SCIENCES, TECHNOLOGIES, HEALTH

MECHANICAL ENGINEERING

Niveau d'étude visé
BAC +5

Durée
2 année(s)

Composante
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

plugin.odf:Domaine régional
Génie mécanique

Présentation

Objectifs

The Mechanical Engineering programme highlights the complementarity of sciences and technologies. It has been built on several conceptual studies ending with today's industrial projects. It is renowned for its open minded character and industrial realism, enabling the engineer:

-to manage and lead development projects (overall design or detailed design)

-to treat system problems (manufacturing, production, integration and testing).

Through a global understanding of the complete process and industrial constraints (from requirements to operations), the engineer is able to work with mechanical systems, equipments, components or piece parts. His generalist profile allows him to adapt to any industrial area.

During his training, he will gain in-depth learning in one of the following subjects:

-Computer assisted design to develop structures and power transmission systems using design software.

-Design of energy transfer systems for the generation, transmission and conversion of energy.

-Design and engineering for project management in the industrialization of mechanical systems.

Et après

Conditions d'accès

Diplôme d'ingénieur habilité par la commission des titres d'ingénieur, 5 années d'études après la fin des études secondaires, confère le grade de Master.

Baccalauréat ou équivalent pour une admission en première année

Admission sur titre possible en année 2, 3 ou 4.

Admission

A tous les niveaux, l'admission aux INSA s'effectue par concours sur titres, dossier et éventuellement entretien ; le dossier rassemble des éléments d'évaluation obtenus par ailleurs par le candidat.

Et après

Poursuite d'études

Le diplôme d'ingénieur confère le grade de Master et permet donc la poursuite d'étude en thèse.

À l'issue de leur formation, les ingénieurs peuvent également candidater à un Mastère de spécialisation des grandes écoles (Institut Français Supérieur du Pétrole et des Moteurs, ISAE, ENSEEIHT).

Insertion professionnelle

La formation de généraliste en Ingénierie Mécanique et en Ingénierie Systèmes s'appuie sur des solides compétences techniques et méthodologiques.

En conséquence, elle offre, même pour les débutants, une grande diversité de débouchés sectoriels (aéronautique, espace, automobile, production de l'énergie etc.), dans des secteurs d'activité très variés tels que l'architecture des systèmes, les domaines des études, des essais ou de la production.

De nombreuses opportunités sont offertes dans le secteur aéronautique et spatial, dans le domaine des transports terrestres ou les domaines de la production d'énergie.

Infos pratiques

Lieu(x)

Toulouse

Programme

FOURTH YEAR INSA TOULOUSE

Autumn semester

MECHANICAL ENGINEERING COURSES

Design of structures	7 crédits	79h
Manufacturing	6 crédits	64h
Mechanical power transmission	9 crédits	133h
Improving autonomy and building a professional project	4 crédits	39h
Improve your management abilities	4 crédits	45h

SYSTEM ENGINEERING COURSES

Control Systems	4 crédits	39,25h
Power systems and instrumentation	7 crédits	85,5h
Multiphysic modeling	6 crédits	72,75h
Improving autonomy and building a professional project	4 crédits	39h
Modelling and Optimization	5 crédits	60h
Improve your management abilities	4 crédits	45h

Spring semester

MECHANICAL ENGINEERING COURSES

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

SYSTEM ENGINEERING COURSES

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

FIFTH YEAR INSA TOULOUSE

Autumn semester

MECHANICAL ENGINEERING COURSES

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

SYSTEM ENGINEERING COURSES

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

Spring semester

Training period (5th year)	21 crédits	2h
Training period (4th year)	9 crédits	1h

Design of structures

Niveau d'étude
BAC +3

ECTS
7 crédits

Composante
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

Volume horaire
79h

En bref

Langue(s) d'enseignement: Français, Anglais

Présentation

Description

Program (detailed contents):

Finite element module :

The student learns various phases of a finite element analysis using a modern software: geometrical modeling of structures, meshing, applying the boundary conditions, solving, postprocessing and analyzing the results from a critical point of view. Student gets to know various features built-in the software related to: meshing technique working firstly on the single part and later on part assembly, using specific finite elements and particular algorithms devoted to linear and nonlinear problems (contact, plasticity), error estimation...

