environmental sciences epistemology and social uses.

AUTUMN-SPRING

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EV10

Environmental analysis: basic methods and tools

6 ECTS credits

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 sensivity studies and impact potentials.
• Wastes integrated management.
• Industrial ecology.

SPRING

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EV11

Materials life cycle management

6 ECTS credits

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.

SPRING

Back to list
**EV12**

**Eco-design, “clean” technologies and recycling**

- **Objective:**
  - To understand the principles of eco-design, “clean” technologies and design for recycling.
  - To teach students eco-design tools and methods.

- **Programme:**
  - Environmental stakes of product, process or service. Principles of eco-design and its implementation in a company.
  - Eco-design tools and methods, principles of life cycle analysis and its application.
  - Clean technologies principles and stakes, notion of Best Available Technique. Pollution treatment (water, air and earth) and areas of wastes elimination, etc.
  - Rational use of energy.

- **Level:** Year 4/5

- **Credit:** 6 ECTS credits

- **Duration:**
  - L: 34hrs
  - SW: 22hrs
  - PS: 20hrs
  - PW: 51hrs

- **Offered:** Autumn

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**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.

- **Programme:**
  - Update and in-depth look in grammar, conjugation and syntax competences.
  - Apply your skills in any kind of writing.

- **Credit:** 4 ECTS credits

- **Duration:** Autumn-Spring

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**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

- **Credit:** 4 ECTS credits

- **Duration:** Autumn-Spring
FQ01  Quality assurance and control

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.
• To give training in the basic principles of total quality and participative management.
• To locate and use efficiently, methods related to quality assurance of the product, control of manufacturing processes and performance assessment.
• To implement action plans.

Level: Year 3/4/5

Prerequisite: SY02

6 ECTS credits

AUTUMN-SPRING

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FQ02  Maintenance methods and techniques

Objective:
• To study techniques, technologies and policies of maintenance; the methods of analysis, and the evaluation and optimization of maintenance to ensure the availability of systems.

Programme:
• Terminologies, technologies and strategies of qualitative maintenance.
• Methods of maintenance optimization of: TPM (Total Productive Maintenance), RCM (Reliability-Centered Maintenance), proactive maintenance.
• Performance and follow-up indicators, evaluation of analytical maintenance.
• Optimization of reliability, maintainability, and availability of costs.
• Modeling of a maintenance process by RdP and Markov graphs.

Level: Year 4/5

6 ECTS credits

SPRING

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FQ03  Experimental plans

Objectives:
• To study the models allowing the students to explain and forecast the behavior of an industrial system from experimental tests and to study the methods for determining among the different factors the ones which are the most influent in order to move to quality continuous improvement approach.

Programme:
• Screening plans for the research of influent factors: complete and fractional plans.
• Tagushi plans and quality in design.
• Modeling plans: design of non linear models.
• Optimization of system performance.
• Blending plans.

Level: Year 3

6 ECTS credits

SPRING

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FQ04  
Reliability: basic methods and tools  
6 ECTS credits  
L  34hrs  
SW  34hrs  
Pw  70hrs  
Mini-project  17hrs  
Level: Year 4/5  
Possibility in English in AUTUMN and French in SPRING  
Objective:  
• To study the fundamental elements system reliability.  
• To study analysis techniques for system reliability.  
Programme:  
• Terminology and definitions (risk, reliability, availability, maintainability...).  
• Functional block-diagrams and success diagrams.  
• Analysis of Failure Modes, their Effects, and their Criticality (FMECA), Hazard Operability Study (HAZOP).  
• Failure trees, importance factors, and binary decision diagrams.  
• Markovian approach to reliability.  
• Modeling and simulation by stochastic Petri nets.  

SPring  
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FQ05  
Reliability and experiment feedback  
6 ECTS credits  
L  34hrs  
SW  34hrs  
PW  51hrs  
Prerequisite SY02  
Level: Year 4/5  
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.  

Autumn  
Back to list

GE04  
Human resources management  
4 ECTS credits  
L  34hrs  
SW  17hrs  
PW  60hrs  
Minor: Entrepreneurship  
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.  

Autumn-Spring  
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GE10
Introduction to micro-economics
4 ECTS credits

L 34hrs
SW 26hrs
PW 60hrs

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.

Minor: Entrepreneurship

Autumn

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GE11
Organizations and decision-making
4 ECTS credits

L 51hrs
PW 34hrs

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.

Minor: Entrepreneurship

Spring

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GE21
Organizations and the law
4 ECTS credits

L 26hrs
SW 26hrs
PW 60hrs

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.

Minor: Entrepreneurship

Autumn-Spring

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GE25
Intellectual property and economic intelligence
4 ECTS credits

**L** 26hrs  **SW** 13hrs  **PS** 6hrs  **PW** 40hrs

**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).

**AUTUMN**

GE28
Business and commercial law
4 ECTS credits

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

**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.

**AUTUMN-SPRING**

GE31
Business management: accounting
4 ECTS credits

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

**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.

**AUTUMN-SPRING**
GE32  
**Corporate finance**  

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**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.

**Skipt to list**

GE33  
**Organizational management**  

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**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.

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GE34  
**Strategy and business management**  

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**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).

**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.

**ECTS credits:** 4

**Lecture hours:** 26

**Seminar hours:** 26

**Practical work hours:** 60

**Miniature:** Entrepreneurship

**Offered during:** 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...).

**ECTS credits:** 4

**Lecture hours:** 34

**Seminar hours:** 17

**Practical work hours:** 60

**Miniature:** Entrepreneurship

**Offered during:** AUTMN

### 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.

**ECTS credits:** 6

**Lecture hours:** 34

**Seminar hours:** 34

**Practical work hours:** 60

**Level:** Year 4/5

**Offered during:** SPRING
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.

L 30hrs
SW 16hrs
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
Production organization and management

**Objective:**
- To understand the essential concepts of production system control, by integrating the economic and human aspects of the industrial environment.

**Programme:**
- The technical-economic context and type of production.
- Specific knowledge: codification, classification, forecasts, organization, planning, scheduling, launching, monitoring, tracking, value analysis, cost.
- Management methods and fields of application: inventory control, MRP, Kanban, MPM, OPT.
- Organization of production management and company performance: reactivity, flexibility, flows, waste reduction, maintenance.

**Level:** Year 3

**Assessment:**
- L: 34hrs
- SW: 34hrs
- PW: 34hrs

**Autumn**

Production planning and scheduling

**Objective:**
- To study various production planning and scheduling problems, as well as some basic methods for their resolution.

**Programme:**
- Scheduling of projects (PERT method, with consumable resources, minimum cost).
- Idea of complexity.
- Scheduling of workshops (machine bottleneck, alternative machines, single routes, multiple routes).
- Hierarchical production management.
- Capacity planning.
- Planning for needs, just-in-time, OPT.

**Level:** Year 4/5

**Assessment:**
- L: 34hrs
- SW: 34hrs
- PW: 80hrs

**Spring**

Forecasting methods and inventory control

**Objective:**
- To study forecasting methods and stock management, according to sectors, and of considered products.

**Programme:**
- Economic quantities.
- Calendar management of stock.
- Management by order.
- Management of nonstationary determinist stock.
- Simple and multiple regressions.
- Decomposition and Buy-Ballot methods.
- Exponential smoothing.
- Box-Jenkins method.

**Level:** Year 4/5

**Assessment:**
- L: 34hrs
- SW: 34hrs
- PW: 60hrs

**Autumn**
### GP28 Industrial excellence

**Level:** Year 3  
**Prerequisite:** GP06  

<table>
<thead>
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<th>Hours</th>
<th>Objective</th>
<th>Programme</th>
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<tbody>
<tr>
<td>6 ECTS</td>
<td>30hrs</td>
<td>To become aware of industrial stakes and to learn the concepts of &quot;Lean Manufacturing&quot;. To be able to perform industrial diagnosis and to build a continuous improvement plan.</td>
<td>Industrial management and accountancy management (management control, ABC, ABM, VAD). Flows and bottlenecks vs work centers and costs, theory of constraints. Global performance and local performance, approach process, performance piloting. Lean Manufacturing and Six Sigma, a continuous improvement stage. Management and Industrial Excellence tools (Hoshin, Kaizen, SMED, SPC, 5S, TPM...)</td>
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**Autumn**  
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### GS10 Information Systems security, legal aspects and regulations

**Level:** Year 5  

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### GS11 Information Systems securization

**Level:** Year 5  

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<th>Programme</th>
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**Autumn**  
[Back to list](#)
**GS13  Security management**

**Objective:**
- Risks are integrated into management in order to prevention. This module initiates students into problems and techniques of risks management. It teaches also students about daily security management as done by a director of information system security in a company.

**Programme:**
- Risks analysis.
- Security policies.
- Professional ethics and jurisprudence.
- ISO, MEHARI and EBIOS methods.
- Recovery and continuity plans.
- Security audit.
- Technological watch.

**L 34hrs**  **SW 34hrs**  **PW 60hrs**  **Level: Year 5**

**AUTUMN**

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**GS14  Project in information system security**

**Objective:**
- Group project.

**Programme:**
- Students will work in group (2 or 3) on 2 kinds of projects: one technical project and one organizational project. 1st one is about security and 2nd one is more global. Projects are defined as being real problems that could rise in companies. Each group will present its work, research and solutions. Evaluation of the course will be based on a project group report and an oral presentation.

**PW 60hrs**  **Level: Year 5**

**AUTUMN**

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**GS15  Security techniques**

**Objective:**
- To allow the student to choose the best products regarding the company needs, to install them and to monitor the progress.

**Programme:**
- Mathematics reviews.
- Basic concepts of cryptology.
- Cryptographic protocols.
- Symmetric and single-ended cryptology.
- Electronic signature.
- Chips.
- Common criteria of evaluation.
- Infrastructure of keys and certificates management (X509).

**L 30hrs**  **SW 10hrs**  **PW 40hrs**  **Level: Year 5**

**AUTUMN**

[Back to list](#)
**Internet networks security**

**Objective:**
- To initiate the students into networks control concepts and methods

**Programme:**
- Security architecture: services and mechanisms.
- Attacks typology.
- Intrusion and denial of service.
- Intrusion detection systems.
- Security of wireless networks 802.11, GSM, UMTS.
- Security protocols: SSL, TLS and IPsec.
- Multi-agents systems applied to security.

**Level:** Year 5

**L** 24hrs
**SW** 24hrs
**PW** 20hrs

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**Engineers in history**

**Objective:**
- To become more aware of the long history of the engineering in the Western world and the various different roles of the engineer.

**Programme:**
- To study different historical periods
- To study the institutions
- Exemplary individuals.

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

**SPRING**

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**History of art**

**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.

**L** 34hrs
**SW** 17hrs
**PW** 60hrs

**AUTUMN**

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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.  

Spring  

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.  

Autumn  

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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.  

Spring  

Back to list
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

Back to list

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

Back to list

IC01  Intercultural management  4 ECTS credits

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.

Level: Year 5

AUTUMN-SPRING

Back to list
IF01  Information theory and coding

Objective: To become familiar with certain aspects of new information technologies within an adapted theoretical framework.

Programme:
- Information theory: characterization of a source, a language and a coding, modeling of transmission channels.
- Detection and correction codes: coding and decoding of linear codes, Hamming codes, cyclic codes.
- Coding and data compression: digital coding of sound and speech, digitalization and compression of fixed and animated images.

Level: Year 3/4

IF02  Information Systems design

Objective: To learn the role of information technologies for solving problems in organizations. To understand the concept of Information System (IS) and of object oriented design of the IS.

Programme:
- What is an Information System: definition, typology.
- Strategic matching of Information Systems.
- Information System development: participants, methodological principles, approaches, models, tools, solutions.
- Information Systems analysis and design: generalities, principles of object oriented analysis and design of Information Systems, analysis phase of an Information System with UML, design phase of an Information System with UML.
- Professions in Information Systems

Level: Year 3/4/5

IF03  Information systems security

Objective: To understand the difficulties of information system protection which are vital, increasingly complex, and increasingly strategic for the company.

Programme:
- Presentation of the various aspects of information system security, from the hardware, software and human point of view (cryptography, electronic signature, infrastructures of management of keys, physical safety, virus, plans of help, plans of recovery, mobility and wireless, cybercrime, workstation, security audits; different types of attacks and defence, the personal element...). The distinction however is preserved between what is internal within the structure and what is external to it (abuse, hacking...).
- Regulations, legal and normative aspects.

