

SHAKE THE FUTURE.



MASTER OF SCIENCE, TECHNOLOGY AND HEALTH

MECHANICAL ENGINEERING

ADVANCED MANUFACTURING

YEAR 1

PROGRAMME SUPERVISORS:
CHRISTIAN BURTIN, SEBASTIEN COMAS-CARDONA

MECHANICAL ENGINEERING - ADVANCED MANUFACTURING
YEAR 1 - AUTUMN SEMESTER

Numerical Methods

Fluid Mechanics 1

Vibrations and Differential Equations

Continuum Mechanics

Algorithmics for Engineering Modeling

Business Environment

Cultural and Communication English

French Language

NUMERICAL METHODS

MECHANICAL ENGINEERING - ADVANCED MANUFACTURING

YEAR 1 - AUTUMN SEMESTER

LEAD PROFESSOR: Grégory LEGRAIN

Objectives

At the end of the course (30 hours + personal work) the students will be able to:

- Classify standard PDEs (elliptic, parabolic, hyperbolic)
- Solve simple elliptic problems by means of finite differences or finite elements
- Solve simple parabolic problems, and assess their stability
- Assess the accuracy of the schemes they use
- Program finite differences and finite elements in both 1D and 2D

Course contents

These lectures aim to present classical numerical methods, their features and limitations.

- Classification of PDEs
- Classification of boundary conditions, well-posedness
- Introduction to finite differences
- Introduction to finite elements
- Parabolic problems

Homework and lab sessions will provide an understanding of the programming and main features of the methods.

Course material

- The Finite Element Method: Linear Static and Dynamic Finite Element Analysis. T.J.R. Hughes
- Numerical Methods for Engineers and Scientists. J.D. Hoffman and S. Frankel

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LABO | PROJECT | EXAM |
|-------------------------|--------------|----------|-----------|--------|---------|-------|
| English | 4 | 14 hrs | 6 hrs | 10 hrs | 0 hrs | 2 hrs |

FLUID MECHANICS 1

MECHANICAL ENGINEERING - ADVANCED MANUFACTURING
YEAR 1- AUTUMN SEMESTER

LEAD PROFESSOR: Guillaume DUCROZET

Objectives

At the end of the course (30 hours + personal work) the students will be able to:

- Describe the main physical properties of a fluid.
- Identify the specificities of fluid mechanics in the continuum mechanics framework (i.e. compared to solid mechanics).
- Identify the non-dimensional numbers at play in any fluid mechanics problem and deduce how to perform experiments with appropriate similarity.
- Understand the notion of stresses and its representation through stress tensor.
- Describe the physical meaning of each term in the Navier-Stokes' equations
- Identify the different flow regimes.
- Evaluate the generalized force applied on any object in still water.
- Understand when the perfect fluid assumption is valid.

Course contents

This course aims to present the foundations and general principles of fluid mechanics. The lectures cover the following topics:

- Physics of fluids
- Dimensional analysis
- Stress tensors and fluids
- Navier Stokes' equations
- Flow regimes: introduction to turbulence
- Fluid statics
- Bernoulli's equation for a perfect fluid

In addition to those lectures, tutorials and lab sessions will allow the students to apply the theoretical knowledge to practical configurations.

Course material

- F. White, Fluid mechanics, McGraw-Hill, New York.
- B.R. Munson et al., Fundamentals of fluid mechanics, John Wiley, New York.

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LABO | PROJECT | EXAM |
|-------------------------|--------------|----------|-----------|-------|---------|-------|
| English | 5 | 14 hrs | 12 hrs | 4 hrs | 0 hrs | 2 hrs |

VIBRATIONS AND DIFFERENTIAL EQUATIONS

MECHANICAL ENGINEERING - ADVANCED MANUFACTURING

YEAR 1 - AUTUMN SEMESTER

LEAD PROFESSOR: Panagiotis KOTRONIS

Objectives

At the end of the course (30 hours + personal work) the students will be able to:

- Derive the dynamic equilibrium equation using variational principles
- Calculate the stiffness and mass matrices of discrete systems using the Lagrange equations
- Study linear vibrations about an equilibrium position
- Calculate the eigenmodes of discrete and continuum systems
- Apply the modal superposition technique
- Apply the Rayleigh-Ritz method