Course is divided into two parts. The first part considers training (with significant help of the teacher) oriented towards understanding and familiarizing with the user interface of the software and the capabilities of the computer code. This computer code serves as a tool to support the training and test the concepts known from the previous courses such as Finite elements, Continuum mechanics and Resistance of materials. During the second part, the student must conduct the analysis of a real-life problem, with a partial autonomy, in the form of a project.

Reliability and Design of experiments module :

The contents are divided in two parts. The first part presents the role and objective of RAMS (Reliability, Avaibility, Maintainability, Safety) analysis. The design of experiments part presents the Taguchy method.

Mechanics of vibrations module :

Firstly the teaching focuses on discrete models with localized parameters (mass-spring model). The analysis and understanding of the basic one-degree-of-freedom oscillator is followed by an extension to multi-degree-of-freedom models. Time domain resolution by direct resolution of differential equations or frequency domain resolution by use of Frequency Response Functions are discussed in the different cases. A second part of the teaching focuses on the vibrations of continuous models (beams, plates, etc.).

Bibliographic work module :

Initiation to bibliographic search tools. Awareness to the concept of "industrial property".

Organization:

Finite element module :

9 seances of 3h, 5x3h of mixed lecture and practical work, 4x3h project

Reliability:

Design of experiments:

4h of lectures, 4 tutorials and 1 labwork of 4h.

Mechanics of vibrations module :

10x1,25h Lecture + 9x1,25h practical

Objectifs

Finite element module :

* Perform finite element analysis using a commercial finite element code (Abaqus for example) following the presented principles and good practice.
* Identify the features offered by these numerical tools and the associated potentialities.
* Create relevant models related to the target objectives.
* Analyse and postprocess the obtained results.
* Analyze the impact of the modeling assumptions.
* Assess the risks inherent to the wrong interpretation of the results.

Reliability and Design of experiments module :

* Apply to practical case analyses the basics of reliability
* Build a design of experiments for the modeling of a physical system from numerical or experimental data.

Mechanics of vibrations module :

* Develop a linear dynamic model of a mechanical structure: a lumped parameters model for a discrete elements structure, or a distributed parameters model for a continuous structure.
* Determine the vibrations of these structures undergoing transient or permanent excitation.

Bibliographic work module :

* Carry out a literature review and establish a state of the art on a research topic that will be developed in I4GMPJ81 formation unit.

This state of the art will present :

* past history (previous studies, de facto situation, necessity of research)
* the main results of these past studies
* The elements that could guide future work in UF I4GMPJ81.

Pré-requis nécessaires

Finite element module :

Computer aided design (CAD)

Finite element concepts.

Mechanics of vibrations module :

Basics in solid mechanics, strength of material, dynamic systems.

Infos pratiques

Contacts

Education manager
EDUARD MARENIC

Lieu(x)

Toulouse

Manufacturing

Niveau d'étude
BAC +3

ECTS
6 crédits

Composante
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

Volume horaire
64h

Présentation

Description

Theory of cutting

Cutting tools

Optimization of cutting conditions

High speed machining

Chatter

Shaping of plastics and composites

Production management : Types of manufacturing, inventory management, lean manufacturing and associated tools.

Casting : Presentation of the processes of shaping of crudes / mechanical parts by plastic deformation, with technologies and associated calculations. The processes discussed are mainly forging, stamping, folding and stamping.

Presentation of Additive Manufacturing processes and intervention of specialized industrialists.

Method of implementing a 3D printing process.

Organization:

The teaching sessions are divided down into Courses, Lectures and Practical work.

6 x 1h15 of course in HSM + 6 x 1h15 of lectures

3 x 1h15 of course in Production Management course + 3 x 1h15 of lectures

2 x 1h15 of course in plastic deformation course + 4 x 1h15 of lectures

4 x 1h15 of course in casting course + 3 x 2h5 of lectures

5 x 1h15 of course in Additive Manufacturing +3 x 1h15 of lectures

3h of practical work on the implementation of means of Additive Manufacturing

9h of practical work on plastic injection, cutting forces and HSM

Objectifs

The student will be able to :

- Define the influencing parameter on cutting material,

optimize a machining operation in HSM.