Level: Year 4/5

ECTS credits

L  34hrs
SW 34hrs
PW 50hrs

L  34hrs
SW 34hrs
PW 68hrs

L  34hrs
SW 34hrs
PW 85hrs

Back to list
IF04  Information systems, production management and industrial strategy

Objective:
- To study, with a systemic approach, the concepts of industrial strategy and production management, such as ICS (Inventory System Control), MRP (Manufacturing Resources Planning) and ERP (Enterprise Resource Planning).

Programme:
- Principal problematic of industrial strategy in the current economic context and their impact on management styles.
- The function of "production" and the activities which constitute it.
- The concepts of systemic production management (ICS, MRP, ERP).
- Models of technical data (operational nomenclatures, ranges) and company information systems (case study of a manufacturing company).
- Audit process of a manufacturing company.

Level: Year 4/5

PR 34hrs
SW 34hrs
PW 68hrs

IF05  Software quality

Objective:
- To study the methods and tools linked to quality management, in particular in the field of computer science. Practice with a project.

Programme:
- Quality officer (audit, quality plan, procedures, certifications...).
- "Agile" methods of cost and delay management (cycle in spiral, customer involvement, scenario, modeling, rapid development of applications, project management by priorities...)
- Joint evolution management of models, programmes, technical documentation and manuals (technical documentation generation, version control, unit tests...).

Level: Year 4/5

Prerequisite:
IF02

L 17hrs
SW 17hrs
PS 34hrs
PW 68hrs

IF08  Management of computer-based projects

Objective:
- To study the principles and techniques of computer-based project management, from project owner to product owner.

Programme:
- Project management principles.
- Computer-based projects specificities and their participants.
- Project management techniques: planning, contractualization, human resources, budget and documentation management.
- Classical methods of project management VS collaborative project mode.

Level: Year 3/4

Prerequisite:
Experience in a company

L 34hrs
SW 34hrs
PW 40hrs

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<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
<th>Lectures</th>
<th>Seminars</th>
<th>Work</th>
<th>Prerequisites</th>
<th>Level</th>
<th>Objective</th>
<th>Programme</th>
<th>Exam Period</th>
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<tbody>
<tr>
<td>IF09</td>
<td>Documentary systems</td>
<td>6 ECTS</td>
<td>34hrs</td>
<td>34hrs</td>
<td>68hrs</td>
<td>Experience in a company</td>
<td>Year 3</td>
<td>To learn methods and techniques related to digital documents as complement to the information systems.</td>
<td>Metadata or “how to describe a document in holdings” (EAD, MARC, WebDAV). Document and time (Diff, CVS, DeltaV). Identify forms in a text or a corpus (XPATH, regular expressions, search for information and language automatic process). From archive version to work version (XSLT, image processing, production chains: Shell, Scripts, Ant, Cocoon). Get the documents (hypermedias, folksonomies).</td>
<td>Autumn</td>
</tr>
<tr>
<td>IF10</td>
<td>Iterative development and Rapid Application Development</td>
<td>6 ECTS</td>
<td>4hrs</td>
<td>51hrs</td>
<td>68hrs</td>
<td>IF02, NF16, LO02</td>
<td>Year 4/5</td>
<td>To study the methods and tools of applications iterative development.</td>
<td>To develop a management information application from its data model (Rapid Application Development). To develop a custom-build application from its static and dynamic models (Model Driven Architecture, Round-Trip Engineering).</td>
<td>Autumn</td>
</tr>
</tbody>
</table>
IF14

Knowledge engineering methods for information systems audit

6 ECTS credits

Objective:
- To understand the basics of cognitive sciences and modeling, which make it possible to acquire and represent knowledge on an organization and its function.

Programme:
- Introduction to the diversity of cognitive and human sciences and concepts of epistemology.
- Social psychology and communication sciences for audit management.
- Linguistics and logics for content analysis.
- Introduction to organizational science.
- Methods of modeling knowledge: MASK.

Level: Year 3/4

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.

Level: Year 4/5

AUTUMN

IF16

Intranet, Groupware and Workflow: concepts and implementation

6 ECTS credits

Objective:
- To understand the basics of co-operation and the design of the groupware applications.

Programme:
- NICT and information systems for co-operation in the new Intranet/extranet/Internet context.
- Introduction to CSCW, groupware models: Johansen matrices.
- Messaging and processus computer-based management (workflow).
- Information System documentary approach and cooperation.
- Evolution of clients/server architectures in “thin clients” contexts.
- Programming in Lotus Notes Domino and content management software (free software).

Level: Year 4/5

AUTUMN
**IF17**

**Decision-making architectures**

6 ECTS credits

**Objective:**
- To understand the risks, tools and difficulties related to the design and integration of decisional applications within Information Systems.

**Programme:**
- Risks and specifics of decisional projects.
- Hardware and software architecture used in decisional computing.
- Methods of data-warehouse design.
- Technological problems and solutions related to the provisioning of data-warehouses.
- Means of diffusion and valorization of information.
- Presentation of the principal tools in the market.
- Interventions in the decisional domain.

**Prerequisite:** NF16

**Level:** Year 4/5

**L** 34hrs

**SW** 34hrs

**PW** 68hrs

**SPRING**

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**IF19**

**Sociology of organizations in Information Systems**

6 ECTS credits

**Objective:**
- To know, understand and analyse organizational behaviors and relations, and thus better manage technical and social dimensions during the implementation of technical innovations.

**Programme:**
- Fundamentals of organizational analysis (what is an organization? What is it made up of? What are the different forms in the actual economy?).
- 4-grid analysis for relations within organizations (power, culture and identity, innovation, trade-off).
- Problems linked to Information Systems: sociology of management tools (KM, ERP…), services, "resistance" to changes...

**Prerequisite:** TN09

**Level:** Year 4/5

**L** 28hrs

**SW** 21hrs

**PW** 40hrs

**SPRING**

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**IF20**

**Integrated management and process modeling**

6 ECTS credits

**Objective:**
- To understand the practical basics of business process modeling and the integration of applications.

**Programme:**
- The management risks and concepts of business process modeling.
- Management applications: certification quality and documentation of procedures, analysis and changes within the organization, cost management by activity.
- Implementation of ERP, migration of information systems, workflow.
- Entities: point of view and meta-models, association of models.
- Tool categories: graphics packages, modelers, meta-modelers, integrators.
- Practice on the principal processes modeling tools on the market, and a mini-project using modeling from a case study.

**Level:** Year 4/5

**L** 17hrs

**SW** 17hrs

**PS** 34hrs

**PW** 40hrs

**AUTUMN**

**Back to list**
IF22  Information systems management

6 ECTS credits

L 24hrs  SW 34hrs  PS 16hrs  PW 50hrs

Objective:
• To understand the management theories necessary to understand and manage the development of information systems within organizations.

Programme:
• Development of information systems.
• Information systems: concepts and risks.
• Strategies of information systems.
• Structures and use of information systems.
• Planning and urbanization of information systems.
• Management control of information systems.
• Introduction to the Integrated Software packages of Management.
• Re-engineering of the processes.

Level: Year 4/5

SPRING

Back to list

IF23  Position determination technology

6 ECTS credits

L 34hrs  SW 17hrs  PS 17hrs

Objective:
• To give the concepts of geographical data acquisition, processing, management, representation and operation.

Programme:
• Basics of geomatic.
• Territory modeling at different scales.
• Measures, uncertainties and errors.
• Coding.
• Location and GPS system.
• Geographic Information Systems.
• Processing: cadastre, agriculture, logistics, monitoring and tourism.

Level: Year 4/5

SPRING

Back to list

IF24  Enterprise Resource Planning, SAP

6 ECTS credits

L 34hrs  PS 50hrs

Objective:
• To know the ERPs architecture, their settings and implementation in a company.

Programme:
• An ERP is an assembly of applicative modules, integrated within the different services of the company. Those modules cover most of the time the management for: accounting and finance, monitoring, production, purchases and sales, stocks, logistics, human resources, etc.

Level: Year 4/5

SPRING

Back to list
IR30  Initiation to research  6 ECTS credits

L  34hrs  SW  34hrs  PW  68hrs

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.

Level: Year 4/5

S  P  R  I  N  G

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IS01  Sport structure in France  6 ECTS credits

L  51hrs  SW  17hrs

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”).

Level: Year 4

A  U  T  U  M  N

Back to list

IS02  Sport marketing  6 ECTS credits

L  51hrs  PW  68hrs

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.

Level: Year 4

S  P  R  I  N  G

Back to list
IS03  Communication strategy  6 ECTS credits
L    51hrs  PW    68hrs
Level: Year 4

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.

SPRING

IS04  Human resources: team management in sport  6 ECTS credits
L    34hrs  SW    34hrs  PW    68hrs
Level: Year 4

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.

SPRING

IS07  Sport event organization  6 ECTS credits
L    17hrs  SW    51hrs  PW    68hrs
Level: Year 4

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.

SPRING
**IS08**  
Event logistics modeling  

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</table>

**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…)

**AUTUMN**

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**IS09**  
Sports and leisure infrastructures management  

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<tr>
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<td>17hrs</td>
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</table>

**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**

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**IS10**  
Organizers responsibilities  

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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.

**AUTUMN**

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IS11

Events security

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.

Level: Year 5

6 ECTS credits

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IS17

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.

Level: M2

6 ECTS credits

AUTUMN

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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.

Level: M2

4 ECTS credits

AUTUMN-SPRING

Back to list
Modern Chinese language and culture - Level 2

4 ECTS credits

SW 51hrs
PW 60hrs

Objectives:
• To be able to communicate in most daily situations.
• To be able to read and write simple texts.
• 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

Modern Chinese language and culture - Intermediate Level

4 ECTS credits

SW 51hrs
PW 60hrs

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

English – Beginner’s level

4 ECTS credits

SW 51hrs
PW 60hrs

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.

AUTUMN-SPRING
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.

Prerequisite: LE00 or placement test

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.

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.

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- 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.

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.

LE02

English – Intermediate level

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 training.
- 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

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.

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.

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.

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.

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.

LE03

English – Practical level

Objective:
- 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

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.

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.

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.

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.

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

**SW**  
Interview  1 hr  
PW  60hrs  

**Prerequisite**  
LE03 or placement test  

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

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

**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  

**SW**  
34hrs  
PW  60hrs  

**Prerequisite**  
B2+ level  

**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.  

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

**AUTUMN-SPRING**  

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

**SW**  
34hrs  
PW  60hrs  

**Prerequisite**  
B2+ level  

**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.  

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

**AUTUMN-SPRING**  

Back to list
LE14  
**English skills 1**  
4 ECTS credits

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

**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.

*Opening of the subject depending on resources available.*

AUTUMN-SPRING

Back to list

LE15  
**English skills 2**

4 ECTS credits

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

**Objective:**
- Practice of the acquired skills in writing and oral expression and in written and oral comprehension.

**Programme:**
- Study and summary work on different written and audio documents.
- Study of contemporary life through authentic and actual documents.
- Identification, analysis and recognition of various written English.
- Identification, analysis and recognition of various oral English.
- Study and analysis of difficulties met with the daily language.

*Opening of the subject depending on resources available.*

AUTUMN-SPRING

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LE16  
**Oral communication in English and cinema**

4 ECTS credits

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

**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.*

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LE17  
English for academic purposes  

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. 

Prerequisite: B2+ level 

Opening of the subject depending on resources available. 

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LE18  
World heritage  

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. 

SPRING

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LF00  
French as a foreign language - Intensive Course  

Objectives: 
- Intensive training for both degree and non degree-seeking exchange students. 
- To “live” the French language immediately, and on a daily basis. 
- To improve the student’s knowledge of the language quickly and effectively. 

Programme: 
- Course work: study of specific situations, video, other documents. 
- Individual work in the multi-media room. 
- Cultural and leisure activities, excursions, visits of companies, etc. 

AUGUST-FEBRUARY

Back to list
**LF05**  
**French: linguistic support**  
4 ECTS credits  
SW  56hrs  
Objectives:  
• Enable the French speaking students to improve their writing expression.  
Programme:  
• Study the different sound forms.  
• Deepen the spelling rules.  
• Improve the syntax.  
• Bring attention to the tenses and to conjugation modes.  
• Explore and refine the word meaning (polysemy, synonymy, etc.).  
• Improve the vocabulary (compound words, etc.).  

