CENTRALE NANTES

Master of Science (MSc)

2025-2026

YEAR 1

CIVIL ENGINEERING

MATERIAL AND STRUCTURES IN THEIR ENVIRONMENT

PROGRAMME SUPERVISOR:

Giulio SCIARRA

YEAR 1 - Autumn Semester

CORE COURSES

Course code	Title	ECTS Credits	Page number
COMEC	Continuum Mechanics	5	4
FLUM1	Fluid Mechanics 1	5	6
NUMAN	Numerical Analysis	4	7
NUMME	Numerical Methods	5	8
TOME1	Tools and Methods for Research 1	4	9
VIBRA	Vibrations	5	10

LANGUAGE COURSES (one module from a choice of three) *

Course code	Title	ECTS Credits	Page number
CCE1	Cultural and Communication English	2	11
ESP1	Spanish Language	2	13
FLE1	French as Foreign Language	2	15

** 'French as Foreign Language' except for French native speakers who will study 'Cultural and Communicational English' or Spanish (depending on sufficient demand).*

YEAR 1 - Spring Semester

CORE COURSES

Course code	Title	ECTS Credits	Page number
CONLA	Constitutive Laws	5	16
CONST	Nonlinear modeling of reinforced concrete structures	5	17
GEOTC	Geotechnical Engineering	5	18
TOME 2	Tools and Methods for Research 2	4	19
IMAGI	Imaging in Civil Engineering	5	20
PHYMD	Physical Modelling	4	22

LANGUAGE COURSES (one module from a choice of three) *

Course code	Title	ECTS Credits	Page number
CCE2	Cultural and Communication English	2	23
ESP2	Spanish Language	2	24
FLE2	French as Foreign Language	2	25

** 'French as Foreign Language' except for French native speakers who will study 'Cultural and Communicational English' or Spanish (depending on sufficient demand).*

YEAR 1 - Autumn Semester

Continuum Mechanics [COMEC]

LEAD PROFESSOR: Siddhartha OMMI

Objectives

This course is an introduction to continuum mechanics, and more generally to the modelling in mechanics. The basic concepts are introduced here, which will be required for more advanced fluid and solid mechanics courses. In its second part, the course focuses on the study of the equilibrium of deformable solid bodies in linear elasticity and infinitesimal strain. This allows to supply some basic tools required for engineers to design simple mechanical systems.
The fundamental concepts introduced in this course are also useful for the courses of fluid mechanics (though recalled within it) and numerical methods (it provides models to be discretized with numerical methods) occuring during the first semester. It is also used as a basis for the course of structural mechanics occuring during the second semester for students that will have chosen the "solid" or "civil engineering" options. A last, it provides useful tools for the course of "Mechanical design analysis" to mechanically design parts.

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

- Understand strain and stress notions, and be able to write correctly their mathematical representation.
- 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

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

The course outline is as follows:

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

Course material

- Introduction to Continuum Mechanics, W. Michael Lai, David Rubin and Erhard Krempl, 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.

Assessment

Individual assessment: EVI 1 (coefficient 1)

Language of instruction	ECTS Credits	Lectures	Tutorials	Lab	Project	Exam
English	5	16 hrs	14 hrs	0 hrs	0 hrs	2 hrs

YEAR 1 - Autumn Semester

Fluid Mechanics 1 [FLUM1]

LEAD PROFESSOR: Guillaume DUCROZET

Objectives

This course aims to present the foundations and general principles of fluid mechanics.

After completing the course, students will be able to:

- Describe the main physical properties of a fluid.
- Identify the specificity 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

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.

Assessment

Individual assessment: EVI 1 (coefficient 1)

Language of instruction	ECTS Credits	Lectures	Tutorials	Lab	Project	Exam
English	5	14 hrs	12 hrs	4 hrs	0 hrs	2 hrs

YEAR 1 - Autumn Semester

Numerical Analysis [NUMAN]

LEAD PROFESSOR: Anthony NOUY

Objectives

The aim of this course is to introduce numerical analysis methods for solving mathematical problems such as linear and nonlinear equations, differential equations, and curve fitting.

