

SYSTEM ENGINEERING COURSES

Dependable systems	5 credits	68,5h
Multidisciplinary design	4 credits	44h
Thermal engines and systems	4 credits	57h
Systems on chip	4 credits	50h
Industrialization and logistics	5 credits	60h
Human Resources Management and Group Work	6 credits	75h
Research project and Industrial property	6 credits	56h

Dependable systems



Presentation

Objectives

At the end of this module, the student will have understood and be able to explain the notions associated with the concepts of risk, dependability and quality as well as the tasks of the associated Management process and their implementations. The student will have to perceive the importance of the continuous improvement of the management activities (Management System). The student will be able to identify the hindrances to safety and quality, to evaluate them and to select the adequate methods to handle these issues.

Useful info

Contacts

Education manager

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Place

> Toulouse

Multidisciplinary design



Level
BAC +4



ECTS
4 credits



Component
INSTITUT
NATIONAL
DES SCIENCES
APPLIQUEES
TOULOUSE



Number of
hours
44h

Presentation

Description

Design of Experiment (DoE)

Accounts.- Practical exercices.- Practical work using Explaser, an interactive simulator of industrial process : to solve a multi parameter problem of laser soldering. In a first stage, all calculations are made by hand without any helps of softwares, in order to understand the mechanic of the calculations and the manner of establishing effect graphisms of factors and of their interactions.- Application of the method to the improvement of a catapult : the Statapult.

Surrogate models and sizing of mechatronic systems

The lectures take the forms of videos (moodle SPOC) and interactive quiz.

Program: design drivers, sizing scenarios, surrogate models, estimation models with scaling laws, life time evaluation, profil mission simulation, optimization, sizing procedure definition, numerical solver.

Projects examples: Optimal preliminary design of thrust vector control actuation system (Ariane, Vega), supercapacitor charge

converter (chopper), flight control actuator (spoiler, aileron), last mile delivery electric vehicle...

Objectives

Design of experiments

To know the global concepts of DoE and understand the interest of the tool.

Surrogate models and sizing of mechatronic systems

To explain the process and the different models usefull for the optimal sizing of mechatronic systems.

The student will be able to:

Design of experiments

- To be able to define and set into work some tests allowing to get an optimistic process.

- To carry out one's own design of experiments.

Surrogate models and sizing of mechatronic systems

- To define the sizing scenarios of a technical system

- To establish the estimation models and simulation modes of the set of components
- To set a design procedure and to define the optimization problem
- To Implement the calculations in a numerical environment

Pre-requisites

Probability (basic), statistics (basic), notions of system architecture (mechanical, hydraulic, electric, etc.)

Useful info

Contacts

Education manager

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Place

➤ Toulouse

Thermal engines and systems

 **ECTS**
4 credits

 **Component**
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TOULOUSE

 **Number of
hours**
57h

Presentation

components of a thermal system, in the framework of a project done by groups of 2 students.

Description

Thermal engines : First, a reminder of the principles of thermodynamics, fluid modeling, thermodynamic transformations (isobar, isenthalp, adiabatic, etc.).

Secondly, analysis of the thermodynamic cycles of steam engines, gas turbines and heat pumps.

Thermal systems : Lumped parameter modeling of components involved in thermal engines and systems such as heat exchangers, compressors, turbines, valves. Case study on an air conditioning and pressurization system for an aircraft.

Computational fluid mechanics : Initiation to the CFD code Fluent. Numerical simulation of one of the

Objectives

At the end of this module, the student should have understood and be able to analyze thermal and mechanical energy production systems and their associated components.

The student should be able to:

- Analyze the thermodynamic cycle associated with a power plant.
- Size a thermal engine to meet specifications in terms of requested power.
- Specify the components of a thermal engine or system.
- Calculate the air conditioning flow requirements to

perform various functions (pressurization, fresh air renewal, heating, cooling) in an aircraft and adjust the recirculation and the flow distribution between the different cabin zones.



Pre-requisites

Basics of thermodynamics and heat transfer.