AUTUMN-SPRING  

**Back to list**

**LF10**  
**French as a foreign language – Lower intermediate 1**  
4 ECTS credits  
SW  56hrs  
PW  60hrs  
Degree-seeking students  
Objectives:  
• Master the important daily life situations.  
• To understand everyday documents (letters, adverts, newspapers, etc.).  
Programme:  
• Acquisition or revision of the basic grammatical structures.  
• To speak with more ease, to express opinions, feelings, ideas (situation role plays).  
• Pronunciation  
• Simple written work (letters, short essays, etc.).  

AUTUMN-SPRING  

**Back to list**

**LF11**  
**French as a foreign language – Lower intermediate 2**  
4 ECTS credits  
SW  56hrs  
PW  60hrs  
Degree-seeking students  
Objectives:  
• Master the important daily life situations.  
• To understand everyday documents (letters, adverts, newspapers, etc.).  
Programme:  
• Acquisition or revision of the basic grammatical structures.  
• To speak with more ease, to express opinions, feelings, ideas (situation role plays).  
• Pronunciation  
• Simple written work (letters, short essays, etc.).  

AUTUMN-SPRING  

**Back to list**
**LF12  Practical French for MATH01**

**Objectives:**
- To learn the mathematics terminology.
- To learn the techniques for an oral or written scientific presentation.
- To identify the keywords in scientific presentation.

**Programme:**
- Vocabulary study (basics and recurrent functions in scientific speech).
- Practice in scientific exercises writing.
- Oral presentations.

- **SW  56hrs**
- **PW  60hrs**

Degree-seeking students

**Autumn-Spring**

**Back to list**

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**LF13  Practical French for PHYS01**

**Objectives:**
- To learn the mathematics terminology.
- To learn the techniques for an oral or written scientific presentation.
- To identify the keywords in scientific presentation.

**Programme:**
- Vocabulary study (basics and recurrent functions in scientific speech).
- Practice in scientific exercises writing.
- Oral presentations.

- **SW  56hrs**
- **PW  60hrs**

Degree-seeking students

**Autumn-Spring**

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**LF14  French as a foreign language - Intermediate level for degree-seeking students**

**Objectives:**
- Be able to communicate about different information on different topics.
- Use and process information in different ways.
- To write or talk about abstract or cultural topics.

**Programme:**
- Broaden vocabulary in general and professional language.
- Grammatical structures.
- Cultural and literary references (various videos and authentic texts, newspaper and media, society events, literature, etc.).
- Oral presentations.

- **SW  56hrs**
- **PW  60hrs**

Degree-seeking students

**Autumn-Spring**

**Back to list**
LF15  
French as a foreign language – Writing techniques for degree-seeking students  
4 ECTS credits

Degree-seeking students

Objective:
• To learn the writing techniques by getting efficient and rational methods.

Programme:
• Identification of essential information in an authentic document.
• To reformulate key elements in a text, summarize a text.
• To structure a text: plan.
• Methods for internship report and presentation.
• Key information research about a topic.

AUTUMN-SPRING

Back to list

LF30  
French as a foreign language – Language and culture  
4 ECTS credits

For exchange students

Objective:
• To communicate in any daily life situations.
• To broaden knowledge in French society.

Programme:
• To learn or review basic grammatical structures.
• To talk more easily about opinions, feelings and ideas.
• Pronunciation.
• Simple texts writing (letters, short texts, etc.).
• Basic scientific vocabulary.

AUTUMN-SPRING

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LF31  
French as a foreign language – Language and culture  
4 ECTS credits

For exchange students

Objectives:
• To improve linguistic knowledge and knowledge in the French culture and civilization.

Programme:
• Grammatical structures.
• Oral and writing exercises based on daily life topics (society, cinema, history, art, etc.).
• Use and process information in different ways.
• Oral presentations.

AUTUMN-SPRING

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LF32

French as a foreign language – Language and culture

Objectives:
• To broaden both linguistic and cultural knowledge.
• To understand radio and television programs on different topics.

Programme:
• To broaden general and professional vocabulary.
• Grammatical structures.
• Cultural and literary references (various videos and authentic texts, newspaper and media, society events, literature, etc.).

For exchange students

AUTUMN-SPRING

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LF33

French as a foreign language – Language and culture

Objectives:
• To improve general and scientific vocabulary.
• To distinguish and use nuances, both in oral and written communication.
• To understand difficult literature.
• To be able to write something for an audience.

Programme:
• Difficult and rare grammatical structures.
• To broaden vocabulary, various language levels.
• To use various styles of languages.

For exchange students

AUTUMN-SPRING

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LF3A

French as a foreign language for UTSEUS students – B1 level

Objectives:
• To be able to communicate in daily life both in speaking and writing: meetings, practical needs, communication with administrations, etc.
• To adapt to local society by participating in local association
• To use multimedia resources (e-learning, etc.)
• To get the linguistic and cultural know-how required for the B1 level

Programme:
• Designed with a semi-autonomous project, the teaching methods enable the students to have prepared interviews (oral expression), to understand the main points in long discussions (oral understanding), to write weekly reports of their activities (writing) and to study with a tutor for autorectification.

Level: A2+

AUTUMN-SPRING

Back to list
LF3P

French as a foreign language for UTSEUS students – B2 level

2 ECTS credits

Objectives:
• To be able to look successfully for an internship in a company
• To master the standards of enterprise communication both in speaking and writing
• To use the logical articulation for expressing your thoughts
• To understand the main points of the current social thinking
• To validate the level required by the Engineering Degree Committee

Programme:
• Applications techniques: CV, motivation letter, skills-video, etc
• Training in phone communication and interviews
• Communication in professional environment: meetings, provide arguments around a project, minutes and meeting reports
• Syntax improvement for validating the B2 level required

AUTUMN-SPRING

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.

AUTUMN-SPRING

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.

AUTUMN-SPRING
LG02  German – Intermediate level  4 ECTS credits

SW  51hrs  
PW  60hrs  

Prerequisite: LG01

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.

AUTUMN-SPRING

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LG03  German – Practical level  4 ECTS credits

SW  51hrs  
PW  60hrs  

Prerequisite: LG02

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.

AUTUMN-SPRING

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LG08  German – Preparation for the B2 level  4 ECTS credits

SW  51hrs  
PW  60hrs  

Prerequisite: LG03

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.

AUTUMN-SPRING

Back to list
LG10  
German – Culture and Civilization  

4 ECTS credits  
SW  51hrs  
PW  60hrs  
Prerequisite  
LG03  
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.  

AUTUMN  
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LG11  
German – Professional level  

4 ECTS credits  
SW  51hrs  
PW  60hrs  
Prerequisite  
LG03  
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...  

SPRING  
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LI01  
Writing workshop  

4 ECTS credits  
SW  51hrs  
PW  60hrs  
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.  

SPRING  
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LI03  Recitative art  4 ECTS credits

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**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

**AUTUMN**

LI04  Literature, culture and society  4 ECTS credits

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**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...).

**SPRING**

LO01  Computing basics  6 ECTS credits

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**Level:** Year 3

**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.

**AUTUMN**
LO02

Principles of, and practice in object-oriented programming

6 ECTS credits

**Objective:**
- To study the concepts, the tools and the programming languages directed to objects.

**Programme:**
- Concept of objects: classes, authorities, attributes, methods...
- Basics of the JAVA language: class, heritage, abstract methods, polymorphism, generic classes, interfaces.
- Advanced Java: exceptions, packages, inputs-outputs, networks.
- Graphical interfaces: MVC model, AWT and SWING libraries.
- Concurrent programming: light processes (threads), synchronization by monitors.

**Level:** Year 3

**Offered in:** Autumn

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LO07

Web technology

6 ECTS credits

**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.

**Prerequisites:**
- NF16

**Level:** Year 3

**Offered in:** Spring

Back to list

LO09

Implementation of distributed applications

6 ECTS credits

**Objectives:**
- To go over the limits of the classic model client/server.
- To develop complex distributed applications (EJB and P2P applications).

**Programme:**
- Review of Java language (objects concepts, threads, networks, RMI).
- Platform architecture J2EE (Java2 Entreprise Edition).
- Application servers EJB (Entreprise Java Beans).
- Session beans with and without report, entity beans CMP and BMP, beans MDB.
- EJB 2.1 and EJB 3.0 specifications.
- Peer-to-peer networks: concepts, applications and implementation.
- Java applications monitoring with JMX.

**Prerequisite:**
- LO02 or LO07

**Level:** Year 4/5

**Offered in:** Autumn

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**LO10**

**Service Oriented Architectures**

**ECTS credits**: 6

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**Prerequisite:**
- LO02 or LO07

**Level:** Year 4/5

**Objectives:**
- To understand the stakes of Services Oriented Architectures (SOA).
- Implementation in different projects.

**Programme:**
- Context and impact of SOA in a company Information System (wide area network, Information System urbanization).
- Comparison with competitive technologies.
- Design methods and implementation (SOAP, REST).
- Integration method (directory, mashup, orchestration).
- Web services security, reliability and performances.
- Message oriented approaches.

**SPRING**

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**LO12**

**Artificial intelligence and applications**

**ECTS credits**: 6

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**Level:** Year 3

**Objective:**
- To know the basics of artificial intelligence and especially the knowledge based systems from their design to their implementation in various domains

**Programme:**
- Propositional and 1st order logics
- Horn clauses, resolution principle and Prolog
- Rules based systems, experts & Clips systems generators
- Multi-agents systems
- Reasoning
- Inaccuracies and uncertainties in knowledge based systems
- Automatic training, neurons networks

**SPRING**

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**LO13**

**3D computer graphics: theory and applications**

**ECTS credits**: 6

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**Level:** Year 4/5

**Objective:**
- To study the methods of 3D graphical representation.

**Programme:**
- Discretization of 3D geometrical objects: geometrical surface meshing.
- Basics of 3D visualization: linear transformations, visual systems, perspective projections.
- Parametric representation of 3D objects: Béziers surfaces, splines, NURBS.

**SPRING**

[Back to list](#)
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.

Prerequisite: NF04 or NF05

Level: Year 3/4/5

LO15  Product lifecycle management systems and collaborative engineering

Objective:
- To understand the principles of the technical information management and the capabilities of the Technical Documentation Management System (TDMS).

Programme:
- Collaborative engineering and open companies.
- Processing of technical information: access, exchange, workflow...
- Data management and administration: control, filing, security, user profile...
- Implementation and integration of product management systems in industrial information systems (GDT, PGI, SLI, CAM).
- Product Design using collaborative techniques and shared data.

Prerequisite: TN16

Level: Year 4/5

LP00  Portuguese language and culture - Level 1

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.
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 language.
- 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.

SW 51hrs
PW 60hrs

Prerequisite: LP00

SPRING

Back to list

LP02
Portuguese language and culture - Intermediate Level
4 ECTS credits

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.

SW 51hrs
PW 60hrs

Prerequisite: LP01

AUTUMN

Back to list

LS00
Spanish – Beginner’s level
4 ECTS credits

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.

SW 51hrs
PW 60hrs

AUTUMN-SPRING

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**LS01**

**Spanish – Elementary level/Basic structures**

4 ECTS credits

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**Prerequisite:**
LS00

**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**

4 ECTS credits

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**Prerequisite:**
LS01

**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**

4 ECTS credits

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**Prerequisite:**
LS02

**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**

[Back to list](#)
LS08

Preparation for the B2 level

Objective:
• To intensively prepare for the B2 level examination.

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

4 ECTS credits

Interview 36hrs
30min
PW 60hrs

Prerequisite: LS10

AUTUMN-SPRING

Back to list

LS10

Spanish – Autonomous level

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...).

51hrs
60hrs

Prerequisite: LS03

AUTUMN-SPRING

Back to list

LS11

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

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.

51hrs
60hrs

Prerequisite: LS10

AUTUMN-SPRING

Back to list
Review in materials sciences and in electromagnetic-material waves interaction

**Objective:**
- Support for the students registered in MA02 and MA03 and who have not taken previously enough subjects in physics and material sciences.