Course contents

- Complements of matrix analysis : localization of eigenvalues, matrix norms.
- Solution of systems of linear equations: direct methods (Gauss, LU), iterative methods (Jacobi, Gauss-Seidel).
- Solution of non-linear equations: bisection method, fixed-point method, Newton's method.
- Interpolation and approximation: Lagrange and Hermite interpolation, piecewise interpolation, best approximation, least squares approximation.
- Numerical integration: quadrature formulas, composite method.
- Numerical methods for differential equations: Euler's method, Runge-Kutta methods.

Course material

- G. Allaire and S. M. Kaber. Numerical linear algebra. Springer, 2007.
- Quarteroni, A, Sacco, R., Saleri, F. Numerical mathematics, Springer (2000)

Assessment

Individual assessment:EVI 1 (coefficient 1.0)

Language of instruction	ECTS Credits	Lectures	Tutorials	Lab	Project	Exam
English	4	22 hrs	0 hrs	8 hrs	0 hrs	2 hrs

Numerical Methods [NUMME]

LEAD PROFESSOR: Grégory LEGRAIN

Objectives

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

- Classify standard second order PDEs (elliptic, parabolic, hyperbolic)
- Solve simple elliptic problems by means of finite differences or finite elements
- Determine the level accuracy of the schemes they use (convergence order)
- Program finite differences and finite elements in both 1D and 2D

Course contents

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

- Classification of PDEs
- Classification of boundary conditions, well-posed problems
- Introduction to finite differences (1D, 2D)
- Introduction to finite elements (1D, 2D)

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

Assessment

Individual assessment: EVI 1 (coefficient 1)

Language of instruction	ECTS Credits	Lectures	Tutorials	Lab	Project	Exam
English	5	16 hrs	4 hrs	10 hrs	0 hrs	2 hrs

YEAR 1 - Autumn Semester

Tools and Methods for Research 1 [TOME1]

LEAD PROFESSOR: Erwan VERRON

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 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.

In addition, students will have to write a report based on a bibliographical study on a subject related to ocean engineering.

Assessment

Individual assessment: EVI 1 (coefficient 1)

Language of instruction	ECTS Credits	Lectures	Tutorials	Lab	Project	Exam
English	4	2 hrs	12 hrs	0 hrs	0 hrs	0 hrs

Vibrations [VIBRA]

LEAD PROFESSOR: Panagiotis KOTRONIS

Objectives

At the end of the course 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

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

In parallel, an introduction is given on differential equations

Course material

- M. Geradin and D. Rixen. Mechanical vibrations (second edition). Theory and application to structural dynamics. John Wiley and Sons Ltd, 1997.
- A. K. Chopra. Dynamics of Structures. Theory and Applications to Earthquake Engineering (second edition). Prentice-Hall, 2001.
- Differential equations for engineers, Wei-Chau Xie, Cambridge

Assessment

Individual assessment: EVI 1 (coefficient 1)

Language of instruction	ECTS Credits	Lectures	Tutorials	Lab	Project	Exam
English	5	16 hrs	14 hrs	0 hrs	0 hrs	2 hrs

YEAR 1 - Autumn Semester

Cultural and Communication English [CCE1]

LEAD PROFESSOR: David TROYA

Objectives

This course aims at improving your critical thinking and persuasion skills in English. Using documentaries, we will explore, discuss and debate a range of cultural, political, social, and environmental issues relevant to current world events.

Speaking and understanding English as a second or third language is a great achievement, but does it mean you are an effective communicator? The next step involves, among other things, critical thinking and persuasive skills, both of crucial importance in the modern professional environment. We will address these issues by analyzing documentaries that will lead to formal debates.

Several competencies will be developed through class exercises. Oral presentations will be an opportunity put your verbal as well as your non-verbal communication skills into practice. During debate, you will be able to sharpen your analytical skills, provide constructive feedback, defend an argument, and prove a point.

Course objectives :

- Improving your communication skills
- Becoming an active listener
- Enhancing your non-verbal communication skills
- Developing critical thinking toward media
- Boosting leadership skills through moderating
- Organizing evidence and arguments

Course contents

Each session will be dedicated to a particular cultural, political, social or environmental topic of relevance in the wider anglophone world. Each topic will include multimedia material in the form of a short documentary or documentary excerpt. During class, students will lead a primer presentation, a moderated discussion and a formal debate.

Primer Presentation:

In pairs, you will hold a short talk to prime us on the topic of that week's documentary: you will introduce us to the topic by setting it in a wider context and establishing what's at stake.

