

# Spring semester

MECHANICAL ENGINEERING COURSES

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Advanced heat transferts and fluid flow	5 credits	65h
Advanced mechanical modelling	7 credits	99h
Multidisciplinary industrial project	6 credits	86h
Research projects and Sports	6 credits	37h
Communicating with in organizations	6 credits	75h

SYSTEM ENGINEERING COURSES

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Tutored projects	4 credits	60h
Systems Engineering processes	5 credits	76h
Dynamics of structures and control	4 credits	54h
Object oriented and real time programming	3 credits	55h
Mechatronic project	4 credits	60h
QSE and Sport	4 credits	48,75h
Communication with in organizations	6 credits	

# Advanced heat transferts and fluid flow

 **Level**  
BAC +3

 **ECTS**  
5 credits

 **Component**  
INSTITUT  
NATIONAL  
DES SCIENCES  
APPLIQUEES  
TOULOUSE

 **Number of  
hours**  
65h

## In brief

➤ **Teaching language(s):** Français, Anglais

## Presentation

### Description

#### Viscous Fluid Flows :

Lectures and Tutorials

- \* Intro: viscosity, fluid particle, deformation, Eulerian and Lagrangian reference system
- \* Fundamental eqs : Conservation of Mass, Linear Momentum (Navier-Stokes eq) and Energy, dimensional analysis and similarity
- \* Internal flows: Analytical solution of the fundamental equations, friction factor, head losses, hydraulic circuits
- \* External flows: laminar and turbulent boundary layers, forces on immersed bodies, elementary aerodynamics.

#### Heat and Mass Transfer :

Lectures and tutorials

- \* unsteady conduction
- \* additional external convection (tube batteries, impacting jets, mass transfer and evaporation)

- \* internal flow convection.

Numerical simulation lab work: introduction to Ansys Fluent code and realization of a project related to the course.

### Objectives

At the end of this course, the student should have understood and will be able to explain the basics allowing to approach a phenomenon involving real (viscous) fluids. He will be able to tackle situations involving more or less complex heat and mass transfers.

The student will also be able to conduct a numerical simulation with Ansys Fluent code.

### Pre-requisites

Inviscid fluid dynamics (I3ICFT01 – Fluid Mechanics 1)

Introduction to heat transfer (I3ICFT01 – Heat Transfer 1)

### Useful info

#### Place

➤ Toulouse



# Advanced mechanical modelling



## Presentation

### Description

#### **Mechanical systems :**

The basis of behavior under preload is highlighted through the study of fatigue life of shafts, angular contact bearings, fasteners, interference shaft assemblies and mechanical springs.

#### **Materials :**

Training to the fundamental basis of plasticity, creep, corrosion and mechanical damage.

#### **Vibrations and transient dynamics :**

Vibrations with finite elements : modal superposition, FRF, damping

Transient dynamics : explicit computing, Newmark's algorithm.

Practical sessions illustrates some experimental aspects of vibration : impact hammer, shaker.

## Objectives

At the end of this module, the student will have understood and be able to explain how works a pre-stressed (or preloaded) mechanical system, basis of fracture mechanics and computations of vibrations and transient dynamics.

The student will be able to identify mechanical systems that are preloaded, discuss with a specialist of fracture mechanics and carry out a simulation of vibrations and transient dynamics.

## Useful info

### Contacts

#### **Education manager**

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### Place

➤ Toulouse

# Multidisciplinary industrial project



Level  
BAC +3



ECTS  
6 credits



Component  
INSTITUT  
NATIONAL  
DES SCIENCES  
APPLIQUEES  
TOULOUSE



Number of  
hours  
86h

## Presentation

### Description

Students work in teams in order to propose their answer to an industrial project. This work induces working on eco-design, life-cycle analysis, quality, security and project management.

Organization :

Few lectures are organized. The main work is done in teams with meetings with our industrial partners on dedicated issues (quality, security...). At the end of the project the students have to promote their work to the author of the project.

### Objectives

At the end of this module, the student will have understood and be able to explain the main principles and definitions of quality management, the importance of health and safety at work, how to assess and prevent risks, eco-design and life-cycle analysis.

The student will be able to develop their capabilities in mechanical design in an industrial project.

## Pre-requisites

Bachelor in mechanical design

## Useful info

### Contacts

#### Education manager

MANUEL PAREDES

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## Place

> Toulouse

## Research projects and Sports



## Presentation

### Description

The first semester of the 4<sup>th</sup> year (semester 7) deals with the bibliographical search. It is managed by the library staff.

The second semester of the 4<sup>th</sup> year (semester 8) addresses the scientific communication and is used to generate the scientific propositions. It is driven jointly by the scientific tutor and the English professors (a specific UE).

The third part is devoted to the implementation and assessment of the scientific proposals. It takes place in the first semester of the 5<sup>th</sup> year (semester 9), as another UE.

Organization:

Semester S7 : 2x1h15 lectures on bibliographical search, delivered by the library staff, plus 30 hours personal work.

Semester S8 : 55 h hour personal work for the team project, driven by the scientific tutor. Close link with English courses for written and oral communication.

Main difficulties for students:

- Manage their time to work every week on the project
- Allocate enough time for the generation of deliverables
- Process with scientific rigor, including for produced documents.

### Objectives

The module aims at giving the students a first experience with research through a tutored project in teams (2 to 4 students).

At the end of the module, the student will :

- know how to conduct a bibliography search, synthesise and cite it, for a given scientific topic;
- communicate with rigor in English, orally or through written documents to highlight the research activity performed;
- perform a simple research action in a team organization to generate scientific propositions, then implement and finally assess them.

## Useful info

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### Contacts

**Education manager**

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### Place

➤ Toulouse



# Communicating with in organizations

 **ECTS**  
6 credits **Number of hours**  
75h

## Presentation

### Objectives

The classes given in French will focus on :

- How to react to society's demand for technical and scientific information
- How to foster critical thinking in order to give appropriate answers when questioned about such issues
- How to communicate effectively in the workplace

The classes given in English will focus on the specific linguistic characteristics of English used in such contexts in order for the students to understand and master them.

The students will also be made aware of the specificity of professional communication within the English-speaking world.

Module L2

The objectives, defined in reference to ther CEFRL for the 5 language activities, depend on the language studied - Chinese, German, Spanish - and the level of the student.

They can be consulted on :

 <https://moodle.insa-toulouse.fr/course/view.php?id=44>

In certain cases, students may be authorised to follow an English module instead of another language.

### Pre-requisites

For classes in English : mastery of general English

## Useful info

### Contacts

#### Education manager

BEATRICE JALENQUES-VIGOUROUX

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## Tutored projects



ECTS  
4 credits



Component  
INSTITUT  
NATIONAL  
DES SCIENCES  
APPLIQUEES  
TOULOUSE



Number of  
hours  
60h

## Presentation

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### Description

The work is composed of two parts :

- \* a bibliographical study dealing with a research theme in relationship with the project. This study is concluded by the writing of a document whose content and form have to follow the recommendations given by the tutors,
- \* a technical realization which is performed during a full semester.

Organisation:

4 hours of documentary research teaching then 10 hours of project management teaching, then 30h of project.

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### Objectives

The module is aimed at motivating students with research activities by means "tutored projects" involving groups of several students and directed by an academic or an industrial tutor. Those projects are completed by a formation to documentary research. A course of project management allows guiding the realisation part of the project.

At the end of this module, the student will have understood and be able to explain (main concepts):

- \* the concepts, norms and techniques related to the building of a state of the art in relationship with the subject of the project subject,
- \* the concepts and techniques in relationship with the management of the project involving several persons.

The student will be able to:

- \* elaborate a state of the art dealing with a domain in relationship with the project,
  - \* manage a project involving several persons,
  - \* integrate techniques of different scientific domains to reach the realization goals of the project.
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### Pre-requisites

Depends of the subject of the project.

### Useful info

## Contacts

### Education manager

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## Place

➤ Toulouse

# Systems Engineering processes

 **ECTS**  
5 credits

 **Component**  
INSTITUT  
NATIONAL  
DES SCIENCES  
APPLIQUEES  
TOULOUSE

 **Number of  
hours**  
76h

## Presentation

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### Objectives

At the end of this module, the student will have understood and be able to explain (main concepts) :

Learn to define, gather, analyse and express the needs and expectations of

involved parties in order to design and implement a system, a product, a service.

Learn to translate the needs and expectations into technical requirements, define

and analyse technical requirements in order to design and implement a

system, a product, a service.

## Useful info

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### Place

> Toulouse

# Dynamics of structures and control

 **ECTS**  
4 credits

 **Component**  
INSTITUT  
NATIONAL  
DES SCIENCES  
APPLIQUEES  
TOULOUSE

 **Number of  
hours**  
54h

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## Presentation

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## Place

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## Objectives

➤ Toulouse

Vibrations of mechanical systems and structures.

Controlling the articulated systems and flexible structures.

The global and local modelling of electromagnetic actuators.

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## Pre-requisites

Basis in electromagnetism, solid mechanics and control

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## Useful info

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## Contacts

### Education manager

SEBASTIEN SEGUY

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# Object oriented and real time programming

 ECTS  
3 credits

 Number of  
hours  
55h

## Presentation

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### Description

The module addresses the specification and design of real time systems, an introduction to main real-time operating systems services, method to program and to test a real-time application.

### Objectives

This module presents real time systems, concepts, attributes, constraints, applications and teach how to program these systems using object oriented languages and using real time operating systems.

## Useful info

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### Contacts


#### Education manager

PIERRE-EMMANUEL HLADIK

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# Mechatronic project

 **ECTS**  
4 credits

 **Number of hours**  
60h

## Presentation

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### Objectives

At the end of this module, the student will have understood and be able to explain :

- Power and information channels of mechatronic systems
- The place of system simulation activities in the design cycle (V design cycle) of complex systems
- The principle of data acquisition with computers.

The student will be able to :

- Establish models suitable for various engineering tasks during the design of mechatronic systems
- Implement models in a system simulation environment and perform validation and verification tasks associated to the V design cycle
- Specify and conduct model-in-the-loop and software-in-the-loop activities for a complex system
- Design the different elements of a simple data acquisition system
- Implement a graphical programming language dedicated to the acquisition (LabWIEW)
- Perform a security analysis

- Perform a lifecycle analysis with a dedicated software

## Useful info

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### Contacts

#### Education manager

ION HAZYUK

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## QSE and Sport

 ECTS  
4 credits

 Number of  
hours  
48,75h


## Useful info

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### Contacts

**Education manager**

MANUEL PAREDES

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# Communication with in organizations



ECTS  
6 credits

## In brief

> **Number of students:** 75

They can be consulted on :

<https://moodle.insa-toulouse.fr/course/view.php?id=44>

In certain cases, students may be authorised to follow an English module instead of another language.

## Presentation

### Objectives

The classes given in French will focus on :

- How to react to society's demand for technical and scientific information
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- How to communicate effectively in the workplace

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### Pre-requisites

For classes in English : mastery of general English

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### Contacts

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