**Programme:**
- Properties of electromagnetic-material wave interaction, polarization, wave's equation (support for MA03).
- Atom physics, crystallography, material's physics (support for MA02).

This support is organized with the timetable of MA02 and MA03.

**AUTUMN**

---

Physics of materials

**Objective:**
- To study material physical properties both at the macroscopic level and at the atomic scale.

**Programme:**
- Quantum physics (waves and corpuscles, statistic distributions, wave-corpuscle duality, basics of quantum and atomic physics).
- Electrical and magnetic properties (Drude model, Sommerfeld model, Bloch & Brillouin model, semi-conduction and Hall effect).
- Thermal properties (Dulong & Petit law, Debye model, Wiedmann-Franz law and Fourier law).
- Mechanical properties (thermal dilatation, sound propagation, Fick law).

**AUTUMN**

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Interaction between materials and electromagnetic waves

**Objective:**
- To study the interactions between material and electromagnetic waves (x-ray, ultra-violet, visible and infra-red).

**Programme:**
- Materials properties: dielectric, metallic, transparent, absorbing behavior, Beer-Lambert law.
- Elastic and non-elastic diffusion.
- Specific properties of materials under electromagnetic field.

**AUTUMN**
MA04  
**Chemistry for materials**  
6 ECTS credits  

**Objective:**  
- To get the chemical fundamentals in the processes of synthesis, development, use and damage of different materials  

**Programme:**  
- Organic chemistry applied to polymers synthesis and their precursors – review of reaction mechanisms and polymers synthesis  
- Chemical reaction kinetics, complex reactions and solid surfaces processing (applications: polymerization and damage, hydrogen stocking, automotive pollution control, etc.)  
- Oxydo-reduction and electrochemistry: potential/pH equilibrium diagram, thermodynamic and kinetic concepts of electrochemical reactions (applications: development and metals corrosion, batteries and electrochemical sensors, etc.)

**Level:** Year 3  

**L 34hrs**  
**SW 34hrs**  
**PS 8hrs**  
**PW 68hrs**  

**Back to list**

MA11  
**Metallic materials**  
6 ECTS credits  

**Objective:**  
- To gain a greater comprehension of metals, their properties, thermal characteristics, and mechanical properties.

**Programme:**  
- Thermal treatments, iron-carbon diagrams, light alloys, TTT and TRC diagrams.  
- Structural introduction to plastic deformation (concepts of dislocation theories, restoration, recrystallization).  
- Norms of metallic materials.  
- Ferrous and non-ferrous alloys (titanium, aluminium...).

**Level:** Year 3/4  

**L 34hrs**  
**SW 34hrs**  
**PS 14hrs**  
**PW 60hrs**  

**Basic knowledge of cristallography**

**Back to list**

MA12  
**Non-metallic materials**  
6 ECTS credits  

**Objective:**  
- To initiate students into the science of non-metallic materials and allow them to acquire specific knowledge of these materials. In particular, studies will cover the polymers; composites and ceramics.

**Programme:**  
- Polymers: definitions from molecule to material, physic-chemical properties.  
- Composite materials, calculation of laminate composites.  
- Ceramics, theory and applications.

**Level:** Year 3/4  

**L 34hrs**  
**SW 34hrs**  
**PS 10hrs**  
**PW 60hrs**

**SPRING**

**Back to list**
MA13  
Material mechanics 

**Objective:**
- To provide students with the means to calculate the constraints and deformations of materials in order to satisfy certain conditions of mechanical resistance. This is particularly applicable to structural materials and high-tech materials.

**Programme:**
- Continuum mechanics: calculation of constraints and deformations, elements of material resistance (traction, cutting, torsion, flexion).
- Behavioral laws: plasticity, brittleness, ductility, creep, damage, fatigue, and rupture.
- Mechanical tests (traction, hardness, resilience).

**L** 34hrs  
**SW** 34hrs  
**PS** 16hrs  
**PW** 60hrs  
**Level:** Year 3  

6 ECTS credits

Back to list

MA14  
Materials and electronic components 

**Objective:**
- To give basic knowledge on materials and technologies used by companies in electronics and sensors/electric actuators.

**Programme:**
- Revision of basic components: passive and active components.
- Intrinsic and doped semi-conductors properties.
- Behavior principle of active components, bipolar technologies, MOS, FET, polymers, etc.
- Specific materials and technologies in electronic companies.
- Behavior principles and materials used in most current electronic systems.

**L** 34hrs  
**SW** 34hrs  
**PS** 24hrs  
**PW** 60hrs  
**Level:** Year 3/4  

6 ECTS credits

Back to list

MA15  
Non-metallic materials technologies 

**Objective:**
- Bridge between theoretical courses in materials and industry.

**Programme:**
- Polymers and composites: processing and forming.
- Glass: characteristics, properties, forming and applications.
- Concrete: characteristics, properties, forming and applications.
- Wood: origin, properties, forming and applications.
- Building and civil industry: market operations, materials choice, study case.
- Project: expertise on one material or transformation process, forming...

**L** 68hrs  
**PW** 100hrs  
**Level:** Year 3/4  

6 ECTS credits

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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

Prerequisites:
Knowledge in geometrical optics

L 34hrs
SW 34hrs
PS 6hrs
PW 60hrs

MA21

Materials analysis and macroscopic characteristics

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.

Level: Year 3/4

L 34hrs
SW 34hrs
PS 14hrs
PW 60hrs

MATH01

Mathematic basics for the engineer

Objectives:

- To allow students to develop scientific reasoning skills.
- To acquire mathematical tools which are fundamental for 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

L 51hrs
SW 51hrs
PS 8hrs
PW 60hrs

Back to list
MATH02  Mathematic tools for the engineer  6 ECTS credits
L  51hrs  
SW  51hrs  
PS  8hrs  
PW  60hrs  
Objectives:
- To acquire and master the mathematical concepts in various contexts: physics, engineering science, matter science…

Programme:
- Sequence and numerical series.
- Elementary results on Fourier series.
- Multiple variable functions.
- Vector functions, vector analysis, integral theorems.
- Multiple integrals, surface and curve integrals.
- Geometry in $\mathbb{R}^2$ and $\mathbb{R}^3$, matrix calculation in 2D and 3D.

Prerequisite: MATH01
Level: Year 1

AUTUMN-SPRING

Back to list

MATH03  Linear algebra  6 ECTS credits
L  34hrs  
SW  34hrs  
PS  16hrs  
PW  68hrs  
Objectives:
- To acquire basic knowledge in linear algebra
- Master the resolution tools of linear systems

Programme:
- Structure of vector spaces
- Linear applications and matrices
- Determining factors, reversal, eigenvalues and eigenvectors
- Euclidean spaces, quadratic forms
- Differential equations systems

Level: Year 2

AUTUMN-SPRING

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MATH04  Functions of complex variables and applications  6 ECTS credits
L  34hrs  
SW  34hrs  
PS  16hrs  
PW  68hrs  
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

Back to list
ME01  Environmental evaluation

L  34hrs  Objective:
SW  17hrs  To master the implementation of the main environmental evaluation methods.
PW  51hrs  Programme:
Level: Year 5
  • Indicators of sustainable development.
  • Ecological footprint and carbon wrap-up.
  • Quantification of material and energy flows.
  • Life-cycle analysis and life-cycle costing.

AUTUMN-SPRING

ME02  Sustainable development management

L  34hrs  Objective:
SW  17hrs  To learn the roll-out, monitoring and efficiency of environmental strategies.
PW  34hrs  Programme:
Level: Year 5
  • Environmental management.
  • Repository of sustainable management.
  • Responsible management and leadership.
  • Strategy, control, watch and perspective planning.
  • Marketing and communication.

AUTUMN-SPRING

ME05  Eco-technologies

L  34hrs  Objective:
SW  17hrs  Study the clean processes and technologies, resources integrated management
PW  34hrs  and their main applications (wastes, energies...).
Level: Year 5
  Programme:
  • Clean technologies and the best technologies available.
  • Ecotechnologies, ecoeffcient processes.
  • Integrated management, wastes treatment and valorization.
  • Energetic intelligence, sustainable development and energy.
  • Prospective planning, technological watch and innovation.

AUTUMN-SPRING

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**MI01**

**Introduction to industry environment**

**6 ECTS credits**

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**Level: Year 4/5**

**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...

**AUTUMN**

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**MM01**

**Introduction to multimedia**

**6 ECTS credits**

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**Level: Year 2**

**Objective:**
- To be able to realize a multimedia project on a chosen subject with respect to the essential phases of project management and technical constraints.

**Programme:**
- Driving a multimedia project.
- From the concept to the story-board.
- Culture and media (choice of Medias and supports).
- Writing and layout rules (chromatometrics, space management...).
- Formats: pictures, sound, videos.
- Legal aspects.
- Financial estimation of the project.

**AUTUMN-SPRING**

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**MO12**

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

**4 ECTS credits**

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**Level: Year 5**

**Objective:**
- To improve knowledge on specific instrumental and theoretical aspects related to nanooptics.

**Programme:**
- Electromagnetism basis (boundary conditions, wave propagation, planar homogenous and inhomogeneous waves, polarization states).
- Planar waves spectrum, near field, far field, far field to near field conversion, evanescent waves.
- Local resonances, volume and surface plasmons, localized plasmons.
- Dipole emission, polarisability, local mater behaviour, local wave-mater interaction, experimental configurations for near field optical microscopes, probes, modulation, heterodyne detection, detection principles (passive and active probes).

**AUTUMN**

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MO13  
Optical spectroscopy  
4 ECTS credits  

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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.

Programme:
• Group theory basis. Principles of spectral analysis in the X rays, UV, visible and infra red domains.
• Spectrums: selection rules, intensity, form and linewidth.
• Absorption, luminescence.
• Raman and IR Spectroscopy, time resolved spectroscopy.
• Experimental aspects (sources, detection, dispersion), Fourier transform spectrometry.
• Spatial and spectral filtering, ultra-short pulses.

Level: Year 5  

AUTUMN

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MO23  
Numerical and mathematical methods in optics  
4 ECTS credits  

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Objective:
• To introduce the various 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

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MQ00  
Modeling, kinematics and statics of mechanical systems  
6 ECTS credits  

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Objective:
• To be able to model a simple mechanism in a system of non-deformable, rigid, solid bodies.
• To be able to solve the associated problems of statics and kinematics.

Programme:
• Modeling of the mechanisms according to the typology of the problems encountered.
• Modeling and analysis of the mechanical connections.
• Statics, statements of the static equilibrium conditions.
• Kinematics, plane movements, combined profiles and cams.
• Mechanism theory.
• Mechanism simulation using the software Pro/Mechanica.
• Use of multimedia supports.

Level: Year 3  

AUTUMN

Back to list
MQ01  
**Strength of materials**  
6 ECTS credits  

**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**  
6 ECTS credits  

**Objective:**
- To study the mathematical tools and the physical principles necessary for the evaluation of constraints in machine elements with complex geometries.

**Program:**
- Stress and strain.
- Behavioral laws.
- Boundary conditions.
- Elasticity problems resolution.
- Deflection energy.
- Strength criteria.

**Level:** Year 3

**Spring**

MQ03  
**Dynamics and vibrations of mechanical systems**  
6 ECTS credits  

**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.

**Level:** Year 3

**Spring**
**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.

**Level:** Year 3

**ECTS credits:** 6

**L ** 34hrs  
**SW** 34hrs  
**PS** 20hrs  
**PW** 68hrs

**Back to list**

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**MQ05**

**Choice of materials**

**Objective:**
- To obtain the knowledge necessary to control the choice and the use of materials

**Program:**
- Analysis of mechanical requirements or environmental problems.
- Analysis of damage and methods of performance improvement.
- Choice of materials according to the industrial sector (automobile, mechanics and aeronautics).
- Case study.
- Personal project.

**Level:** Year 4/5

**ECTS credits:** 6

**L ** 34hrs  
**SW** 34hrs  
**PW** 68hrs

**Prerequisite:** MA13 or MQ04

**Back to list**

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**MQ06**

**Modeling structures using finite elements**

**Objective:**
- To implement the finite element method (FEM) to resolve the problems of solid equilibrium and of linear elastic structures.

**Programme:**
- Review of basic equations for the mechanics of linear elastic solids.
- Different formulations of the problems of linear elastic solids equilibrium.
- Using the finite element method to approximate the balance of linear elastic solids.
- Application to structures with bars (lattices) and right beams (gantries).
- Application to 2D solids (membranes).
- Use of I-DEAS Master Series software (meshing, calculations and visualization).