Course contents

These lectures aim at presenting the main aspects of the non-linear behaviour of steel, of concrete and of civil engineering structures. The main items of these lectures are:

- Discrete and continuum systems
- Hamilton principle
- Lagrange equations
- Linear vibrations about an equilibrium position
- Eigenmodal analysis
- Modal superposition technique
- Rayleigh-Ritz method

Course material

- M. Geradin and D. Rixen. Mechanical vibrations (second edition). Theory and application to structural dynamics. John Wiley and Sons Ltd, 1997.
- K. Chopra. Dynamics of Structures. Theory and Applications to Earthquake Engineering (second edition).

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LABO | PROJECT | EXAM |
|-------------------------|--------------|----------|-----------|-------|---------|-------|
| English | 4 | 16 hrs | 14 hrs | 0 hrs | 0 hrs | 2 hrs |

CONTINUUM MECHANICS

MECHANICAL ENGINEERING - ADVANCED MANUFACTURING

YEAR 1 - AUTUMN SEMESTER

LEAD PROFESSOR: Thomas HEUZE

Objectives

At the end of the course (30 hours + personal work), the students will:

- understand strain and stress notions, and be able write their mathematical representation correctly.
- know that there are different kinds of equations with different purposes (balance equations, constitutive equations, boundary conditions).
- Be able to define the problem of the equilibrium of a deformable elastic solid body in infinitesimal strain by writing a Boundary Value Problem (BVP), and to choose the right set of boundary conditions.
- know the different possible approaches available to solve that BVP, and be able to solve it.

Course contents

This course is an introduction to continuum mechanics, and more generally to modelling in mechanics. The basic concepts required for more advanced fluid and solid mechanics courses are introduced here. The course then focuses on the study of the equilibrium of deformable solid bodies in linear elasticity and infinitesimal strain. This provides some basic tools required for engineers to design mechanical systems.

After some necessary lectures, the course is built on alternating the introduction of fundamental concepts and training examples, each lasting approximately 2 hours.

The course outline is as follows:

- Mathematics for continuum mechanics
- Introduction
- Kinematics
- Stresses
- Equations of conservation
- Constitutive equations
- Equations of linear elasticity in infinitesimal strain

Course material

- Introduction to Continuum Mechanics, W. Michael Lai, David Rubin and Erhard Krempf, Elsevier, 2010.
- Continuum Mechanics, A.J.M. Spencer, Dover Publications, 2004.
- Mécanique des Milieux Continus et discrets, Handbook of N. Moës, 2011,
- Mécanique, P. Germain, 1985, Ecole Polytechnique, volumes 1 & 2.

- Introduction to the mechanics of a continuous medium, L.E. Malvern, Prentice-Hall, 1969.
- An introduction to continuum mechanics, M.E. Gurtin, Academic Press, 1981.

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LABO | PROJECT | EXAM |
|-------------------------|--------------|----------|-----------|-------|---------|-------|
| English | 5 | 16 hrs | 14 hrs | 0 hrs | 0 hrs | 2 hrs |

ALGORITHMICS FOR ENGINEERING MODELING

MECHANICAL ENGINEERING - ADVANCED MANUFACTURING

YEAR 1 - AUTUMN SEMESTER

LEAD PROFESSOR: Jose-Vicente AGUADO / Domenico BORZACCHIELLO

Objectives

At the end of the course the students will be able to:

- Identify and properly apply numerical methods to different engineering problems
- Understand algorithmic aspects and handle practical implementation issues
- Program and optimize algorithms in Matlab/Octave
- Use standard libraries for scientific computing in Matlab/Octave

Course contents

The course proposes a gentle introduction to numerical methods in scientific computing and their respective algorithms through practical problems that are often encountered in engineering applications. It will cover five fundamental topics : interpolation and differentiation, numerical quadrature, time-stepping integration techniques for ordinary differential equations, iterative solvers and nonlinear solvers.

Each topic will be presented through a practical application, that will serve as a basis to review implementation aspects as well as theoretical principles of the numerical methods involved. Several exercises in Matlab/Octave are proposed.