Moderated Discussion :

In pairs, you will moderate a discussion related to the themes explored by the documentary. Moderators will come prepared with open-ended questions pertaining to the strengths and weakness of the documentary. They will distinguish between content and form and encourage critical, constructive opinions.

Formal Debate:

What's the difference between an opinion and an argument? You will soon find out. After the moderated discussion, and persuasive skills.

During the debate, each speaker will be assigned an audience member who evaluates their individual performance and provides a short debrief. A panel of two judges will determine which side wins.

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).

Assessment

Individual assessment: EVI 1 (coefficient 1)

Language of instruction	ECTS Credits	Lectures	Tutorials	Lab	Project	Exam
English	2	0 hrs	32hrs	0 hrs	0 hrs	0 hrs

YEAR 1 - Autumn Semester

Spanish Language [ESP1]

LEAD PROFESSOR: Marta HERRERA

Objectives

For beginners:

- Practice and reinforcement of the five skills (oral and written expression and comprehension as well as interaction) Acquisition of vocabulary and linguistic structures
- Be able to talk about yourself and those around you Be able to express oneself during daily activities Know how to give your opinion

For advanced students:

- Practice and reinforcement of the five skills (oral and written expression and comprehension as well as interaction) Acquisition of specialised vocabulary
- Be able to understand the essential content of concrete or abstract subjects including a technical discussion Be able to communicate spontaneously and fluently
- Be able to express oneself in a clear and detailed manner, to express an opinion on a topical subject

Course contents

For beginners:

- Personal environment (introduce yourself, express yourself, your tastes, your character, your hobbies, etc.), your surroundings (friends, family, location, climate), your interests (sports, leisure)
- Present tense (regular and irregular)
- Language patterns to express habit, obligation, "gustar" and its equivalents, Possessive adjectives
- Differences between "es", "está", "hay" Use of "por" and "para"
- Adverbs and frequency patterns Numeral adjectives

For advanced students:

- Knowledge of the Hispanic world (economic, technical, cultural and social environment) Present tense (regular and irregular)
- Imperative Past tenses
- Direct / indirect style Future tense Conditional tense
- Present and past subjunctive moods

Course material

Preparation manuals, our own tailor-made documents, written and internet press, general civilization documents, digital tools

Assessment

Individual assessment: EVI 1 (coefficient 1)

Language of instruction	ECTS Credits	Lectures	Tutorials	Lab	Project	Exam
Spanish	2	0 hrs	32hrs	0 hrs	0 hrs	0 hrs

French as Foreign Language [FLE1]

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. Gving 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).

Assessment

Individual assessment: EVI 1 (coefficient 1)

Language of instruction	ECTS Credits	Lectures	Tutorials	Lab	Project	Exam
French	2	0 hrs	48 hrs	0 hrs	0 hrs	0 hrs

YEAR 1 - Spring Semester

Constitutive Laws [CONLA]

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
- Manipulate theorems of limit analysis

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 is 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

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.enstaparistech.fr/~mbonnet/mec551/mec551.pdf
- J. Lubliner Plasticity theory, Dover publications 2006

Assessment

Individual assessment: EVI 1 (coefficient 1)

Language of instruction	ECTS Credits	Lectures	Tutorials	Lab	Project	Exam
English	5	16 hrs	14 hrs	0 hrs	0 hrs	2 hrs

Nonlinear modeling of reinforced concrete structures [CONST]

LEAD PROFESSOR : Panagiotis KOTRONIS

Objectives

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

- Describe the elastic and inelastic behavior of concrete and steel
- Understand the principles of hydrostatic-pressure-independent yield surfaces
- Understand the principles of hydrostatic-pressure-dependent yield surfaces
- Describe the main properties of a proper yield criterion for steel
- Describe the main properties of a proper failure criterion for concrete
- Give examples of plasticity models for steel
- Give examples of plasticity and damage mechanics models for concrete
- Criticize the results of non-linear static and dynamic calculations of reinforced concrete structures

Course contents

These lectures aim to present the main aspects of the non-linear behaviour of steel, of concrete and of civil engineering structures.