- Define a Production Management Approach.

- Design parts by casting.

- Define the advantages and limitations of additive manufacturing processes.

- Design and produce plastic parts using an additive manufacturing process.

- Know the different ways to get rough part and their costs and performance, define a range of rough part and design the necessary tools.

Pré-requis nécessaires

CAM manufacturing technology

Tolerance Manufacturing analysis

Mechanical characteristics of materials

Resistance of materials : elasticity

Digital production chain : CAD, CAM, Post-processing, use of means of production, control

Contrôle des connaissances

Written exam in the different subjects.

Infos pratiques

Contacts

Education manager
SEBASTIEN SEGUY
seguy@insa-toulouse.fr

Lieu(x)

Toulouse

Mechanical power transmission

Niveau d'étude
BAC +3

ECTS
9 crédits

Composante
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

Volume horaire
133h

Présentation

Description

Part I - CAD

- best use of CAD software (organising the data; top-bottom modeling via skeletons)

- practice with 3DX

Part II - Gears

- planetary gears

- detailed geometry of involute gears

- gear sizing using ISO6336

Part III - Project work

Groups of 2 or 3 students

Using the following specifications:

. use context, geometrical constraints

. input and output data

. expected service life

Each team has to produce:

. a thorough sizing synthesis document (gears, bearings, shafts, clampings)

. a drawing of the mechanism

. a CAD model of the mechanism

Objectifs

At the end of this module, the student will be able to analyse technical requirements related to the design of a gear reducer, create a design with the associated sizing calculations, present their solution by means of both a draft and a CAD model.

Pré-requis nécessaires

Fundamentals of mechanical design:

- basics of manufacturing (welding, machining)

- common clamping technology (key, splines, screws, etc.)

- pivot joints (rolling bearings joint design and sizing)

- basics of technical drawing

- calculating forces in a mechanical system (equilibrium laws)

- calculating stresses (torsion and bending of beams)

Infos pratiques

Contacts

Education manager

DIMITRI LERAY

61639667

leray@insa-toulouse.fr

Lieu(x)

Toulouse

Improving autonomy and building a professional project

ECTS
4 crédits

Composante
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

Volume horaire
39h

Présentation

Objectifs

Construire une équipe projet, Approfondir ses connaissances,

Investir le métier, les domaines d'activité, les fonctions.

L'étudiant devra être capable de :

- d'analyser avec les autres un problème posé (Identifier le problème, définir les axes d'approche dans un bilan interactif : organisation, physique, technique, stratégique, motivation, confiance...

- de décider ensemble (permettre à tout le monde d'exprimer son avis, ajuster et réguler sa conduite en fonction de l'analyse collective),

- d'identifier les ressources du groupe (sens critique, repérage des points forts et faibles de chacun).

Lieu(x)

Toulouse

Infos pratiques

Improve your management abilities

ECTS
4 crédits

Volume horaire
45h

Présentation

Objectifs

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

* The basic rules of business law

* The objectives, principles and means of marketing

* The principles and procedures of financial diagnosis and/or investment.

The student will be able to apply principles and rules of management and law in simple situations. Take into account the parameters of the management (customer needs, cost effectiveness an legal compliance).

Infos pratiques

Contacts

Education manager
LUCIE LECLERT
+33.(0)562266003
leclert@insa-toulouse.fr

Control Systems

ECTS
4 crédits

Composante
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

Volume horaire
39,25h

Présentation

Objectifs

Introduction to basic concepts of analysis and design of continuous-time feedback systems.

Introduction to SIL (Software in the loop) and HIL (Hardware in the loop).

Infos pratiques

Contacts

Education manager
GWENDOLINE LE CORRE
lecorre@insa-toulouse.fr

Lieu(x)

Toulouse

Power systems and instrumentation

ECTS
7 crédits

Composante
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

Volume horaire
85,5h

Présentation

Objectifs

To be able to identify standard power transmission architectures. To be able to generate

or to analyse architectures of power systems

To acquire a global knowledge in the technology for power transmission (mechanical,

hydraulic, electrical and thermal). To able to characterise them with respect to

performance, advantages and drawbacks.