Course material

- Slides and Course Notes

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LABO | PROJECT | EXAM |
|-------------------------|--------------|----------|-----------|-------|---------|-------|
| English | 4 | 10 hrs | 20 hrs | 0 hrs | 0 hrs | 2 hrs |

BUSINESS ENVIRONMENT

MECHANICAL ENGINEERING - ADVANCED MANUFACTURING

YEAR 1 - AUTUMN SEMESTER

LEAD PROFESSOR: Spencer HAWKRIDGE

Objectives

- Understand the general concepts of business English and marketing principles
- Understand the principles of given business models (for example: the collaborative economy)
- Build a professional project and explore international opportunities
- Develop strategies for inter-cultural practice
- Organize, lead and participate in discussions, interviews and meetings
- Strengthen self-confidence and level of conviction
- Develop active listening and understanding to reformulate, explain and argue
- Acquire notions of corporate culture and values
- Develop well-being at work and a sense of responsibility
- Enhance team work

Course contents

Business Environment: exercises to explore in practice the areas of business and marketing

Field-related or inter-cultural project:

- Field-based radio project: prepare, conduct and promote interviews for ECN's radio programme: L'Heure Centralienne (<http://www.euradionantes.eu/emission/l-heure-centralienne>), with the contribution of professors, doctorate students, industrial partners, industry players at fairs, etc.
- Inter-cultural project: construct a myplace4U eZoomBook, using the eZoomBook template. Devise a place branding strategy and analyse its impact on potential users of the myplace4U eZoomBook.

Course material

Written and televised press, information and digital tools, general documents business environment and company strategies.

Internet conferences (Ted Talks, etc.), our own educational materials on Hippocampus (Moodle). Our own eZoomBook template for the Intercultural project.

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LABO | PROJECT | EXAM |
|-------------------------|--------------|----------|-----------|-------|---------|-------|
| English | 4 | 14 hrs | 16 hrs | 0 hrs | 0 hrs | 2 hrs |

CULTURAL AND COMMUNICATION ENGLISH

MECHANICAL ENGINEERING - ADVANCED MANUFACTURING

YEAR 1 - AUTUMN SEMESTER

LEAD PROFESSOR: Spencer HAWKRIDGE

Objectives

Introduction to Cultural and Communicational English:

- Understand the general concepts of communication English (different levels of language, etc.)
- Build a communicational project
- Develop strategies for enhanced interaction
- Organize, lead and participate in discussions, interviews and meetings
- Behavioral skills in an inter-cultural environment:
- Strengthen engagement and level of conviction
- Develop a capacity to explain and argue
- Acquire notions of corporate culture and values
- Enhance team work

Course contents

Cultural and Communicational English: exercises to explore in practice the areas of culture and communication

Inter-cultural project (for example, documentary project, publishing project: construct a work of fiction or of educational value and experience the complete publishing process)

Course material

Written and televised press, information and digital tools, general documents business environment and company strategies.

Internet conferences (Ted Talks, etc.), our own educational materials on Hippocampus (Moodle).

Our own eZoomBook template for the Intercultural project.

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LABO | PROJECT | EXAM |
|-------------------------|--------------|----------|-----------|-------|---------|-------|
| English | 4 | 0 hrs | 32 hrs | 0 hrs | 0 hrs | 0 hrs |

FRENCH LANGUAGE

MECHANICAL ENGINEERING - ADVANCED MANUFACTURING

YEAR 1 - AUTUMN SEMESTER

LEAD PROFESSOR: Silvia ERTL

Objectives

The objective is to familiarize the learner with the French language and French culture through an entertaining task-based communicative language teaching, focused on speaking combined with:

- Phonetics
- Self-correcting exercises on our learning platform
- Learning Lab activities
- Project work
- Tutoring

Course objectives include the acquisition and reinforcement of vocabulary, syntax, and pronunciation by both traditional means and through the use of digital resources. Students will learn general French, develop language skills of oral and written comprehension and expression.