**Level:** Year 3

**ECTS credits:** 6

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

**Prerequisite:** MQ01, or MQ02

**Back to list**
MQ07  Fluid mechanics  6 ECTS credits

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

AUTUMN

MQ08  Theoretical and experimental stress analysis  6 ECTS credits

Objectives:
• To model and optimize the behavior of structures by finite elements.
• To measure the constraints inherent within structures by experimental techniques.

Program:
• Experimental methods of stress measurement: photoelasticity measurement, Moiré interferometry, and laser interferometry of Speckle.
• Analytical methods to calculate numerical constraints.
• Digital methods of constraints analysis, finite element method.
• Structure optimization with respect to the constraints.
• Software for finite element calculation: ABAQUS, CATIA, IDEAS, Pro/Mechanica and RADIOSS.

Level: Year 4/5

AUTUMN

MQ09  Meshing and adaptation methods  6 ECTS credits

Objective:
• To understand the basic concepts of meshing and adaptation methods for mechanical calculations.

Programme:
• Geometric modeling of curves and surfaces: 2D models, 3D solids, and 3D surfaces.
• Meshing optimization, error estimation.
• Applications to the mechanics of solids - fluid mechanics - other disciplines of digital calculation.

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.

Level: Year 4/5

AUTUMN

MQ12

Materials and structure forming

6 ECTS credits

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).

Level: Year 4/5

AUTUMN

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
MT11  Analysis and algebra revision  6 ECTS credits
L  34hrs  Objective:
SW  34hrs  • A revision of mathematics for students without a strong background in this
PW  68hrs  subject, to bring everyone up to a common level.
Revision course
Level: Year 3
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.

AUTUMN
Back to list

MT12  Mathematics for the engineer  6 ECTS credits
L  34hrs  Objective:
SW  34hrs  • To get familiar with some mathematical problems faced by an engineer, and the
PS  16hrs  numerical methods used to resolve them.
PW  68hrs  Program:
Prerequisites:  • Linear systems: theoretical bases and direct numerical methods.
MT22, MT23  • Matrix norms and conditioning.
• Latent roots (reiterated power, deflation), singular values.
• Linear least squares (position of the problem, factorization QR).
Level: Year 3  • Introduction to optimization without constraint (optimal conditions, gradient type
methods).
• Convolution, Laplace transformation.

AUTUMN
Back to list

MT13  Digital methods for the engineer  6 ECTS credits
L  34hrs  Objective:
SW  34hrs  • To study methods of space-time discretization for the physical problems of
 continuous media, and to resolve these problems with a digital method approach
(finite differences, finite elements, boundary elements).
PS  16hrs  Program:
PW  68hrs  Prerequisite:  • Mathematical classification of the discretized problem.
MT23  • Finite difference method in 1 and 2 D.
• Principle methods of space discretization.
Level: Year 3  • Application to physical problems (thermal, mechanical, hydraulic...).
• Digital methods for ordinary differential equations resolution.
• Digital methods for linear and nonlinear systems resolution.
• Digital methods for eigenvalues research.

AUTUMN
Back to list
MT14

Operational research

Objective:
• To study various optimization models, and the corresponding resolution methods, as well as the steps to follow when modeling real problems.

Program:
• Mathematical formulation of optimization problems.
• Linear programming of real numbers, graphic method, simplex methods.
• Penalization methods, in two steps.
• Sensitivity analysis and linear parametric programming, duality.
• Programming in integers.
• Dynamic programming.
• Models of transport and graph (maximum flow, shortest route).
• Nonlinear programming (with or without constraints, Lagrangian relaxation).

NF02

General technology of computer systems

Objectives:
• To know every levels of the software and hardware structures of computer systems (from logic gate to the network)
• To realize autonomously simple operations on computer systems

Program:
• Hardware structure of computer systems
• Software structure at every level (microprogrammed layer, OS,…)
• Peripherals management
• Principle and practical operation of networks, communication protocols

NF04

Algorithmics

Objectives:
• To formalize a problem and associated specifications.
• To identify and analyze the possible solutions.
• To choose a solution and to translate it into algorithmic language.

Program:
• Step-by-step algorithmic approach to the resolution of problems.
• Elements of algorithmic complexity and analyses.
• Simple data structure (tables, chains, articles…).
• Examples of traditional algorithmic problem resolution (sorting, search for elements, elementary digital calculations…).
• Introduction to computer architecture.
• Internal data and instruction representation.
NF05

**Introduction to C language**

**6 ECTS credits**

**Objectives:**
- To be able to write a “good” software programme, starting from an algorithm, and meeting industrial requirements.
- To understand programming tools (syntax-directed editor, compiler, debugger...).
- C language will be used throughout the semester.

**Program:**
- Introduction to C language.
- Environment of application development.
- Structure of traditional data in C language (tables, files, articles...).
- From the algorithm to the program.
- Control of software code and quality.
- Advanced elements of C language.
- Introduction to the operating systems, files and information systems.

**Period:** AUTUMN-SPRING

**Prerequisite:** NF04

**Level:** Year 2

**Back to list**

NF14

**Computer-aided management of industrial systems**

**6 ECTS credits**

**Objective:**
- To provide a global approach to systems assisted by industrial commercial computers, as well as concrete know-how in management of production and management of computer-aided maintenance.

**Programme:**
- Use of computer-aided systems within a company.
- Information structure: data bases (conceptual and logical models, SQL...).
- Production management: technical data, medium-term planning, calculation of needs, supply management, scheduling and launching.
- Maintenance management.
- Presentation of ERP and CIM, settings realization.

**Period:** SPRING

**Prerequisite**
- GP06

**Level:** Year 4/5

**Back to list**

NF15

**Advanced computer-aided design systems**

**6 ECTS credits**

**Objective:**
- To study the contribution of advanced computing techniques and artificial intelligence in the design of mechanical systems.

**Program:**
- Artificial intelligence techniques: expert systems, knowledge management.
- Optimization of mechanical systems.
- Advanced product modeling: functional-structural approach, trade integration model...
- Aided-innovation tools: TRIZ, TechOptimizer.
- Industrial reports/presentations: implementation of calculation knowledge, advanced 3D modeling software.

**Period:** AUTUMN

**Level:** Year 4/5

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**NF16**  
**Databases**  

<table>
<thead>
<tr>
<th>Credits</th>
<th>Lectures</th>
<th>Seminars</th>
<th>Practicals</th>
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<tr>
<td>6</td>
<td>34hrs</td>
<td>34hrs</td>
<td>68hrs</td>
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</table>

**Objective:**  
- To study the fundamental concepts related to the installation and the use of databases.

**Program:**  
- Data modeling using the entity/association approach.
- Relational model, relational algebra and calculation of tuples.
- SQL and SQLPlus.
- Standardization of relational databases.
- Processing and optimization of requests.
- Stocking of data on disc and index structures.
- Transactions and techniques for competition control.
- Basics of oriented data objects.

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

**AUTUMN**

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**NF18**  
**PLM interoperability, Service and Virtualization oriented Architectures**  

<table>
<thead>
<tr>
<th>Credits</th>
<th>Lectures</th>
<th>Seminars</th>
<th>Practicals</th>
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<tr>
<td>6</td>
<td>34hrs</td>
<td>34hrs</td>
<td>68hrs</td>
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</table>

**Objective:**  
- To understand the principles and tools related to PLM platforms interoperability and to their virtualization for meeting the collaborative design stakes.

**Programme:**  
- PLM application interoperability: mapping and matching card, HTTP communication between heterogeneous systems.
- Relational databases for technical data management (Oracle, DB2).
- Services and developments virtualization.

**Level:** Year 4/5

**SPRING**

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**NM01**  
**Nanomaterials and nanotechnologies**

<table>
<thead>
<tr>
<th>Credits</th>
<th>Lectures</th>
<th>Level: Year</th>
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<tr>
<td>6</td>
<td>64hrs</td>
<td>4/5</td>
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</table>

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

**Program:**  
- To study the use of nanomaterials in nanomechanics (micro engines, microactivators, microchips...), nanoelectronics (electronic nanochips, material properties at the atomic and nanometric level, fullerenes, nanotubes...), nanooptics (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.

**AUTUMN**

[Back to list](#)
NR01  Regulations and conformity  6 ECTS credits

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

Back to list

NT01  Nanotechnologies and Industry  4 ECTS credits

Objective:
- To learn the main physical and chemical effects linked to industrial applications in nanotechnologies (surface treatment, nanocomposites).

Programme:
- Surface chemistry and treatment.
- Materials characteristics and properties: photocatalysis, absorption, adsorption…
- Integration (physical boundaries)
- Principle of Toxicity and nanomaterials biocompatibility.

Level: Year 5

Back to list

OB01  Basic scientific tools for the engineer  6 ECTS credits

Objectives:
- To be able to model a problem and to resolve it digitally.
- To get an optimal representation of a physical law according to one or more parameters.

Program:
- Introduction to Octave software
- Mathematical tools (matrix calculations, interpolation, digital integration, differential equations, Fourier transform, optimisation).
- Study of different physics problems, parameters influence, results validity, coding optimization

Level: Year 3

Back to list
OP01  Optic and optoelectronic materials

Objective:
- To present the materials and components properties and characteristics used in optics and optoelectronics from a theoretical, applied and industrial point of view.

Program:
- General properties: dispersion, absorption, luminescence, non-linearity, anisotropy, ...
- Components (processes, principles and applications)
  - Glass industry (the main categories and their applications)
  - Energy (photovoltaic, photothermic)
  - Telecommunications (laser, optic fibers, modulators)
  - Lighting and display
  - Data storage
- 4 or 5 seminars
- Visit to the Optics show

WINTER

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

WINTER

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:
- 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.

WINTER
OS03  Stochastic processes

4 ECTS credits

L  20hrs
SW 20hrs
PW 40hrs
Level: Year 5

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.

AUTUMN

Back to list

OS06  Bayesian approach for inverse problems

4 ECTS credits

L  20hrs
SW 20hrs
PW 40hrs
Level: Year 5

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.

AUTUMN

Back to list

OS10  Models and algorithms for production planning and scheduling

4 ECTS credits

L  20hrs
SW 20hrs
PW 40hrs
Level: Year 5

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

Programme:
• Production management and hierarchical breakdown.
• Complexity theory.
• Production planning (MRP, needs aggregation, capacity planning).
• Central scheduling and project scheduling.
• Main scheduling problems (1 machine, parallel machines, flow shop, job shop) and resolution approaches.
• Mini-project: simple resolution algorithms for the resolution of some simple scheduling problems.

AUTUMN

Back to list
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

4 ECTS credits

L  20hrs
SW 20hrs
PW 40hrs

AUTUMN

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

4 ECTS credits

L  20hrs
SW 20hrs
PW 40hrs

AUTUMN

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.

Level: Year 5

4 ECTS credits

L  20hrs
SW 20hrs
PW 40hrs

AUTUMN
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.

6 ECTS credits
L 34hrs
PW 68hrs

PH15
The rise of technology and the crisis of progressive ideas

Objective:
- To understand the evolutions which affect the rise of technologies, to exert in a more lucid and responsible way, the occupation of engineer.

Program:
- Origins and genesis of the modern idea of progress.
- Crisis of the modern idea of progress.
- Responsibility, principle of precaution, democratic evaluation of technological choices: towards a new management of the rise of technologies.

4 ECTS credits
L 26hrs
SW 26hrs
PW 60hrs

PH16
Introduction to political philosophy

Objective:
- Politic function of the language
- Relation with politics.
- Politics future in opened and composite linguistic environments.

Programme:
- Democratic Greek language (Platon).
- Modern political philosophy in the XVIIth century (Hobbes).
- Language politics.
- Language and ideology.
- Politics rhetorics (Perelman).