Acquire knowledge in measurement and computer-controlled data acquisition:

-selection and design of the components involved in an acquisition circuit

- use a graphical programming language dedicated to data acquisition (Labview).

Pré-requis nécessaires

1D multiphysics

Electro-kinetics. Algorithms and textual language programming (C, ADA)

Infos pratiques

Lieu(x)

Toulouse

Multiphysic modeling

ECTS
6 crédits

Composante
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

Volume horaire
72,75h

Présentation

Objectifs

To design and analyse high-level models of multidomain energy-transfer

systems or mechatronic systems.

Formalisation of physics concepts from previous years as lumped-parameter

modelling (0D-1D) in electrical, magnetic, hydraulic, thermal and

mechanical systems. Lectures, tutorial, lab-work with Modelica or Amesim.

Implementation and analysis of multiphysics systems with block diagrams and

state-space simulation models. Several modelling problems using lumped

parameter systems: setting to equations in various domains, simulation using

simulink, time and frequency analysis. Lectures, tutorials, lab-with Matlab /

Simulink or Amesim.

Defining and designing models using the bond-graph formalism.

Lectures and modelling project

Pré-requis nécessaires

General physics (mechanics, electricity, fluid mechanics, thermodynamics).

Infos pratiques

Lieu(x)

› Toulouse

Modelling and Optimization

ECTS
5 crédits

Volume horaire
60h

Présentation

Objectifs

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

- Various approaches to analyze and evaluate the performances of discrete event system DES

- Various types of modelling adapted to the problems considered (deterministic of stochastic models, numerical and combinatorics optimization models, models of concurrency)

-Algorithms available to solve these problems.

The student will be able to :

- Model and solve operational research problems (optimization, linear programming, graphs, stochastic process) and discrete event systems problems

- Model stochastic systems, such as a network of queues, using Markov chains. Comptute their stationary performance measures, and dimension its capacity

- Model a DES by Petri net, analyse the properties of the Petri net by various methods of analysis (exhaustive and structural).

Infos pratiques

Contacts

Education manager
FRANCOIS VERNADAT
+33.(0)561336265
vernadat@insa-toulouse.fr

Improve your management abilities

ECTS
4 crédits

Volume horaire
45h

Présentation

Objectifs

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

* The basic rules of business law

* The objectives, principles and means of marketing

* The principles and procedures of financial diagnosis and/or investment.

The student will be able to apply principles and rules of management and law in simple situations. Take into account the parameters of the management (customer needs, cost effectiveness and legal compliance).

Infos pratiques

Contacts

Education manager
LUCIE LECLERT
+33.(0)562266003
leclert@insa-toulouse.fr

Advanced heat transferts and fluid flow

Niveau d'étude
BAC +3

ECTS
5 crédits

Composante
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

Volume horaire
65h

En bref

Langue(s) d'enseignement: Français, Anglais

Présentation

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.

Objectifs

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.

Pré-requis nécessaires

Inviscid fluid dynamics (I3ICFT01 – Fluid Mechanics 1)

Introduction to heat transfer (I3ICFT01 – Heat Transfer 1)

Infos pratiques

Lieu(x)

Toulouse

Advanced mechanical modelling

Niveau d'étude
BAC +3

ECTS
7 crédits

Composante
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

Volume horaire
99h

Présentation

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.

Objectifs

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.

Infos pratiques

Contacts

Education manager
ALAIN DAIDIE
61+33.(0)83101
daidie@insa-toulouse.fr

Lieu(x)

Toulouse

Multidisciplinary industrial project

Niveau d'étude
BAC +3

ECTS
6 crédits

Composante
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

Volume horaire
86h

Présentation

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.

Objectifs

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.