After completing this course (32 hours + personal work), the students will be able to communicate in spoken and written French, in a simple, but clear manner, on familiar topics in the context of study, hobbies etc. Another important goal of this course is to introduce the student to French culture. At the end of the course (2 semesters), complete beginners can achieve an A1 level and some aspects of the A2 of The Common European Framework of Reference for Languages. More advanced students may aim for B1/B2 levels.

Course contents

Full range of practical communication language exercises: reading comprehension, listening comprehension, written expression, oral expression.

Learners will be able to use the foreign language in a simple way for the following purposes:

1. Giving and obtaining factual information:
 - personal information (e.g. name, address, place of origin, date of birth, education, occupation)
 - non-personal information (e.g. about places and how to get there, time of day, various facilities and services, rules and regulations, opening hours, where and what to eat, etc.)
2. Establishing and maintaining social and professional contacts, particularly:
 - meeting people and making acquaintances
 - extending invitations and reacting to being invited
 - proposing/arranging a course of action
 - exchanging information, views, feelings, wishes, concerning matters of common interest, particularly those relating to personal life and circumstances, living conditions and environment, educational/occupational activities and interests, leisure activities and social life

3. Carrying out certain transactions:

- making arrangements (planning, tickets, reservations, etc.) for travel, accommodation, appointments, leisure activities
- making purchases
- ordering food and drink

Course material

Preparation manuals, our own tailor-made documents, written and televised press, internet, general civilization documents, digital tools, our own educational materials on Hippocampus (Moodle).

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LABO | PROJECT | EXAM |
|-------------------------|--------------|----------|-----------|-------|---------|-------|
| French | 4 | 0 hrs | 32 hrs | 0 hrs | 0 hrs | 0 hrs |

MECHANICAL ENGINEERING - ADVANCED MANUFACTURING
YEAR 1 - SPRING SEMESTER

Computer Aided Design

Constitutive Laws

Structural Mechanics

Engineering Materials

Conferences and Initiation to Research

Mechanical Design

Cultural and Communication English

French Language

COMPUTER AIDED DESIGN

MECHANICAL ENGINEERING - ADVANCED MANUFACTURING

YEAR 1 - SPRING SEMESTER

LEAD PROFESSOR: Stéphane CARO

Objectives

- To provide students with the main CAD skills they need to design a mechanism with CAD software (CATIA V5 is used in the framework of this lecture)
- To design and model (CAD model) a real product
- To generate manufacturing drawings with tolerances

Course contents

The course comprises two main parts:

- Part design, Surface design, Parametric design, Detailed design, Assembly design, Simulation and Structural Analysis
- Design of a product, which has been previously defined and analysed in the Mechanical Design course (with Stéphane Caro)

Course material

- French, M. J. Conceptual Design for Engineers, 3rd ed., 1999 (Springer)
- Pahl, G. and Beitz, W. Engineering Design: A Systematic Approach, 2nd ed. Wallace, K.M. (editor); Blessing, L., Bauert, F. and Wallace, K.M. (translators), 1996 (Springer-Verlag, London)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LABO | PROJECT | EXAM |
|-------------------------|--------------|----------|-----------|-------|---------|-------|
| English | 5 | 16 hrs | 14 hrs | 0 hrs | 0 hrs | 2 hrs |

CONSTITUTIVE LAWS

MECHANICAL ENGINEERING - ADVANCED MANUFACTURING

YEAR 1 - SPRING SEMESTER

LEAD PROFESSOR: Giulio SCIARRA

Objectives

At the end of the course (30 hours + personal work) the students will be able to:

- Use thermodynamics to get restrictions on the constitutive laws
- Describe the inelastic behaviour of materials and structures
- Model the elastoplastic response of materials within the framework of continuum mechanics
- Calculate the response of elastoplastic structures
- Describe the main aspects of (brittle) fracture
- Calculate stress singularities in linear elasticity

Course contents

These lectures aim to present the main aspects of modelling irreversible processes within the framework of continuum mechanics. The thermodynamics of irreversible processes (TPI) is introduced as a fundamental tool to obtain a proper characterization of constitutive laws, then plasticity theory and fracture mechanics are presented in detail.

