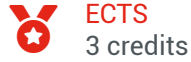


MECHANICAL ENGINEERING COURSES

System level modelling and simulation	3 credits	30h
Composite structures and case study	3 credits	46h
Heat Engines, Refrigerators and Heat Pumps	3 credits	38h
Non destructive testing/English	4 credits	55h
Research projects (part 3)	4 credits	60h
Optional modulus	7 credits	90h
Human Resources Management and Group Work	6 credits	75h

System level modelling and simulation



Presentation

Description

This course is dedicated to the lumped parameters modelling and simulation of power systems. The methodology and the analysis is supported by the Bond-Graph formalism. A progressive approach leads the student to acquire knowledge and practical know-how in multi-domain modelling (models structures, adaptation to simulation software, link with distributed models and inverse problems).

Practicals are based on up-to-date industrial examples that are simulated within both

Matlab/Simulink, AMESim and DymoLa.

Organization:

Lecture/tutorials plus practicals

Main difficulties for students:

Establishing multiphysics path, understanding the need.

Objectives

The student will be able to build, simulate and analyse system-level models of multi-domain power systems.

Pre-requisites

Dynamic systems, fluid mechanics, solid rigid mechanics, dynamic systems

Useful info

Place

➤ Toulouse

Composite structures and case study



Level
BAC +4



ECTS
3 credits



Component
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Number of
hours
46h

Presentation

Description

A general course (16.25 h) to the whole group is given on laminate theory and technos. A handout deals with simple and more complex issues of composite theories. A general presentation deals on technos.

Organization:

- * A project on an aeronautic case study is done within 6 courses of 3h each and deals with basic static sizing, damage tolerance design and manufacturing.
- * The project is done by pair under the supervision of academic or senior engineer.
- * 6h of CATIA Composite are also done to study practical composite design rules of aeronautic industry.
- * Two practical works of 3h each enables to manufacture composite plates by hand stacking or LRI.

The student will be able to:

- * Choice a couple of fibers and matrix and their commercial products.
- * Choice a type of composite structure: laminates, sandwiches, 2D1/2,3D, 4D.
- * Determine the manufacturing method: hand layup, fiber placement, RTM, LRI, RFI.
- * To be inspired by solutions of automotive, naval, wind energy or aerospace industry.
- * To be inspired by past experience in aeronautic industry.
- * Know and use laminate theory.
- * Knows and use simple sizing of junctions.
- * Know issues of impact and ageing.
- * Know issues of failure and damage.
- * Realize a case study : example wing box of an acrobatic aircraft.
- * Make a presentation of their sizing and their design.
- * Work in a collaborative manner.

Objectives

Main Objectives :

The student will be able to perform simple sizing of composite structures and to choice a couple manufacturing/material for a given case study.

Pre-requisites

- Beam theory, Continuum mechanics, Materials behaviors.

- Matrix calculation.

Useful info

Place

➤ Toulouse

Heat Engines, Refrigerators and Heat Pumps



Level
BAC +4



ECTS
3 credits



Component
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Number of
hours
38h

Presentation

Description

With appropriate reminders and complements of thermodynamics, this course focuses on the behaviour of various industrial thermal systems :

- engines with continuous mass transfer (compressors, turbines...),
- condensable steam engines (steam-powered engines, refrigerating and heat pumps...), with the objective to optimize them, notably from an energetic efficiency point of view.

Organization:

- 8 lectures provide the necessary thermodynamic knowledge for modelling heat engines, refrigerators and heat pumps.
- 13 tutorial sessions deal with various problems. Students should prepare for these sessions in advance for maximum efficiency and personalization of interactions with the teacher. They have at their disposal a booklet gathering the problems and the tables and graphs necessary for their resolution.

- 3 lab work sessions devoted to the study of a compressor, a heat pump and an air handling unit complete the course.

Objectives

At the end of this course, the student should have understood and will be able to explain the operation of conventional heat engines, refrigerators and heat pumps as well as the basics of combustion.

The student should be able to size and optimize conventional heat engines, refrigerators and heat pumps.

Pre-requisites

Fundamentals in thermodynamics (1st year)

Thermodynamics and Thermodynamic Analysis (1st year)

Useful info

Place

➤ Toulouse

Non destructive testing/English



Level
BAC +4



ECTS
4 credits



Component
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Number of
hours
55h

In brief

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

Presentation

Description

Syllabus (detailed contents):

Module 1 : Non Destructive testing (NDT)

Theory of testing and defect analysis.

