

# MECHANICAL ENGINEERING COURSES

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

# 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



Level  
BAC +3



ECTS  
7 credits



Component  
INSTITUT  
NATIONAL  
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APPLIQUEES  
TOULOUSE



Number of  
hours  
99h

## 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**

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## Place

> Toulouse

## Research projects and Sports



Level  
BAC +3



ECTS  
6 credits



Component  
INSTITUT  
NATIONAL  
DES SCIENCES  
APPLIQUEES  
TOULOUSE



Number of  
hours  
37h

## 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

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