The lectures will cover the following:

- TPI: conservation laws, the first and the second principle of thermodynamics
- Rheological models
- Modelling the elastoplastic behaviour of materials, main postulates and principles
- Perfect plasticity and hardening plasticity
- Plasticity of structures
- The static and the kinematic theorem
- Basic formulation of fracture mechanics
- Stress singularities in prototype problems

Course material

- J. Lemaitre, J.L. Chaboche Mechanics of solid materials, Cambridge University Press, 2000
- J.-J. Marigo Plasticité et Rupture <https://cel.archives-ouvertes.fr/cel-00549750v1>
- P. Suquet Rupture et Plasticité <http://perso.enstaparis.fr/~mbonnet/mec551/mec551.pdf>
- J. Lubliner Plasticity theory, Dover publications 2006

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LABO | PROJECT | EXAM |
|-------------------------|--------------|----------|-----------|-------|---------|-------|
| English | 5 | 16 hrs | 14 hrs | 0 hrs | 0 hrs | 2 hrs |



STRUCTURAL MECHANICS

MECHANICAL ENGINEERING - ADVANCED MANUFACTURING

YEAR 1 - SPRING SEMESTER

LEAD PROFESSOR: Thomas HEUZE

Objectives

At the end of the course (30 hours + personal work), the students will be able to:

- understand what are the key points in defining the kinematics of a beam.
- define the problem of the equilibrium of a beam or a lattice trusses in infinitesimal strain by writing a Boundary Value Problem (BVP), and choose the right set of boundary conditions.
- understand the different possible approaches available for the solution of that BVP, and solve it.

Course contents

This course is an introduction to structural mechanics. We focus on the study of the equilibrium of linear elastic slender structures like beams, but also lattice trusses, undergoing infinitesimal strain and displacements in order to design them with respect to external loads. This will provide some of the basic tools for engineers to design mechanical systems. The basic concepts required for this course will have already been introduced in the continuum mechanics course during the first semester. These concepts are here particularized for slender structures; the same methodology of analysis of a problem is also followed during this course.

The course outline is as follows:

- Study of 3D solutions of beams: torsion and pure bending
- Introduction to the beam theory:
 - kinematics,
 - modeling of internal forces,
 - equilibrium and boundary conditions,
 - writing of the Boundary Value Problem (BVP).
- Study of the in-plane bending subproblem.
 - Force and displacement solution approaches
 - Isostatic/hyperstatic beams, and strength criteria applied to beams
- Study of lattice trusses
 - writing of the Boundary Value Problem (BVP); examples.
- Opening:
 - buckling of beams,
 - Vibration of beams.

Course material

- Beams, plates and shells. Donnell Lloyd Hamilton (1976). Mc Graw-Hill.
- Poutres et arcs élastiques. Patrick Ballard, (2009), Editions de l'Ecole Polytechnique.
- Handbook of Structural Mechanics. (2001) Patrice Cartraud.
- Poutre et plaques. Jean-Louis Batoz (1990). Editions Hermès.
- Théorie des poutres. Serge Laroze (1980). Paris Eyrolles.

- Mécanique des structures. Tome2: Poutres. Serge Laroze. Éditeur Toulouse Cépaduès-Éd. DL 2005.
- Mécanique des structures. Tome 5: Poutres exercices. Serge Laroze. Éditeur Toulouse Cépaduès-Éd. DL 2005,

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LABO | PROJECT | EXAM |
|-------------------------|--------------|----------|-----------|-------|---------|-------|
| English | 5 | 16 hrs | 14 hrs | 0 hrs | 0 hrs | 2 hrs |

ENGINEERING MATERIALS

MECHANICAL ENGINEERING - ADVANCED MANUFACTURING

YEAR 1 - SPRING SEMESTER

LEAD PROFESSOR: Christian BURTIN

Objectives

At the end of the course the students will be able to understand and control:

- The characteristics of dislocations and their involvement in plastic deformation and how to design with strengthening for a metallic alloy
- The mechanism of crack propagation, the difference between the stress concentration factor and the toughness and how to design with the fatigue.
- The structure of polymers and how to design with the viscoelasticity
- The different types of fiber-reinforced composites and how to design with a unidirectional composite material
- The thermodynamics and kinetics of corrosion and how to design a metal in presence of corrosion
- The tribology and how to design with contact mechanics, wear and lubrication
- The rheology and how to design with non-Newtonian fluids.

Course contents

These introductory lectures aim to present some fundamentals of materials science:

- Physical plasticity. Application to metals
- Effect of defects on failure. Application to the fatigue case (ceramics and metals)
- Effect of time on mechanical behaviour: Viscoelasticity. Application to polymers.
- Rheology at molten state. Application to the rheology of polymers
- Effect of direction on the mechanical behaviour. Application to composites
- Effect of degradation on mechanical behaviour: corrosion (metals)
- Effect of the surface on mechanical behaviour: Tribology (metals and ceramics)

Homework will provide an understanding of the topics discussed during the lessons.

Course material

- Ashby & Jones, Engineering Materials, Volume 1 & 2

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LABO | PROJECT | EXAM |
|-------------------------|--------------|----------|-----------|-------|---------|-------|
| English | 5 | 16 hrs | 14 hrs | 0 hrs | 0 hrs | 2 hrs |

CONFERENCES AND INITIATION TO RESEARCH

MECHANICAL ENGINEERING - ADVANCED MANUFACTURING

YEAR 1 - SPRING SEMESTER

LEAD PROFESSOR: Christian BURTIN

Objectives

At the end of the course, the students will be able to:

- Write a scientific and technical paper on mechanical engineering area
- Establish the reasoning of scientific paper writing
- Present orally and clearly scientific data in the context of mechanical engineering
- Write the abstract on an article

Course contents

The goal is preparing undergraduate students to start a PhD or any relative research activity (academic or industrial) in the context of mechanical engineering. The course INITR is composed of four main parts :

Part A : lecture on IMRAD concept

Part B : Scientific paper reading and analysis based on IMRAD

Part C : Oral presentation and discussion

Part D: How to write the abstract of an article

These parts represent how to organize and publish (Part B and part D), how to communicate (Part C) and how to prepare and present a technical and scientific report (Part A). Applications are given for engineering works.

Course material

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LABO | PROJECT | EXAM |
|-------------------------|--------------|----------|-----------|-------|---------|------|
| English | 2 | 2 hrs | 12 hrs | 0 hrs | 0 hrs | hrs |

MECHANICAL DESIGN

MECHANICAL ENGINEERING - ADVANCED MANUFACTURING

YEAR 1 - SPRING SEMESTER

LEAD PROFESSOR: Stéphane CARO

Objectives

This course presents an overview of the product design process:

- How to identify customer needs and to transform it into specifications
- Basic knowledge in product design development
- Functional analysis and value analysis
- Interviews and focus groups

Course contents

Design is an engineering activity that affects almost all areas of human life, using the laws and insights of science, building upon special experience, and providing the prerequisite for the physical realisation of solution ideas.

This course will deal with all the phases of the design process of a product, namely: task definition, conceptual design, embodiment, detailed design.

Particular attention will be paid to the conceptual design phase as it is a distinct phase of the design process and 75% of total product life-cycle cost is committed at that stage.

The course is evaluated with a final project that is conducted by groups of two students. Projects are suggested by the instructor. Project proposals are discussed during the first lecture to allow students an early start. A final report is due at the end of the course. The final project is also presented orally.

The instructions for the project are the following:

- a market study of the product (enterprises, patents, etc)
- a definition of the need and a system analysis of the product
- the search for innovative solutions according to the product requirements
- a comparison of the different technical solutions identified by the student

Course material

- French, M. J. Conceptual Design for Engineers, 3rd ed., 1999 (Springer)
- Pahl, G. and Beitz, W. Engineering Design: A Systematic Approach, 2nd ed. Wallace, K.M. (editor); Blessing, L., Bauert, F. and Wallace, K.M. (translators), 1996 (Springer-Verlag, London)
- Suh, N.P. The Principles of Design, 1990 (Oxford University Press, Oxford)
- Suh, N.P. Axiomatic Design. Advances and Applications, 2001 (Oxford University Press, Oxford)