4 ECTS credits
L 34hrs
SW 17hrs
PW 60hrs
## PH18

### How to live together? History of philosophy through the respect concept

<table>
<thead>
<tr>
<th>L</th>
<th>34hrs</th>
<th>4 ECTS credits</th>
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<td>PW</td>
<td>60hrs</td>
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**Objective:**
- To develop an international philosophical, ethical and political culture
- To develop a personal reflection on the “respect” concept, so often used nowadays
- To discuss around philosophical problematics developed by lectures as well as personal research

**Programme:**
- The main classical thinkers, promoters of the occidental rationality, as well as other Asian and oriental mainstreams
- Respect concept history and its moral and political questions from the ancient times till now

**SPring**

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## PHYS01

### Physics basics for the engineer

<table>
<thead>
<tr>
<th>L</th>
<th>51hrs</th>
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<tbody>
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<td>PW</td>
<td>60hrs</td>
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</tbody>
</table>

**Level:** Year 1

**Objective:**
- To understand the concepts and basics tools for the engineer in mechanics and electrokinetics.

**Programme:**
- Frame of physics, dimensional analysis.
- Mechanics: kinematics, dynamics.
- First applications (friction, ballistics...).
- Quasi-steady state approximation, continuous rating, variable rating.
- Electric circuits with R, L and C.
- Energy and power in mechanics and electrokinetics.
- Free and forced oscillatory system in mechanics and electrokinetics.

**Autumn-Spring**

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## PHYS02

### Mechanics

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<tr>
<th>L</th>
<th>34hrs</th>
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<tbody>
<tr>
<td>SW</td>
<td>34hrs</td>
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<tr>
<td>PS</td>
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<td>PW</td>
<td>68hrs</td>
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</table>

**Level:** Year 2

**Objective:**
- Be able to model and solve a simple problem in non-deformable solid mechanics and in incompressible fluid mechanics
- To know some joint and friction examples

**Programme:**
- Modeling of material assemblies and mechanical actions
- Kinematics of non-deformable solids, movements analysis
- Kinetics, energetics and dynamics of non-deformable solids
- Problems solving
- Introduction to incompressible fluid mechanics
- Friction and basics of tribology

**Autumn**

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PHYS03  Fields, waves, vibrations, propagations

6 ECTS credits

Objective:

- Master the concepts and tools linked to fields and waves
- Know the different wave categories and their behavior
- Know the waves related phenomena (interferences...)

Programme:

- Fields description (hydrodynamic, acoustic, electromagnetism)
- Wave equation, waves structure
- Travelling waves, standing waves, waveguides
- Application to acoustic waves
- Application to electromagnetic waves, specific case of light
- Interferences and diffraction
- Introduction to quantum mechanics

Level: Year 2

AUTUMN

PHYS04  Thermics, energetics and thermodynamic machines

6 ECTS credits

Objective:

- Know the principles of thermodynamics
- Know the different forms of energy and their properties
- Master the basics in heat transfer and principles of thermodynamic machines

Programme:

- Thermodynamics
- Energy, work, heat and 1st principle
- Thermics and heat transfer
- 2nd principle and entropy
- Thermodynamic machines

Level: Year 2

SPRING

PHYS05  Conversion, transfer and transformation of energy

6 ECTS credits

Objective:

- Know the methods and techniques of electrical energy transport
- Know the techniques of electrical and electromechanical conversion
- Master the basics of electrical engineering

Programme:

- Electrical energy: transport and transformation
- Electrical energy conversion (rectification, power systems)
- Electromechanical conversion (motors and alternators)
- Concepts on systems regulation
- Conversion of hydraulic power, turbines
- Electronic systems for controlling energy conversion (photovoltaic, ...)

Level: Year 2

SPRING
PO03

Introduction to political life

4 ECTS credits

Objectives:
- To understand the fundamental ideological and sociological reference marks of current political life: advanced democracies (project, new challenges and limits), totalitarianisms...
- To study the current political and jurisdictional structures which govern the relationship between the State and the society.

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, UN...).
- New challenges to democracy (abstention, racism, civil society...).

AUTUMN-SPRING

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PR01

Metallic materials processing

6 ECTS credits

Objective:
- To understand the main processes for forming and treatment of metallic materials.

Programme:
- Forming processes of metallic alloys (forging, stamping, die-stamping, foundry and sintering).
- Hardening heat treatment (structural hardening, martensitic hardening) and annealing heat treatment.
- Thermochemical treatments (carburizing, carbonitriding, nitriding).
- Corrosion, coating and surface treatment.

SPRING

Back to list

RE01

Corporate networks

6 ECTS credits

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.

AUTUMN

Back to list
RE02
Information transmission
6 ECTS credits

L 34hrs
SW 34hrs
PS 20hrs
PW 50hrs
Level: Year 3

Objective:
• To study various parameters and transmission techniques, according to the characteristics of the supports used.

Programme:
• Information and signal.
• Analog signal digitizing.
• Parameters of digital transmission.
• Codes and modulation.
• Transmission on metallic lines.
• Radio frequency transmission.
• Optical transmission.

SPRING

RE04
Telecommunications networks 1
6 ECTS credits

L 34hrs
SW 34hrs
Level: Year 3/4

Objective:
• To understand the basics of extended networks.

Programme:
• Function of transmission.
• Data encoding.
• Data binding.
• Multiplexing.
• Circuits, packets, signaling switching.
• Evolution of packets switching (X25, Frame Relay, ATM).
• Communication architectures.
• Internet protocols (IP, TCP).

SPRING

RE06
Telecommunications networks 2
6 ECTS credits

L 24hrs
SW 24hrs
PS 16hrs
Level: Year 4/5

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).
• Telephony in packet mode (IP, ATM).
• Service quality.
• VoIP signaling: H323, SIP, IAX.
• Computer Telephony Integration (CTI).
• New networks generations for telephony (NGTN).
• Security.
• Evolution, migration strategy.

AUTUMN
RE12  

**Network services**  

**Objective:**  
- To know and understand the standard services used in company networks, from concepts to the implementation of the servers.  

**Programme:**  
- High layers of the OSI model  
- Web and names resolution.  
- Electronic mails.  
- IP telephony.  
- Directory services.  
- Storage in company networks.  
- Equipments and services management.  

**Prerequisite:** RE01, LO14  

**Level:** Year 4/5  

**6 ECTS credits**  

**L 32hrs**  
**SW 16hrs**  
**PS 32hrs**  
**PW 64hrs**  

**SPRING**  

**Back to list**

RE13  

**Mobile and wireless networks**  

**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  

**6 ECTS credits**  

**L 34hrs**  
**SW 34hrs**  
**PW 12hrs**  

**AUTUMN**  

**Back to list**

RE14  

**IP networks**  

**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,...)  
- Possibility to take the CCNA Cisco certification  

**Prerequisite:**  

**Level:** Year 4/5  

**6 ECTS credits**  

**L 34hrs**  
**SW 34hrs**  
**PS 24hrs**  
**PW 70hrs**  

**SPRING**  

**Back to list**
RE15  Service quality networks and interconnection

**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:**

- RE14
- Level: Year 4/5

**Credits:** 6

**Level:** Year 4/5

**Schedule:** AUTUMN

**Back to list**

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**RE16  Network security**

**Objective:**

- To manage the internet/intranet security within companies.
- To be able to manage a enterprise network especially regarding security.

**Programme:**

- Network architecture (VLAN, translations).
- Filtering (IP, TCP, intrusion applications and detection).
- Firewalls.
- Securized interconnections: VPN, IPSec.
- Radius authentication.
- Security management.
- Possibility to take the CISCO “Network Security” certificate.

**Prerequisites:**

- RE04, RE01
- Level: Year 4/5

**Credits:** 6

**Level:** Year 4/5

**Schedule:** AUTUMN

**Back to list**

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**RE20  Operators networks**

**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.

**Prerequisites:**

- RE14
- Level: Year 4/5

**Credits:** 6

**Level:** Year 4/5

**Schedule:** SPRING

**Back to list**
RE21  
Uses, services and ergonomics of terminals  
6 ECTS credits

Objective:
• To understand the telecommunications uses/services/ergonomics link around communication terminals.

Programme:
• Typology of communicating applications.
• Impact on behaviors and the organization.
• New communicating objects.
• Acceptability of new services.
• Implementation of functional services.
• Functional models of services.
• Functional and surface ergonomics of the terminals.
• Conception, design, marketing.
• Development of Human-computer interaction (HCI) in Java for mobile applications.

Level: Year 4/5  
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:
• 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.

Level: Year 4/5  
SPRING

SC00  
Introduction to communication  
4 ECTS credits

Objective:
• To learn the Communication and Information sciences, through lectures and readings of basic texts.

Programme:
• Theories and models of communication.
• Ethnography.
• Psychosociology.
• Linguistics.
• Analysis of the media.
• Interculturality.
• Semiology.

Minor: COESO  
AUTUMN

Back to list
SC01 Corporate communication

4 ECTS credits

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Objectives:
- To understand the basics of corporate communication: essential concepts, principal methods.
- To use some communication tools.

Programme:
- Objectives of corporate communication.
- Relations with the media, elected officials.
- Event-driven communication.
- Financial communication.
- Crisis communication.
- Environmental communication.
- Internal communication.

Minor: COESO

SPRING

Back to list

SC02 Communication and the media

4 ECTS credits

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

Programme:
- Influence of media.
- History, law, and economy of the media.
- Newspapers.
- TV news.
- Talk-shows

Minor: COESO

SPRING

Back to list

SC04 Psychology and communication

4 ECTS credits

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Objectives:
- To study the various fields and methods of psychology (clinical, social, cognitive...) to understand how human communication operates.

Programme:
- Objects and psychology methods.
- Clinical psychology and psychoanalysis.
- Social psychology and its influence on groups.
- Group dynamics.
- The role of emotion in communication.
- Non-verbal communication.
- Analyse of human interactions.
- Cognition and communication.

Minor: COESO

Prerequisites:
- SC00

AUTUMN

Back to list
SC05  Cognitive psychology and work psychology  4 ECTS credits

L  24hrs  Objectives:
SW  32hrs  • To allow the future engineers to better react to individual mental activities at work (problems solving, information research, errors management…).
PW  60hrs  • 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 fiability and human error.
• Activity analysis at work.

SPRING

Back to list

SC06  Use of communication and innovation technologies  4 ECTS credits

L  34hrs  Objectives:
SW  17hrs  • 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

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

Back to list

SD10  Introduction to literature search  2 ECTS credits

L  14hrs  Objectives:
SW  14hrs  • Introduction to literature search.
PW  20hrs  Programme:
• Basics of writing (synthesis)
• Oral presentation
• CV, letter of motivation, professional interviews
• Access to literature database.
• Literature synthesis.

AUTUMN

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SE01  **History of economic concepts**  

**4 ECTS credits**

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**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.

**AUTUMN**

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SE02  **Basic economics for the engineer**  

**4 ECTS credits**

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**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.

**SPRING**

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SG11  **Human and goods security – 1st part**  

**6 ECTS credits**

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**Objective:**
- Risk history and typology, social and economic impact, strategic anticipation, ranked industrial sites.
- Violence phenomena and social risks, movement society and globality.
- European institutions and their roles, the different political and juridisctional structures and the relations between the States and the society.
- Global and transversal view of mediatization; crisis management and intelligence cell; economic intelligence; corporate and know-how protection.

**Programme:**
- Risk sociological approach / violence sociology and social risks.
- European and international institutions; conflict geopolitics.
- Economic intelligence and media management.

**AUTUMN**

Back to list
**SG12**  
**Human and goods security – 2nd part**

**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.

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

**Level:** Year 5  
**ECTS credits:** 4  
**L:** 51hrs  
**PW:** 45hrs  

**AUTumn**

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**SG21**  
**Security of private / financial /industrial places – 1st part**

**Objective:**
- To see the history of environmental problems and understand the contemporary 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:**
- Ecotoxicology / fire, hygiene and building safety standards / governmental, social, industrial and commercial societies and their security expectations.

**Level:** Year 5  
**ECTS credits:** 4  
**L:** 51hrs  
**PW:** 51hrs  

**AUTumn**

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**SG22**  
**Security of private / financial /industrial places – 2nd part**

**Objective:**
- To present the security policy regarding defence, the new challenge of army forces; to understand the importance of army nowadays, the technology, the new forms of conflicts, terrorism, new theatres of war and forces projection; to understand the United Nations and the national defence concept, military recruitment, the major risks and the crisis communication.

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

**Level:** Year 5  
**ECTS credits:** 4  
**L:** 51hrs  
**PW:** 51hrs  

**AUTumn**

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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.

**Level:** Year 5  
**L** 51hrs  
**PW** 51hrs

_Autumn_

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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, 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.