Pré-requis nécessaires

Bachelor in mechanical design

Infos pratiques

Contacts

Education manager
MANUEL PAREDES
+33.(0)561248591
paredes@insa-toulouse.fr

Lieu(x)

Toulouse

Research projects and Sports

Niveau d'étude
BAC +3

ECTS
6 crédits

Composante
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

Volume horaire
37h

Présentation

Description

The first semester if the 4th year (semester 7) deals with the bibliographical search. It is managed by the library staff.

The second semester of the 4th year (semester 8) addresses the scientific communication and is used to generation 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 5th 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.

Objectifs

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 of 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.

Infos pratiques

Contacts

Education manager
JEAN-CHARLES MARE
618126+33.(0)8
mare@insa-toulouse.fr

Lieu(x)

Toulouse

Communicating with in organizations

ECTS
6 crédits

Volume horaire
75h

Présentation

Objectifs

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 therm.

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.

Pré-requis nécessaires

For classes in English : mastery of general English

Infos pratiques

Contacts

Education manager
BEATRICE JALENQUES-VIGOUROUX
jalenque@insa-toulouse.fr

Tutored projects

ECTS
4 crédits

Composante
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

Volume horaire
60h

Présentation

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 witting 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.

Objectifs

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.

Pré-requis nécessaires

Depends of the subject of the project.

Infos pratiques

Contacts

Education manager

PATRICK ESQUIROL

+33.(0)561205914

esquirol@insa-toulouse.fr

Lieu(x)

Toulouse

Systems Engineering processes

ECTS
5 crédits

Composante
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

Volume horaire
76h

Présentation

Objectifs

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.

Infos pratiques

Lieu(x)

> Toulouse

Dynamics of structures and control

ECTS
4 crédits

Composante
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

Volume horaire
54h

Présentation

Objectifs

Vibrations of mechanical systems and structures.

Controlling the articulated systems and flexible structures.

The global and local modelling of electromagnetic actuators.

Pré-requis nécessaires

Basis in electromagnetism, solid mechanics and control

Lieu(x)

Toulouse

Infos pratiques

Contacts

Education manager
SEBASTIEN SEGUY
seguy@insa-toulouse.fr

Object oriented and real time programming

ECTS
3 crédits

Volume horaire
55h

Présentation

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.

Objectifs

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.

Infos pratiques

Contacts

Education manager
PIERRE-EMMANUEL HLADIK
pehladik@insa-toulouse.fr

Mechatronic project

ECTS
4 crédits

Volume horaire
60h

Présentation

Objectifs

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 lifeclycle analysis with a dedicated software

Infos pratiques

Contacts

Education manager
ION HAZYUK
hazyuk@insa-toulouse.fr

QSE and Sport

ECTS
4 crédits

Volume horaire
48,75h

Infos pratiques

Contacts

Education manager
MANUEL PAREDES
+33.(0)561248591
paredes@insa-toulouse.fr

Communication with in organizations

ECTS
6 crédits

En bref

Effectif: 75

Présentation

Objectifs

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 therm.

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.

Pré-requis nécessaires

For classes in English : mastery of general English

Infos pratiques

Contacts

Education manager
BEATRICE JALENQUES-VIGOUROUX
jalenque@insa-toulouse.fr

System level modelling and simulation

Niveau d'étude
BAC +4

ECTS
3 crédits

Composante
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

Volume horaire
30h

Présentation

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 muti-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.

Objectifs

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

Pré-requis nécessaires

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

Infos pratiques

Lieu(x)

› Toulouse

Composite structures and case study

Niveau d'étude
BAC +4

ECTS
3 crédits

Composante
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

Volume horaire
46h

Présentation

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.

Objectifs

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.

The student will be able to:

* Choice a couple of fibers and matrix and their commercial products.
* Choice a type of composite structure: laminates, sandwichs, 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.

Pré-requis nécessaires

- Beam theory, Continuum mechanics, Materials behaviors.

- Matrix calculation.

Infos pratiques

Lieu(x)

Toulouse

Heat Engines, Refrigerators and Heat Pumps

Niveau d'étude
BAC +4

ECTS
3 crédits

Composante
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

Volume horaire
38h

Présentation

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.

Objectifs

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.