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LABO | PROJECT | EXAM |
|-------------------------|--------------|----------|-----------|-------|---------|-------|
| English | 4 | 14 hrs | 16 hrs | 0 hrs | 0 hrs | 2 hrs |

CULTURAL AND COMMUNICATION ENGLISH

MECHANICAL ENGINEERING - ADVANCED MANUFACTURING

YEAR 1 - SPRING SEMESTER

LEAD PROFESSOR: Spencer HAWKRIDGE

Objectives

Interview techniques and communicational English:

- Understand the general concepts of interactive communication
- Build a media project
- Acquire interview techniques
- Understand the process of sourcing and checking facts and figures
- Understand issues related to plagiarism
- Create a bibliography
- Behavioral skills in an inter-cultural environment:
- Strengthen self-confidence and capacity for interaction
- Develop active listening and reformulation skills
- Develop networking skills

Course contents

Cultural and Communicational English: exercises to explore in practice the areas of culture and communication.

Media project (for example: prepare, conduct and promote interviews for a radio programme: L'Heure Centralienne (<http://www.euradionantes.eu/emission/l-heure-centralienne>), with the contribution of professors, PhD students, industrial partners, industry players at fairs, etc.

Course material

Written and televised press, information and digital tools, general documents business environment and company strategies.

Internet conferences (Ted Talks, etc.), our own educational materials on Hippocampus (Moodle).

Our own eZoomBook template for the Intercultural project.

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LABO | PROJECT | EXAM |
|-------------------------|--------------|----------|-----------|-------|---------|------|
| English | 4 | 0 hrs | 32 hrs | 0 hrs | 0 hrs | hrs |

FRENCH LANGUAGE

MECHANICAL ENGINEERING - ADVANCED MANUFACTURING

YEAR 1 - SPRING SEMESTER

LEAD PROFESSOR: Silvia ERTL

Objectives

The objective is to familiarize the learner with the French language and French culture through an entertaining task-based communicative language teaching, focused on speaking combined with:

- Phonetics
- Self-correcting exercises on our learning platform
- Learning Lab activities
- Project work
- Tutoring

Course objectives include the acquisition and reinforcement of vocabulary, syntax, and pronunciation by both traditional means and through the use of digital resources. Students will learn general French, develop language skills of oral and written comprehension and expression.

After completing this course (32 hours + personal work), the students will be able to communicate in spoken and written French, in a simple, but clear manner, on familiar topics in the context of study, hobbies etc. Another important goal of this course is to introduce the student to French culture. At the end of the course (2 semesters), complete beginners can achieve an A1 level and some aspects of the A2 of The Common European Framework of Reference for Languages. More advanced students may aim for B1/B2 levels.

Course contents

Full range of practical communication language exercises: reading comprehension, listening comprehension, written expression, oral expression.

Learners will be able to use the foreign language in a simple way for the following purposes:

1. Giving and obtaining factual information:

- personal information (e.g. name, address, place of origin, date of birth, education, occupation)
- non-personal information (e.g. about plMechanical Engineering - Advanced manufacturing and how to get there, time of day, various facilities and services, rules and regulations, opening hours, where and what to eat, etc.)

2. Establishing and maintaining social and professional contacts, particularly:

- meeting people and making acquaintances
- extending invitations and reacting to being invited
- proposing/arranging a course of action
- exchanging information, views, feelings, wishes, concerning matters of common interest, particularly those relating to personal life and circumstances, living conditions and environment, educational/occupational activities and interests, leisure activities and social life

3. Carrying out certain transactions:

- making arrangements (planning, tickets, reservations, etc.) for travel, accommodation, appointments, leisure activities
- making purchases
- ordering food and drink

Course material

Preparation manuals, our own tailor-made documents, written and televised press, internet, general civilization documents, digital tools, our own educational materials on Hippocampus (Moodle).

| LANGUAGE OF INSTRUCTION | ECTS CREDITS | LECTURES | TUTORIALS | LABO | PROJECT | EXAM |
|-------------------------|--------------|----------|-----------|-------|---------|------|
| French | 4 | 0 hrs | 32 hrs | 0 hrs | 0 hrs | hrs |