**Level:** Year 5  
**L** 68hrs  
**PW** 51hrs

_Autumn_

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SI10  
**Training in writing and oral communication**  
4 ECTS credits  

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

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

**Level:** Year 1  
**L** 26hrs  
**SW** 34hrs  
**PW** 60hrs

_Autumn-Spring_

Back to list
SI11  Writing and oral communication for the engineer  

4 ECTS credits

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.

SPRING

Back to list

SL  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.

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SM01  Continuum mechanics basis  

4 ECTS credits

Objective:
• Kinematic and dynamic modeling of malleable continuum mechanics with the 1st gradient method.

Programme:
• Tangent linear application and transformation gradient.
• Study of continuum mechanics deflections: Lagrangian and Eulerian descriptions.
• Deflection rates, supply output formulas and continuum kinematics.
• Virtual power and forces definition
• Stress tensors and their Lagrangian and Eulerian derivatives.
• Objectivity and stress conjugaison – deflection.
• Conservation laws of continuum physics.

AUTUMN

Back to list
SM02

Advanced modeling of finite elements structures

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).

Level: Year 4/5

SM03

Advanced design methods

Objective:
- To have a global view of the most recent methodologies in mechanical products design. These methodologies take part in the design process that generates from the product design specifications the data describing the product aspects.

Program:
- Mechanical design conventional approach and main design methods and theories suggested by the scientific community.
- Task constraints integration methods (production and calculations / optimization).
- Knowledge management methods related to expertises.

Level: Year 5

SM05

Pre-stressing engineering

Objective:
- To give students the knowledge about residual stresses, their origins, their consequences on dimensional stability and/or structures service life. The main measurement and design methods will be described. The course will present the residual stresses that are taken into account in industries.

Program:
- Residual stresses generation origin and mechanism, interaction with material aspects.
- Residual stresses measurement by X-ray diffraction and by mechanical methods
  - Residual stresses modeling by finite elements.
  - Design approach taking into account residual stresses.

Level: Year 5
SM06  Design of torqued thermodynamic phenomena  

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**Level:** Year 4/5  

**Objective:**  
- To present various modeling methods for thermomechanical phenomena in continuous thermodynamics under the assumption of infinitesimal transformations.

**Program:**  
- Non-reversible process thermodynamics with state variables. Consequences and implications on models formulas.
- Applications for usual behaviour: coupling modeling (state coupling and dissipation coupling) between different thermomechanical phenomena:  
  - linear thermoelasticity, isotropic and anisotropic  
  - plasticity and viscoplasticity  
  - damage.

**Autumn**

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SM07  Product design and technical data exchange/management  

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**Level:** Year 5  

**Objective:**  
- To present formalisms and tools in order to build product models, to establish evolution rules in a technical data management context.

**Program:**  
- Functional, structural and geometrical modeling and multi-views for integrated design.
- Technical data exchange and standards or associated formats (STEP, IGES, VDA, STL).
- Product life cycle management methods and tools.
- Product and document structure management, access control and modifications, data securization, workflow.

**Autumn**

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SM08  Elasto-plastic structures calculations by Finite Element Method  

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**Level:** Year 5  

**Objective:**  
- To deepen the knowledge on Finite Element Method with high material nonlinearity problems such as viscoplasticity with small strains.

**Program:**  
- Equilibrium problem in elasto-viscoplasticity.
- Equilibrium and behaviour equations and initial and boundary conditions.
- Movement and speed equations. Strong and small forms.
- Spatial discretization by FE and incremental linearization methods.
- Resolution digital strategies (explicit and implicit methods).
- Local integration methods of plasticity models
- Consistent tangent operator calculation.

**Autumn**

Back to list
SM09  Structures dimensioning under complex stresses  4 ECTS credits

Objective:
- To present the structure design under complex stresses with highlight on dimensioning methods and rules.

Program:
- Introduction to multiaxial fatigue criteria.
- Methods used for mechanical structure design.
- Problems with associated application examples: tridimensional structures oligocyclic fatigue / fatigue with a high cycle number of components and mechanical structures / structure thermomechanical fatigue / composite structures fatigue.
- Methodology to set up digital and experimental devices for integrated design.
- Examples of simulation softwares and of test modular frames.

Level: Year 5

SM16  Materials mechanics and composite structures  4 ECTS credits

Objective:
- To give the homogenizing basics applied to composite materials and structures: conversion micro (components) – meso (ply) and conversion meso (ply) – macro (laminate).

Programme:
- General introduction to composite materials.
- Conversion micro-meso: homogenizing.
- Anisotropic elasticity reviews.
- Behaviour law of orthogonal ply.
- Classic theory of laminate thin plates (Love-Kirchhoff), by taking into account hygrothermal deflection.
- To take into account transversal shearing.
- Dimensioning elements (failure criteria).

Level: Year 5

SO02  Sociology of violence and social risks  4 ECTS credits

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

Program:
- From natural aggressiveness to violence: a human specificity?
- Ghettos: communitarianism or republican model?
- Who are those responsible for violence? Where do they come from? Hordes or gangs?
- Urban violence or urbanization of violence?
- Morale of the masses in a city: migratory flows, crowd psychology, rumor, panic.
- Sport and violence: spectators, supporters, hooligans or martyrs?
- Between order and disorder: zero tolerance impossible for the authorities.
- Security and insecurity, interactivity goes to other logic: safety.

Level: Year 5
SO03  
**Events and democratic societies**  
4 ECTS credits  
L 25hrs  
SW 25hrs  
PW 60hrs  
Objective:  
- To know about mass gathering and festive events.  
- Influence of public opinion.  
- Evolution of institutional responses.  
- Analysis of mass phenomena.  
Prerequisite:  
SO02  
Program:  
- Outdoor and indoor flow management.  
- Presentation of the different participants, institutions responses.  
- “Chaos” analysis. Danger science based on equilibrium between confusion and order.  

SPRING

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.  

SPRING

SO05  
**Risky sociotechnical systems management**  
4 ECTS credits  
L 26hrs  
SW 26hrs  
PS 60hrs  
Objective:  
- Understand the current stakes of risky sociotechnical systems management.  
- Understand the main concepts and their effects on different professional environments.  
- Get used with some methodological approaches of risky situations.  
Programme:  
- What is sociotechnical engineering of risky situations?  
- How to take into account the cognitive, sociological and organizational factors in risky systems management?  
- Which models and concepts for reliable sociotechnical systems analysis and design? (resilience, robustness, HRO, normal error…).  
- Which tools for risks prevention and management and for experience capitalization.  

SPRING
SP01  Introduction to sports activity organization

Objectives:
- To gain a good comprehension of the essential qualities and needs of activities and their organization.
- To learn ordered methodological skills.

Program:
- Sports education: training in the carrying out of a sport activity project.
- Management: motivational strategies and profiles.
- Learning concepts.
- Basics in anatomy and physiology.
- Organization of sport in France.
- Sport: the tutorials are sport student-organized sessions.

4 ECTS credits
L  20hrs
SW 32hrs
PW 48hrs

AUTUMN-SPRING

Back to list

SP02  Sports activity management

Objectives:
- To acquire skills in the field of sports activity management.
- To develop group management skills with a project.

Program:
- Sports education: training in the carrying out of a sport activity project.
- Management: motivational strategies and profiles.
- Learning concepts.
- Basics in anatomy and physiology.
- The organization of sport in France.
- Weekly management of a sports activity.

4 ECTS credits
L  20hrs
SW 12hrs
PS 40hrs
PW 60hrs

AUTUMN-SPRING

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SP03  Sports activity manager qualification

Objectives:
- To obtain a qualification in sports or sporting association management.

Program:
- Ministry of Youth and Sports training: federal or state diploma.
- Training in refereeing of the sport discipline chosen.
- Management of a sport activity.

4 ECTS credits

Hours depend on the sport chosen
Prerequisite: SP02

AUTUMN-SPRING

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SP10

**Physiology of effort**

**Objective:**
- To apply physiological principles to manage a sport performance project.

**Program:**
- Bioenergetics of muscular activity.
- Cardiovascular and respiratory adaptation to effort.
- Metabolism of muscular activity.
- Mechanism of muscular contraction.
- Performance and training planning.
- Endocrinology and doping.

**SPRING**

**Back to list**

SP11

**Sports performance project**

**Objectives:**
- To apply their knowledge in managing a sport performance project.
- To learn ordered methodological skills.

**Program:**
- To organize a performance driven project.
- Anatomy: sports warm-up.
- Physiology: training planning and energy paths.
- Dietetics and sport diets.
- Training methodology.
- Psychology: mental training.
- Sport activities: initiation, improvement or competition

**AUTUMN-SPRING**

**Back to list**

SP20

**Sports project design and management**

**Objectives:**
- To understand the sporting world in terms of the market, communication and commercial relations.
- To acquire methodological competency in terms of project management.
- To organize a sport event.

**Program:**
- Management of a project: definition stages, execution, and assessment.
- Human resource management: meeting management.
- Marketing: market research.
- Communication: presentations, press relations.
- Budget management: accountancy, finance.
- Event security.
- The structure of sport in France.

**SPRING**

**Back to list**
**SY01**

**Basic principles of probability**

Objectives:
- To become familiar with random concepts.
- To learn to use necessary tools to process simple random phenomena.

Program:
- Introduction to the calculation of probabilities: random experiments and events, axioms of probability calculations, conditional probabilities, independence in probability, random experiments.
- Random variables: concept and definition, laws of probability, study of several laws, conditional laws, functions of a random variable, moments.
- Random variable couplets: concept and definition, joint laws of probability, functions of random variables, united moments, characteristic functions.

Level: Year 2

Level: Year 2

**SY02**

**Statistics for the engineer**

Objectives:
- To identify, and then correctly formulate a problem, from random data, in order to define the statistical approaches to set up.
- To study the “fundamental theories” which allow the comprehension and correct use of the basic tools of statistics.

Programme:
- Estimation: definition and properties of estimators, intervals confidence.
- General presentation of hypotheses tests.
- Parametric tests in the Gaussian case, nonparametric and adequacy tests.
- Analysis of variance and linear regression.

Prerequisite: SY01

Level: Year 3

**SY04**

**Tools for Information Systems and networks design**

Objectives:
- To know the necessary tools for Information Systems design and for network performance evaluation and design.

Program:
- Mathematic logics.
- Algebra specifications.
- Graphs theory.
- Markov processes by discrete and continuous time.
- Simple queuing and queuing networks.

Level: Year 3

Level: Year 3
SY05  Tools for decision-making strategy  6 ECTS credits

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**Objective:**
- To learn various techniques for decision-making within a business environment.

**Program:**
- Decision-making theory.
- Value of information.
- Multi-stage decisions.
- Theory of utility.
- Zero-sum games and non-zero-sum games
- Iterative games.
- Cooperative games.

**Prerequisite:**
- MT14, SY01

**Level:** Year 4/5

SPRING

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SY06  Signal analysis and processing  6 ECTS credits

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**Objective:**
- To become familiar with the tools necessary for the study of signals and systems.

**Program:**
- Deterministic signals (temporal and frequential representations, power and energy, correlation and spectral density functions).
- Filtering (impulse response, produced convolution, transfer functions).
- Signals and digital systems (sampling, quantification, discrete Fourier transforms, digital filtering).
- Random signals (definitions, properties, ergodism, filtering and spectral analysis of random signals, and estimates of characteristic sizes).
- Practical work using Matlab software.

**Level:** Year 4/5

SPRING

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SY08  Multimedia signals processing  6 ECTS credits

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**Objective:**
- To introduce the new concept of multi-media, to present it in terms of technology and services, to ensure its good function and interoperability.

**Program:**
- Contents of the new multi-media concept.
- Encryption and compression of sound (voice, others).
- Encryption and compression of fixed and animated images.
- Modeling, analysis and voice synthesis.
- Content analysis methods.
- Representation methods for scenes in 3D.

**Prerequisites:**
- IF01, SY06

**Level:** Year 4/5

AUTUMN

Back to list
### SY12: Automation and industrial control

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**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.

**Level:** Year 3

**Practical Experiment:**
- Autumn

### SY13: Automatic control

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**Objective:**
- To study the basic methods for analysis and synthesis of continuous or digital control systems for continuous state dynamic processes.