Pré-requis nécessaires

Fundamentals in thermodynamics (1st year)

Thermodynamics and Thermodynamic Analysis (1st year)

Infos pratiques

Lieu(x)

› Toulouse

Non destructive testing/English

Niveau d'étude
BAC +4

ECTS
4 crédits

Composante
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

Volume horaire
55h

En bref

Langue(s) d'enseignement: Français, Anglais

Présentation

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.

Objectifs

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.

Pré-requis nécessaires

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).

Infos pratiques

Lieu(x)

› Toulouse

Research projects (part 3)

Niveau d'étude
BAC +4

ECTS
4 crédits

Composante
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

Volume horaire
60h

En bref

Langue(s) d'enseignement: Français, Anglais

Présentation

Description

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

Organization : project

Objectifs

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 and be able to explain (main concepts :

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

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.

Infos pratiques

Contacts

Education manager
JEAN-CHARLES MARE
618126+33.(0)8
mare@insa-toulouse.fr

Lieu(x)

Toulouse

Optional modulus

Niveau d'étude
BAC +4

ECTS
7 crédits

Volume horaire
90h

En bref

Langue(s) d'enseignement: Français, Anglais

Présentation

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.

Objectifs

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

Infos pratiques

Contacts

Education manager
MANUEL PAREDES
+33.(0)561248591
paredes@insa-toulouse.fr

Human Resources Management and Group Work

ECTS
6 crédits

Composante
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

Volume horaire
75h

Présentation

Objectifs

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

Pré-requis nécessaires

None

Lieu(x)

Toulouse

Infos pratiques

Dependable systems

ECTS
5 crédits

Composante
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

Volume horaire
68,5h

Présentation

Objectifs

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.

Infos pratiques

Contacts

Education manager

CLAUDE BARON
+33.(0)562471327
baron@insa-toulouse.fr

Lieu(x)

Toulouse

Multidisciplinary design

Niveau d'étude
BAC +4

ECTS
4 crédits

Composante
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

Volume horaire
44h

Présentation

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...

Objectifs

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

Pré-requis nécessaires

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

Infos pratiques

Contacts

Education manager
MARC BUDINGER
mbudinge@insa-toulouse.fr

Lieu(x)

Toulouse

Thermal engines and systems

ECTS
4 crédits

Composante
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

Volume horaire
57h

Présentation

Description

Thermal engines : First, a reminder of the principles of thermodynamics, fluid modeling, thermodynamic transformations (isobar, isoenthalp, 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 components of a thermal system, in the framework of a project done by groups of 2 students.

Objectifs

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.

Pré-requis nécessaires

Basics of thermodynamics and heat transfer.

Infos pratiques

Contacts

Education manager
ION HAZYUK
hazyuk@insa-toulouse.fr

Lieu(x)

Toulouse

Systems on chip

ECTS
4 crédits

Composante
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

Volume horaire
50h

Présentation

Objectifs

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)

Pré-requis nécessaires

Computer engineering

Exigencies engineering

Lieu(x)

Toulouse

Infos pratiques

Industrialization and logistics

Niveau d'étude
BAC +4

ECTS
5 crédits

Composante
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

Volume horaire
60h

Présentation

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 requiered 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

Objectifs

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
- Identify mechanisms that enable management of product offer and its customisation
- Demonstrate that final product manufactured is conform to expectations

Pré-requis nécessaires

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

Basic elements on : probabilities – Linear programming.

Infos pratiques

Contacts

Education manager
Anna Carla Araujo
araujo@insa-toulouse.fr

Lieu(x)

Toulouse

Research project and Industrial property

ECTS
6 crédits

Volume horaire
56h

Présentation

Objectifs

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.

Infos pratiques

Contacts

Education manager

XAVIER HEBRAS

hebras@insa-toulouse.fr

Training period (5th year)

ECTS
21 crédits

Composante
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

Volume horaire
2h

En bref

Langue(s) d'enseignement: Français, Anglais

Infos pratiques

Lieu(x)

Toulouse

Training period (4th year)

ECTS
9 crédits

Composante
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

Volume horaire
1h

En bref

Langue(s) d'enseignement: Français, Anglais

Infos pratiques

Lieu(x)

Toulouse