Useful info

Contacts

Education manager

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Place

➤ Toulouse

Systems on chip

 **ECTS**
4 credits **Component**
INSTITUT
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TOULOUSE **Number of
hours**
50h

Presentation

Place

Objectives

➤ Toulouse

At the end of this module, the student will have understood and be able to explain (main concepts):-the design and optimisation of advanced digital systems-the life cycle of a software-hardware system (specifications, design, implementation)-co-design of software hardware complex systems upon the application requests-co-verification of new software & hardware complex systemsThe student will be able to:-design and implement advanced digital systems on FPGA using VHDL and optimise their performances in power consumption and functioning frequency upon the application requests-design and implement hardware and software systems on programmable chips (SoPC) and systems on chip (SoC)

Pre-requisites

Computer engineering

Exigencies engineering

Useful info

Industrialization and logistics



Level
BAC +4



ECTS
5 credits



Component
INSTITUT
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Number of
hours
60h

Presentation

Description

Industrialization :

Through two types of industrialization : The automotive and aerospace ; we detail :

- The different types of production management organizations
- Industrial measures implemented
- Piloting of industrialization : PLM , ERP, PDM , MES, lean management
- Design and simulation of the system of industrialization
- Introduction to CAD and CAM Catia V5

Labwork of optimization of production and organization and production management

Visits to factories and conference on lean management

Organization : 5 hours of lectures, 10.25h of Tutorials , 8h of Labwork, 3h conference, examen: 1.25 MCT

Production management, planning, scheduling :

Production management and logistics

linear programming applied to planning

Graphs and scheduling application

Scheduling and combinatorial optimization

Production Planning

Labwork : Introduction to AMPL and Excel

Organization : 12.5 hours of lectures, 2.5h of Tutorials , 2.5h of Labwork, examen: 1.25h

Configuration Management :

1 – Airbus world (Aircraft families, industrial roles accros Europe, all different maturity steps of a program)

2 – Configuration management generalities (first look and presentation of modules that will be detailed afterwards)

3 – Product structure (What is product structure, how it is built and what are the main rules)

4 – The change process (all different steps of a change request during the full process, data and deliverables required pending on progress in the process)

5 – Offer management (what is offer management and what are the associated deliverables)

6 – Attestation and control of conformity (Delta managements)

Organization: 6 x 2h30 of course + 2 x 2h30 of labwork + 2h of exam

- Identify mechanisms that enable management of product offer and its customisation

- Demonstrate that final product manufactured is conform to expectations

Objectives

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

The organization , management and control of a system of industrialization

The challenges of production management (PM) and supply chain (SCM) as well as issues of scheduling

What is configuration management, what are the enablers and what is the purpose

The student will be able to :

- Define the industrial means used and the type of production management organization associated with the system of industrialization
- Define the tools to control it : PLM , ERP, PDM , MES, the lean management
- Use tools for design and simulation of industrialization : CAD and CAM CATIA
- Use of models, methods and tools GP , SCM, and scheduling
- Roughly describe airbus world (A/Cs family, industrial sharing across the Europe)
- Define a hierarchical & appropriated breakdown of a complex product
- Apply the change process and identify required data to allow decision

Pre-requisites

Reading of plans, current metallic materials, various types of machining.

Basic elements on : probabilities – Linear programming.

Useful info

Contacts

Education manager

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Place

➤ Toulouse

Human Resources Management and Group Work

 ECTS
6 credits

 Component
INSTITUT
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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

Research project and Industrial property

 **ECTS**
6 credits **Number of hours**
56h

Presentation

Objectives

Industrial Property

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

Major differences between intellectual and industrial properties. He must be able to initiate protections by himself by addressing the right people with regard to his inventive activity and his need for protection. He will have to know the costs and limitations.

The student must be able to :

- describe the different types of protections available
- define the legal framework of each protection and the modalities of application
- understand the different protection strategies associated with patents, disclosure or secrecy
- to know and virtually identify the corporate strategies associated with the defense and exploitation of industrial property : "Patent Pool" strategy. Know how to explain the advantages and disadvantages of each strategy
- know the major protection organizations, their respective roles in order to make good decisions about their protection needs
- know how to initiate the steps to protect an invention, a brand, a drawing, a model, a domain name, a book, a musical

composition, a computer program, or any other discovery. Know the time, costs, temporal and geographical limitations.

Useful info

Contacts

Education manager

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