Analysis of the link between industrial production and defects as well as between defects and the mechanical behaviour of items.

The main nondestructive testing methods are introduced:

- Dye penetration and Magnetoscopy
- Eddy currents: corresponding fundamentals in physics, applications to defect detection.
- Ultrasonic testing: corresponding fundamentals in physics, industrial applications.
- radiology (X-ray and gamma): corresponding fundamentals in physics, radiation safety, industrial applications.

Module 2 : Metallic alloys for high temperature applications – Creep behaviour

Creep phenomena and resistance.

Creep modelling to determine life expectancy: Norton's law and Larson-Miller parameters.

High temperature metallic alloys : properties and applications.

Module 3 : English

The students, organized in small groups, are tutored by English teachers while writing abstracts and preparing short oral presentations bearing on each of the nondestructive methods. The stress is put on student autonomy and constructive feedback from the English teachers.

Objectives

At the end of this module, the student will have

understood and be able to explain (main concepts):

Module 1 : Non Destructive testing (NDT)

Students have to know the main nondestructive testing methods with advantages/drawbacks and how to apply them to practical industrial cases. They must be able to choose the most appropriate method to solve specific industrial issues.

Module 2 : Metallic alloys for high temperature applications – Creep behaviour

Analysis of the physics occurring during creep and of the parameters which affect creep resistance.

How to apply basic theoretical models to calculate rupture life expectancy.

Knowledge of the main metallic alloys withstanding creep at high temperatures.

Module 3 : English

Students must be able to organize their scientific speech and writing logically, to use proper English in a concise and appropriate style while meeting genre conventions; master technical terms ; resort to appropriate registers (specialized/non specialized audiences/readers) and quote scientific sources according to international citation standards.

Pre-requisites

Module 1 : Nondestructive testing (NDT)

L1, 2 and 3 courses or equivalent : knowledge of fundamental principles in physics i.e. electricity, electromagnetism, optics, atomic structure and Materials Science.

Module 2 : Metallic alloys for high temperature applications - Creep behaviour

Mechanics of Materials : defects in metallic materials and plastic deformation mechanism ; behaviour of materials.

Module 3 : English

Students must master general English and know how to write and talk about general scientific elements in a rigorous way (1st,2nd, 3rd & 4th year English courses).

Useful info

Place

› Toulouse

Research projects (part 3)



Level
BAC +4



ECTS
4 credits



Component
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Number of
hours
60h

In brief

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

and be able to explain (main concepts :

- the concepts and techniques in relationship with the management of the research project involving several persons.

Presentation

The student will be able to :

- finalize a research project involving several persons,
- integrate scientific approaches and techniques of different scientific domains to meet the realization goals of the research project.

Description

Complete and analyse a realization which is performed during a full semester.

Organization : project

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.

At the end of this module, the student will have understood

Useful info

Contacts

Education manager

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Place

➤ Toulouse

Optional modulus



Level
BAC +4



ECTS
7 credits



Number of
hours
90h

In brief

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

The student will be able to successfully follow 4 optional modules related to mechanical design skills.

Useful info

Presentation

Description

The module is composed of 3 sub-modules of 30h each to be elected by students among a proposed list.

The modules enable students to develop their ability to research work or to increase their knowledge on issues related to mechanical engineering such as :

- production management, maintenance, modeling of flow
- configuration management, special industrialization techniques,
- compressible fluid mechanics, microfluidics, turbomachines, computational fluid dynamics,
- hydraulic systems and components,
- nonlinear FEA, optimal design, multiaxial fatigue, digital mock-up, HSM optimization.

Objectives

Contacts

Education manager

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Human Resources Management and Group Work

 **ECTS**
6 credits

 **Component**
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 **Number of
hours**
75h

Presentation

Place

Objectives

➤ Toulouse

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

Human Resource Management

Aims and organisation of a Human Resources position, job analysis and forecasting, recruiting, work motivation, skills, salary, training, career management, conflict mitigation, work contract

Social Psychology

Groups, what they are, their influences and dynamics

The student will be able to analyse a group situation

Pre-requisites

None

Useful info