**Program:**
- Modeling and analysis of dynamic systems: transfer function, temporal/frequential analysis, Bode and Black diagrams, sensitivity, precision, stability.
- Frequential synthesis of continuous regulation.
- Synthesis in the root locus (Evans).
- Enhancement of regulation loops (internal model, cascade or predictive command...).
- Modeling in state space and command by state feedback.
- Digital regulation.

**Level:** Year 3

**Practical Experiment:**
- Spring

### SY14: Analysis and dynamics of systems

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**Objective:**
- To understand the conceptual and methodological bases to the global solution of systems (systemic), and to apply them to problems of industrial companies and systems.

**Program:**
- Basic concepts of the systemic approach.
- Categories and dimensions of systems.
- Methodology for overall analysis of temporal systems.
- Temporal and dynamic aspects of the systems.
- Modeling of systems.
- Applications to technological systems, organizational systems, etc.

**Level:** Year 3

**Practical Experiment:**
- Autumn

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**SY15**  
**Industrial systems simulation**  

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**Prerequisites:**  
NF14, SY01  
**Level:** Year 3  

**Objective:**  
- To study the methodology and techniques of algorithmic description of industrial systems, as well as computing simulation tools.  

**Program:**  
- The Monte Carlo method.  
- Simulation of random variables and functions.  
- Simulation of discrete events.  
- Simulation systems: Witness, ARENA.  

**Spring**  

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**SY16**  
**Signal and images digital processing**  

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**Prerequisites:**  
SY06  
**Level:** Year 3  

**Objective:**  
- To know the theoretical and practical tools for digitally processing and analyzing signals and images  

**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**  

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**SY17**  
**Production systems design**  

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**Level:** Year 4/5  

**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.  

**Autumn**  

[Back to list](#)
SY18  
**Modeling and performance evaluation tools**  
6 ECTS credits  

**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.  

Level: Year 3  

**SPRING**  
[Back to list](#)

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SY20  
**Industrial intelligence**  
6 ECTS credits  

**Objectives:**  
- To perceive the layers of overall performance within a communicating factory.  
- To discover the standards of exchange, processing, of industrial information.  

**Program:**  
- Hierarchy of industrial data, the sensor of the decision-making systems.  
- Basics of industrial data processing (physical supports, protocols, standard OPC).  
- MES (Manufacturing Executive System) and its 11 functions.  
- Strategy of collaboration and sharing of information between MES and ERP (ISA 95.00.02).  
- Exploitation of the industrial data bases by SQL and Visual Basic.  
- Structure and standards of business information exchange (XML,.NET).  

Level: Year 4/5  

**SPRING**  
[Back to list](#)

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SY22  
**Wireless systems**  
6 ECTS credits  

**Objectives:**  
- To study the wireless communication of embedded Information Systems from the electronical, software and radio view.  

**Programme:**  
- Embedded Java systems.  
- Signals modulation.  
- Radio transmission.  
- Ad-hoc networks.  
- GSM/GPRS.  
- Satellite communication.  
- Bluetooth/Wi-Fi.  

Level: Year 4/5  

**AUTUMN**  
[Back to list](#)
SY23  
**Embedded systems**

- **ECTS credits**: 6
- **L**: 34hrs
- **PS**: 30hrs
- **PW**: 20hrs
- **Prerequisite**: LO02, LO14
- **Level**: Year 4/5

**Objectives:**
- To have an approach on embedded Information Systems from the electronic, software, operating systems, communication and energetic angles.

**Programme:**
- Embedded systems electronics.
- Embedded operating systems.
- Embedded Java systems.
- Communication bus.
- Management of embedded systems energy.

**SPRING**

SY24  
**Information processing and security**

- **ECTS credits**: 6
- **L**: 30hrs
- **SW**: 24hrs
- **PW**: 48hrs
- **Prerequisite**: SY16
- **Level**: Year 4/5

**Objectives:**
- To get the information processing tools for secure systems development

**Programme:**
- Images and videos coding and compression
- 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

**SPRING**

SY25  
**Sensors networks**

- **ECTS credits**: 6
- **L**: 30hrs
- **SW**: 12hrs
- **PS**: 24hrs
- **PW**: 68hrs
- **Prerequisite**: SY16
- **Level**: Year 4/5

**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

**AUTUMN**
**TITS**

**Technological and scientific investigation**

**Objectives:**
- To know how to find information and get knowledge on a technology matter
- Get an overview of the research area, how a laboratory is working, know how to find information about scientific matter

**Programme:**
- To specify the frame and objectives of a project and manage a planning
- To find information on a technology project and produce an experience
- Discover and participate in a research activity and get information about it
- Summarize acquired knowledge, write a report
- Oral presentation of acquired knowledge

**PW 120hrs**

**6 ECTS credits**

**AUTUMN-SPRING**

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**TN01**

**Introduction to the definition and manufacture of a technical object**

**Objectives:**
- To be able to establish the link between representation, manufacture and control of a technical object.
- To acquire the basic tools of mechanical engineering.

**Programmes:**
- Norms of technical drawing, projections, perspective.
- Reading simple plans, analysis of connections and kinematic diagrams.
- Introduction to CAD.
- Manufacturing techniques involving the metal removal (turning, drilling and milling).
- Assembly, dimensional and material audit.

**L 26hrs**
**SW 34hrs**
**PS 32hrs**
**PW 34hrs**

**6 ECTS credits**

**Level: Year 1**

**AUTUMN-SPRING**

**Back to list**

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**TN02**

**Technology and introduction to mechanical design**

**Objective:**
- To analyze, choose, and implement the technical elements and basic mechanical functions necessary to the mechanical designer.

**Programmes:**
- Basic gauging of mechanical components.
- Technology of the functional connections.
- Standard elements.
- Oil clearance, tightness, lubrication.
- Statics.
- Tension-contraction on a beam.
- CAD applications in the form of a mini project.

**L 26hrs**
**SW 51hrs**
**PS 8hrs**
**PW 34hrs**

**Prerequisite**
- **TN01**

**Level: Year 1/2**

**6 ECTS credits**

**AUTUMN-SPRING**

**Back to list**
Multi-technique productions 6 ECTS credits

**Objective:**
- To develop initiative and responsibility through the study and/or creation of objects and systems of different types: mechanical, hydraulic, electronic...
- To get to know project management basics including results, cost, time and safety constraints
- To know the basics of work safety

**Programme:**
- To produce an object or multi-technique system
- To study the feasibility and plan its development
- To manage a project and the practical production
- Result evaluation with possible corrections
- Training in safety

**AUTUMN-SPRING**

One month technical training period 6 ECTS credits

**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.

**FEBRUARY**

Experience abroad (4 ECTS credits) 4 ECTS credits

**Objectives:**
- To discover a foreign country and its culture.
- To become aware of the challenges related to international mobility.

**Programme:**
- Research of a host country for the month.
- Organization of travel and the stay.
- Production of a written report and/or an investigation in connection with the host country.
- Production of a written report giving a personal reflection on the experience.
- Oral presentation.

**FEBRUARY or JULY/AUGUST**
TN08  
**Introduction to matter working**  

**Objective:**  
- To know the general properties of different kind of materials  
- To know how to choose a material depending on the Product Design Specifications  

**Programme:**  
- Principal properties of materials  
- Materials categories  
- Characteristics and general properties (mechanics, forming, damage...)  
- Choice of materials for the design phase  
- Economic and environmental aspects  

**Level:** Year 2  
**Credits:** 6 ECTS  
**Lecture Hours:** 34hrs  
**Workshop Hours:** 34hrs  
**Practice Hours:** 16hrs  
**Teaching Hours:** 68hrs  

**Semiannual:** SPRING  
**Compulsory:**  
**Back to list**

TN09  
**Industrial work placement**  

**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  
**Credits:** 30 ECTS  
**Duration:** 1 semester  
**Compulsory:** for all Major students  

**Semiannual:** AUTUMN or SPRING  
**Back to list**

TN10  
**Final Year Project**  

**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 student  
- 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 UT 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.  

**Level:** Year 5  
**Credits:** 30 ECTS  
**Duration:** Final semester of degree  
**Compulsory:** for all Major students  
**Prerequisite:** Engineer qualification  

**Semiannual:** AUTUMN or SPRING  
**Back to list**
TN12  
**Engineering and design**  
6 ECTS credits  

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**Level:** Year 3  

**Objective:**  
- From Product Design Specifications, to be able to fully design a simple mechanical system in accordance with cost and production resources constraints, to plan the production, use and recycling  

**Programme:**  
- Tools of Product Lifecycle Management, design methods  
- Eco-design for mechanics  
- Design of functional connections and assemblies  
- Power transmission technology  
- Functional dimensioning and tolerancing  

**SPRING**  

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TN14  
**Initiation into C.A.D.: geometric modeling**  
6 ECTS credits  

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**Level:** Year 3  

**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.  

**AUTUMN**  

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TN15  
**Standard manufacturing techniques**  
6 ECTS credits  

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**Level:** Year 3  

**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**  

Back to list
Concurrent engineering and CAD/CAM support

**Objective:**
- To obtain the necessary basics to manage and administrate a CAD/CAM platform in a context of concurrent engineering.

**Programme:**
- Product engineering: product life-cycle, integrated design, concurrent engineering, Co-design.
- Software: CAD, CAM, TDM, structural analysis, simulation, ergonomics, digital models, reverse engineering.
- Technical data exchange: STEP, IGES, SET, VDA.
- CAD/CAM management: materials, operating systems, networks, user management, software installation, databases.

---

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.

---

Advanced production techniques

**Objective:**
- To obtain an outline of advanced manufacturing techniques in industry, in order to better choose processes and manufacturing parameters.

**Programme:**
- Composites manufacture.
- Treatment of conventional surfaces (mechanical or thermal) and special surfaces (shot blasting of pre-stressed concrete).
- High speed machining.
- Unconventional machining (ultrasound, electroerosion, water jet, laser...).
- Rapid prototyping.
- Three-dimensional metrology (macroscopic and nanoscopic scales).
TN19

Purchasing techniques and cost reduction

6 ECTS credits

Level: Year 4/5

L 34hrs
SW 34hrs
PW 82hrs

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.

AUTUMN

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TN20

Analysis and dimensioning of mechanical systems

6 ECTS credits

Level: Year 3

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

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.

SPRING

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TN30

Master’s thesis

30 ECTS credits

Final semester of degree
Compulsory for master’s students

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.

AUTUMN or SPRING

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TN31

Specific placement in environment and sustainable development

18 ECTS credits
4 months

For students in the double degree in 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
2 months

For students in the double degree in sustainable development

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.

SPRING

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TN40

Laboratory project for exchange student

30 ECTS credits

Prerequisites:
Bachelor level

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.

AUTUMN or SPRING

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### TN51

**Work-study program 1**

**18 ECTS credits**

**Prerequisites:**
Master's level

**Level:** Year 5

**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.

**Programme:**
- Work-study program 1
- Work-study program 2

**Semester:** AUTUMN or SPRING

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### TN52

**Work-study program 2**

**18 ECTS credits**

**Prerequisites:**
Master's level

**Level:** Year 5

**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.

**Programme:**
- Work-study program 1
- Work-study program 2

**Semester:** AUTUMN or SPRING

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### TS01

**Systems security**

**6 ECTS credits**

**Level:** Year 4/5

**Objective:**
- To be able to evaluate, structure and manage the preventive and corrective measures of industrial systems safety.

**Programme:**
- The system approach and human factors.
- Rules.
- Accident analysis, risk analysis.
- Security management.
- Installation security.
- Ergonomics and security, work and safety analyses, organization of work and safety.
- Case studies, operational reliability.

**Semester:** SPRING

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TS02

Industrial risks management

**Objective:**
- To study technological and natural risk management, through general methods of analysis, and management of risks and crises.

**Programme:**
- Introduction, terminology and history of the field.
- Risk prevention and safety evaluation.
- Rules and legislation.
- Human factors.
- Operational security in several fields (transport, nuclear power, chemistry).
- Environmental and fire risks (human activities and natural environments).
- Crisis management (visit to a technical crisis centre).

**Level:** Year 4/5

**ECTS credits:** 6

**L** 60hrs

**SW** 34hrs

**PW** 17hrs

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TX

Creation and experimentation

**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.

**ECTS credits:** 6

**PW** 120hrs

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