The lectures will cover the following:

- 1D Numerical implementation (plasticity)
- Yield criteria for steel
- Failure criteria for concrete
- Examples of non-linear calculations of reinforced concrete structures

Course material

- Inelastic Analysis of Structures, M. Jirásek and Z. Bažant, Wiley, 2002.
- Plasticity in reinforced concrete, WF. Chen, J. Ross Publishing, 2007
- Engineering damage mechanics. J. Lemaitre, R. Desmorat, Springer 2005.
- Computational Inelasticity. J.C. Simo and T.J.R. Hughes, Springer, 2000.

Assessment

Individual assessment: EVI 1 (coefficient 1)

Language of instruction	ECTS Credits	Lectures	Tutorials	Lab	Project	Exam
English	5	16 hrs	6 hrs	10 hrs	0 hrs	0 hrs

Geotechnical Engineering [GEOTC]

LEAD PROFESSOR: Siddhartha OMMI

Objectives

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

- Describe the macroscopic behaviour of soils
- Identify the experimental set-ups necessary to provide a characterization of the constitutive response of soils
- Identify the peculiar states which characterize the behaviour of soils (dilatancy, shear bands formation, liquefaction etc.)
- Use enhanced constitutive model of soils
- Understand dynamical processes occurring in soils.

Course contents

The lectures will cover the following topics:

- Introduction to the physics of granular materials (compaction, segregation, pattern formation, flows and instabilities)
- Tests and experimental results on sands and clays
- The stress path concept: application in the description of drained and undrained conditions
- Peculiar behaviours of soils: dilatancy, shear band formation, liquefaction
- Constitutive model of soils
- Wave propagation in soils. Liquefaction & cyclic mobility

Course material

- R. Nova Soil mechanics Wiley, 2010
- R. Lancellotta Geotechnical engineering Taylor & Francis 2009
- Andreotti, Forterre & Pouliquen, Granular Media: Between Fluid and Solid, Cambridge University Press, 2013

Assessment

Individual assessment: EVI 1 (coefficient 1)

Language of instruction	ECTS Credits	Lectures	Tutorials	Lab	Project	Exam
English	5	16 hrs	6 hrs	8 hrs	0 hrs	2 hrs

YEAR 1 - Spring Semester

Tools and Methods for Research 2 [TOME2]

LEAD PROFESSOR : Giulio SCIARRA

Objectives

The purpose of this module is to introduce every student to the research activities in Civil Engineering conducted at GeM. Students will be involved in a research project currently developed in the laboratory.

Bibliographic research, preliminary laboratory activity and/or basic theoretical and numerical modeling of physical problems in Civil Engineering could be addressed.

Course contents

The course content is defined in accordance with the research program defined by the academic responsible of the project.

Course material

The course material is established by the academic responsible of the project.

Assessment

Individual assessment: EVI 1 (coefficient 1)

Language of instruction	ECTS Credits	Lectures	Tutorials	Lab	Project	Exam
English	4	0 hrs	0 hrs	0 hrs	32 hrs	0 hrs

YEAR 1 - Spring Semester

Imaging in Civil Engineering [IMAGI]

LEAD PROFESSOR: Benoît HILLOULIN

Objectives

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

- Grasp the theory of some of the imaging techniques commonly used in civil engineering
- Use the basics of ImageJ software in image data analysis
- Calculate the displacement and deformation field of a sample deformed in the laboratory, using digital image correlation (2D)
- Choose the most compatible method from a range of imaging techniques for different civil engineering applications.

Course contents

Imaging techniques are used to an ever-increasing extent in academic and private research to understand and optimize the mechanical behaviour of various materials (concrete, rock, soil, glass etc). This course provides an overview of the main imaging techniques that Master's students may encounter during their research internships. The advantages and drawbacks of such methods will be presented, as well as their combination with standard techniques in civil engineering.

The course will focus on digital image and volume correlation in particular, with direct applications in deformation monitoring in underground structures.

At the end of the 32 hours, the students should have a basic foundation and training in image techniques and data analysis of civil engineering materials. As a rough guide, the course is broken down into the following parts:

- Why use imaging techniques? Introduction to non-destructive and destructive imaging techniques
- Definition of an image and overview of image acquisition techniques (camera with simple pictures, x-ray tomography, electron microscopy etc.)
- Continuity of techniques from 2D, 3D (laboratory experiments) to 4D (time-resolved Synchrotron imaging)
- Combination of imaging techniques with standard techniques in civil engineering (deformation in triaxial conditions under x-ray tomography for example)
- Overview of image analysis techniques to extract quantitative data (optical full measurement techniques, segmentation, filtering)
- Advantages and drawbacks of imaging techniques (resolution, scale, combination with other methods etc)
- Applications in civil engineering, and for petroleum and nuclear waste.
- Homework and lab sessions will provide an understanding of the major processes used in the composites industry.

Course material

- Mesures en mécanique par méthodes optiques, Brémand et al., (2011). Techniques de l'Ingénieur
- Les techniques optiques de mesure de champ; essai de classification, 2005 Y.Surrel.
- Full field measurements and identification in solid mechanics, Mechanical engineering and solid mechanics series, Ed. Wiley (2013)

Assessment

Individual assessment: EVI 1 (coefficient 1)

Language of instruction	ECTS Credits	Lectures	Tutorials	Lab	Project	Exam
English	5	16 hrs	0 hrs	10 hrs	6 hrs	0 hrs

YEAR 1 - Spring Semester

Physical Modeling [PHYMD]

LEAD PROFESSOR: Luc THOREL

Objectives

Introduction to the use of reduced-scale models in Civil Engineering. We draw upon the exceptional concentration of large-scale test facilities and scientific expertise in the Nantes area (geotechnical centrifuge, wind tunnels, towing tank and wave tank, semi-anechoic room, laser interferometry measurement bench). Knowledge of the basics of physical modelling, use of scaling laws, interpretation of experimental results.

Course contents

The course starts with an overview of scaling laws and similitude problems, followed by a presentation of the main tools used for their analysis and by specific applications in the following fields:

- Geotechnics
- Aerodynamics
- Hydrodynamics
- Acoustics
- Geophysics

Assessment

Individual assessment: EVI 1 (coefficient 1)

Language of instruction	ECTS Credits	Lectures	Tutorials	Lab	Project	Exam
English	4	16 hrs	14hrs	0 hrs	0 hrs	2 hrs

YEAR 1 - Spring Semester

Cultural and Communication English [CCE2]

LEAD PROFESSOR : David TROYA

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).

Assessment

Individual assessment: EVI 1 (coefficient 1)

Language of instruction	ECTS Credits	Lectures	Tutorials	Lab	Project	Exam
English	2	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs

YEAR 1 - Spring Semester

Spanish Language [ESP2]

LEAD PROFESSOR: Marta HERRERA

Objectives

For beginners:

- Practice and reinforcement of the five skills (oral and written expression and comprehension as well as interaction) Acquisition of vocabulary and linguistic structures
- Be able to talk about yourself and those around you Be able to express oneself during daily activities Know how to give your opinion

For advanced students:

- Practice and reinforcement of the five skills (oral and written expression and comprehension as well as interaction) Acquisition of specialised vocabulary
- Be able to understand the essential content of concrete or abstract subjects including a technical discussion Be able to communicate spontaneously and fluently
- Be able to express oneself in a clear and detailed manner, to express an opinion on a topical subject

Course contents

For beginners:

- Personal environment (introduce yourself, express yourself, your tastes, your character, your hobbies, etc.), your surroundings (friends, family, location, climate), your interests (sports, leisure)
- Present tense (regular and irregular)
- Language patterns to express habit, obligation, "gustar" and its equivalents, Possessive adjectives
- Differences between "es", "está", "hay" Use of "por" and "para"
- Adverbs and frequency patterns Numeral adjectives

For advanced students:

- Knowledge of the Hispanic world (economic, technical, cultural and social environment) Present tense (regular and irregular)
- Imperative Past tenses
- Direct / indirect style Future tense Conditional tense
- Present and past subjunctive moods

Course material

Preparation manuals, our own tailor-made documents, written and internet press, general civilization documents, digital tools

Assessment

Individual assessment: EVI 1 (coefficient 1)

Language of instruction	ECTS Credits	Lectures	Tutorials	Lab	Project	Exam
Spanish	2	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs

YEAR 1 - Spring Semester

French as Foreign Language [FLE2]

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:

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.)

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

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).

Assessment

Individual assessment: EVI 1 (coefficient 1)

Language of instruction	ECTS Credits	Lectures	Tutorials	Lab	Project	Exam
French	2	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs