CENTRALE NANTES

MASTER OF SCIENCE, TECHNOLOGY AND HEALTH

2023-2024

YEAR 2

MARINE TECHNOLOGY

HYDRODYNAMICS FOR OCEAN ENGINEERING

PROGRAMME SUPERVISOR(S):
Zhe LI

Marine Technology - Hydrodynamics for Ocean Engineering

YEAR 2 - Autumn Semester

CORE COURSES

Course code	Title	ECTS Credits
CONF	Conferences	-
EXPHY	Experimental Hydrodynamics	5
GCHYD	General Concepts of Hydrodynamics	4
HYDRD	Hydrodynamics R&D	5
NUMHY	Numerical Hydrodynamics	5
PROJT	Project	-
SGCHYD	Soutien - General Concepts of Hydrodynamics	-
WSINT	Wave-structure Interactions and Moorings	5
WWSSM	Water Waves and Sea States Modeling	4

LANGUAGE COURSES

Course code	Title	ECTS Credits
CCE3	Cultural and Communication English	2
ESP3	Spanish Language	2
FLE3	French Language	2

YEAR 2 - Spring Semester

CORE COURSES

Course code	Title	ECTS Credits
THESIS	Master Thesis or Internship	30

Master Programme - Marine Technology - Hydrodynamics for Ocean Engineering

YEAR 2 - Autumn Semester

Conferences [CONF]

LEAD PROFESSOR(S): Zhe LI

Objectives

This course gathers different conferences organized within the course of the M2 MTECH-HOE (industrial partners, scientific communication, etc.).

The conferences are planned every year and consequently differ from one year to another. They are provided by university scholars, industrial partners, alumni, etc. in order to provide the students a general overview of the field of ocean engineering: challenges, working opportunities, etc.

Course contents

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Course material

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	-	12 hrs	0 hrs	0 hrs	0 hrs	0 hrs

Master Programme - Marine Technology - Hydrodynamics for Ocean Engineering

YEAR 2 - Autumn Semester

Experimental Hydrodynamics [EXPHY]

LEAD PROFESSOR(S): Félicien BONNEFOY

Objectives

To provide students with state-of-the-art knowledge on experimental fluid dynamics in the field of offshore renewable energy and ship hydrodynamics. Despite the development of numerical modelling, experimental approaches remain a major source of knowledge development in ship hydrodynamics and marine renewable energy. The contribution to the selection of adequate hypotheses and to the validation of analytical or numerical models is of primary importance. In numerous situations, the experimental approach remains the most reliable, economical and fastest way to validate new designs. Specific instrumentation and facilities are presented in this course and used in lab work.

Course contents

Lesson 1 - Introduction to experimental hydrodynamics
The students discover the main topics in MRE experiments.

Lesson 2 - Experimental ocean engineering
Experimental tests in offshore basins.

Lesson 3 - Resistance
Ship resistance and experiments in towing tanks. Reynolds and Froude similitude; extrapolation at full scale.

Lesson 4 - Ship manoeuvrability
Mathematical formulation, experimental determination of hydrodynamic coefficients. Modelling of towed structures.

Lesson 5 - Measurements and signal processing
Sensors and transducers, sampling theory. Signal processing, Fourier analysis.

Course material

- S.A. Hughes, Physical Models and Laboratory Techniques in Coastal Engineering
- N. Newman, Marine Hydrodynamics
- O.M. Faltinsen, Sea loads on ships and offshore structures
- V. Bertram, Practical Hydrodynamics
- S. Chakrabarti, Offshore structure modelling

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	5	12 hrs	0 hrs	20 hrs	0 hrs	0 hrs

Master Programme - Marine Technology - Hydrodynamics for Ocean Engineering

YEAR 2 - Autumn Semester

General Concepts of Hydrodynamics [GCHYD]

LEAD PROFESSOR(S): Lionel GENTAZ

Objectives

The objectives of this course are to give a general overview to students about the use of Hydrodynamics in marine and ocean engineering fields, about modelling and physics of free surface flows, numerical simulation in Hydrodynamics, hydrostatics and stability of floating structures. This global overview will be then detailed in other courses of the Master program.

Course contents

Lesson 1 - Industrial, R&D and research activities connected to free surface hydrodynamics and ocean engineering
A state of the art of the problems of engineering or applied research use of Hydrodynamics is required.

Lesson 2 - Different classes of approximation used in Hydrodynamics
Presentation of different mathematical models which can be used in Hydrodynamics to describe free surface incompressible free surface flows (Navier-Stokes equations, Euler equations, boundary layer equations, Potential flow model) and main problems of free surface Hydrodynamics for which each model is adapted.

Lesson 3 - Introduction to Numerical Simulation
- Methodology for numerical simulation of a physical problem
- Implementation of a numerical method
- Pre- and post-treatment
- High-performance computing
- Practical application : introduction to discretisation of partial derivative equations using finite difference schemes

Lesson 4 - Introduction to experimental approach in hydrodynamics
Physical problems which can be treated using experimental approach and related facilities (towing tang, wave tank ...) are presented.

Lesson 5 - Hydrostatic and Stability of ships and marine structures
Intact and damaged stability of floating structures are investigated through theoretical and practical aspects. Computer lab work is done with state-of-art industry software.

Course material

- E. Guyon, J.P. Hulin, L. Petit L., hydrodynamique physique, InterEditions /Editions du CNRS
- J.N. Newman, Marine Hydrodynamics, The MIT press, 1977
- V. Bertram, Practical Ship hydrodynamics, Elsevier, 2012 (2nd Edition)
- A.J. Hermans, Water Waves and Ship Hydrodynamics: An Introduction, Springer, 2010 (2nd Edition)
- Biran, Ship Hydrostatics and Stability, Butterworth-Heinemann, 2003
- J.H. Ferziger, M. Peric, Computational Methods for Fluid Dynamics, Springer
- https://ittc.info/downloads/proceedings/ : proceedings of ITTC conferences

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	20 hrs	4 hrs	6 hrs	0 hrs	2 hrs

Hydrodynamics R&D [HYDRD]

LEAD PROFESSOR(S): Antoine DUCOIN

Objectives

To provide students an overview of the current research in numerical methods for hydrodynamics.

Course contents

Lesson 1 - LBM (lattice Boltzmann method)
Over the last two decades, the lattice Boltzmann method (LBM) has emerged as a promising numerical tool for simulating, and not limited to, various types of fluid flows in nature as well as in engineering applications. It has been recently demonstrated that the LBM can be systematically derived from the Boltzmann equation (kinetic theory). This inherent feature allows the LBM to solve fluid dynamic problems with a large range of scales. This course consists of four hours of lectures and four hours of programming lab work. The theoretical basis of the LBM is first presented in the lecture, such as the derivation from the Boltzmann equation using Hermite polynomial expansion, the relation with the Navier-Stokes equation via the Chapman-Enskog analysis. The second part of the lecture is devoted to the presentation of the numerical aspects of the LBM, such as the collision and streaming steps, the boundary condition treatment. In the lab
work, the students will learn how to write an LBM program using Matlab in order to simulate some academic test-cases, e.g. Poiseuille flow, lid driven cavity. The objective of the lab work is to make the students better understand this numerical method and experience its simplicity of implementation.

Lesson 2 - FSI (Fluid Structure Interaction)
An overview of Fluid Structure Interactions (FSI) for hydrodynamic applications is presented in this class. The first part concerns the basic equations for fluid structure interaction problems, followed by a non-dimensional analysis to extract the different class of fluid structure interactions. The class will then focus on the particular case of flow induced vibration. Two simple FSI problems are then studied: the free motion of a 2D cylinder under unsteady, periodic flow, and the static deformation of a 2D hydrofoil under stationary flow. In the third part, an overview of the numerical methods for fluid structure interaction problems is presented. In the computer lab work, students will study a free oscillating cylinder submitted to hydrodynamic flow, using Direct Numerical Simulation (DNS).

Lesson 3 - SPH (Smoothed Particle Hydrodynamics)
The Smoothed Particle Hydrodynamics method is of growing interest for complex free surface flows, mainly when characteristic times are short (impact, slamming, sloshing, spray, etc.). The course covers the various aspects of the method theory and application to marine engineering. First are highlighted the different reasons why this method is well suited to these complex free surface problems (advantages), and why it is also mainly limited to them (drawbacks). The method theory is then developed and compared to standard mesh-based methods in terms of: schemes of approximation of the differential operators, convergence and accuracy, explicit solving of Navier-Stokes equations, weak-compressibility assumption, quasi-Lagrangian description, etc. Implementation is also discussed, especially in the context of High Performance Computing. Finally, it is shown how this method is applied to industrial marine engineering problems, and it is discussed what are its current trends of development: improvement of convergence, particle refinement, easy Fluid-Structure Interaction, coupling to Finite Volumes.

Course material

Lecture 1 (LBM):
▪ Shan, X., Yuan, X.F., Chen, H. Kinetic theory representation of hydrodynamics: a way beyond the Navier-Stokes equation. Journal of Fluid Mechanics 550: 413-441, 2006.
▪ Guo, Z., Zheng, C., Shi, B. Discrete lattice effects on the forcing term in the lattice Boltzmann method. Physical Review E 65: 046308, 2002.
▪ Succi, S. The lattice Boltzmann equation: for fluid dynamics and beyond. Oxford University Press. 2001

Lecture 2 (FSI)

- M.P. Païdoussis. Fluid-Structure Interaction: Slender Structures and Axial Flow. Academic Press, 2004
- J.F. Sigrist, Fluid-Structure Interaction: An Introduction to Finite Element Coupling, Wiley, 2015

Lecture 3 (SPH):
- D. Le Touzé, 'Smoothed Particle Hydrodynamics, fact checking: from theory to applications', Keynote lecture at the 2017 SPHERIC international workshop, http://spheric-sph.org//files/SPHERIC_Beijing_Keynote_pdf.pdf
- G.R. Liu, M.B. Liu, 'Smoothed Particle Hydrodynamics, a meshfree particle method', World Scientific Pub Co Inc

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	5	18 hrs	0 hrs	12 hrs	0 hrs	2 hrs

Master Programme - Marine Technology - Hydrodynamics for Ocean Engineering

YEAR 2 - Autumn Semester

Numerical Hydrodynamics [NUMHY]

LEAD PROFESSOR(S): Lionel GENTAZ

Objectives

The goal of this class is to provide students with an overview of Computational Fluid Dynamics (CFD) methods and the simulation environment for the computation of free-surface unsteady flows in ocean engineering. Different methods rely on different physical approximations of the wave-structure interaction problem. The latter approximations are based upon the space-time scales (from hours and km^2 to seconds and m^2) of the investigated problems and the engineering objectives (energy conversion quantification, design for standard operation, extreme condition design, maintenance operations, etc.). According to the approximations made, different numerical methods can be developed and applied.

The primary objective is that students gain a clear vision of the use of different approximations and methods, and of their respective ranges of application, computational cost, human and resource cost of use, versatility, limitations, ease of use, space discretization (mesh), etc. The methods reviewed range from potential flow theory (BEM: Boundary Element Method, HOS: High-Order Spectral), to a full description of the Navier-Stokes equations (FD: Finite Differences, FV: Finite Volumes) associated with interface models (VoF: Volume of Fluid, LS: Level Set).

For each method, the mathematical model, discretization and implementation principles are explained. Turbulence modeling principles (RANS: Reynolds Averaged Navier-Stokes, LES: Large-Eddy Simulation, hybrid RANS/LES) are provided. The link with space discretization (structured surface meshes, unstructured volume meshes, meshless etc) is detailed. Numerical properties such as convergence, stability, consistency are reviewed.

Finally, the links between numerical method and current simulation environment are covered: existing commercial software, human and computational resources, choice of software depending on the targeted problem, link with hardware (High-Performance Computing, cloud resources) etc.

Practical projects using software based on different methods studied in class (BEM, FVM, etc.) are proposed to students with the use of commercial software or software developed at Centrale Nantes.

Course contents

Lesson 1 - Knowledge and understanding of potential flow solvers
Potential flow methods (BEM), Integral methods solving, Surface meshing, Hydrodynamic loading calculation

Lesson 2 - Numerical methods for free surface flows
Volume discretization methods (Finite Volumes), Time integration and stability,

Lesson 3 - Navier-Stokes equations solution techniques
State of the art of CFD in hydrodynamics for Ocean Engineering
Pressure-velocity coupling, Linear system solving, Volume meshing
Hydrodynamic loading calculation, Interface methods (VoF, LS)
Turbulence models (RANS, LES)

Course material

- H. Lomax et al., Fundamentals of Computational Fluid Dynamics, Springer, 2011
- B. Andersson et al., Computational Fluid Dynamics for engineers, Cambridge Univ. Press, 2011
- J.H. Ferziger, M. Peric, Computational Methods for Fluid Dynamics, Springer, 1997
- J.F. Wendt, Computational Fluid Dynamics, an introduction, Springer, 2009
- R.H. Nichols, Turbulence Models and Their Application to Complex Flows, Univ. Alabama, 2012
- V. Bertram, Practical Ship Hydrodynamics, Elsevier, 2012

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	5	14 hrs	2 hrs	14 hrs	0 hrs	2 hrs

Project [PROJT]

LEAD PROFESSOR(S): Zhe LI

Objectives

This module contains specific projects carried on during the first semester of the M2 MTECH-HOE.

The projects are proposed each year and consequently differ one year from another.

Course contents

This module contains specific projects carried on during the first semester of the M2 MTECH-HOE.

The projects are proposed each year and consequently differ one year from another.

Course material

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	-	0 hrs	0 hrs	0 hrs	30 hrs	0 hrs

Master Programme - Marine Technology - Hydrodynamics for Ocean Engineering

YEAR 2 - Autumn Semester

Soutien - General Concepts of Hydrodynamics [SGCHYD]

LEAD PROFESSOR(S): Sandrine AUBRUN

Objectives

Remind the minimum required knowledges on fluid mechanics to tackle the core lectures of the master program

Course contents

Lecture 1
Fluid properties
Vectors and tensors
Why Partial derivatives?
Mathematical operators (del operator, grad, div rot)

Lecture 2
Hydrostatics, Euler equations
Pressure loads

Lecture 3
Dynamics of perfect fluids
Bernoulli equation
Extension to generalised Bernoulli Equation (head loss, hydraulic machines) no detail

Lecture 4
Stress tensors
NS equations
Similarity laws

Course material

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	-	10 hrs	0 hrs	10 hrs	0 hrs	0 hrs

Wave-structure Interactions and Moorings [WSINT]

LEAD PROFESSOR(S): Pierre FERRANT

Objectives

The objective of the first part of the course is to give a complete presentation of the available models for the determination of marine structure response in a seaway, emphasizing the advantages and drawbacks of each approach. A complete presentation of the linearized theory of wave-body interactions, treated in a deterministic sense, is first given. Both frequency domain and time domain approaches are described. Fundamental relations between both solutions are systematically emphasized. High and low frequency second order effects are explained and illustrated. Then, an overview of the available nonlinear theories and numerical models for wavestructure interactions is given. Different levels of approximation are described, from the simple addition of nonlinear hydrostatics to fully nonlinear time domain models.

The second part addresses the modelling of mooring systems. Different options in terms of mooring systems and arrangements are presented in order to give students the main information necessary for undertaking a mooring design process.

For both parts, lectures are completed by practical exercises based on state-of-the-art software for wave-structure interaction and mooring modeling, using both frequency domain and time-domain analysis. The topics of the practical sessions will be realistic ocean engineering problems such as the response of a floating wind turbine platform to waves, for example.

Course contents

Lesson 1 - Objectives, theoretical framework

Lesson 2 - Short review of linear systems theory

Lesson 3 - Formulation of the boundary value problem. Linearization

Lesson 4 - Frequency domain approach
- Definition of diffraction and radiation sub-problems
- Hydrodynamic loads: added mass and damping
- Calculation of motions
- Relations between elementary solutions

5 - Time domain approach
- Forced motion of a floating body
- Formulation of the diffraction problem in the time domain
- Equations of motion
- Relation to frequency domain response

Lesson 6 - Second-order effects and introduction to non-linear models
- Drift forces
- Low and high-frequency loading in irregular waves
- Nonlinear hydrostatics and Froude-Krylov loading
- Weak scattered hypothesis
- Fully nonlinear models

Lesson 7 & 8 - Moorings for marine structure
- Some examples in Oil and Gas energy
- Different types of mooring systems
- Offloading operations

- Some examples in Marine Renewable energy
- Mooring main functions
- Mooring arrangement
- Mooring components
- Environmental conditions
- Mooring Design basis

Course material

- J.N. Newman (1977) Marine Hydrodynamics, MIT Press.
- O.M. Faltinsen (1990) Sea Loads on Ships and Offshore Structures, Cambridge University Press.
- Adrian Biran (2003) Ship Hydrostatics and Stability, Butterworth-Heinemann.
- API recommended Practice 2SK (2005) Design and analysis of Station-keeping Systems for Floating Structures.
- Vryhof anchors (2010) Anchor Manual, The Guide to Anchoring.

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	5	18 hrs	2 hrs	10 hrs	0 hrs	2 hrs

Water Waves and Sea States Modeling [WWSSM]

LEAD PROFESSOR(S): Guillaume DUCROZET

Objectives

This course provides an overview of some of the numerous mathematical models used to represent free-surface gravity waves and the associated underlying flow. The models are used to describe the main physical features of ocean wave propagation. The scope is voluntarily restricted to the most useful models generally used by ocean/marine engineers and researchers. In a few cases, a deeper theoretical insight is presented in order to allow the students to understand the subtleties of water wave theory and nonlinear physics. In the second part, the use of the statistical approach is presented, both for the representation of sea states and sea structures' responses.

After completing the course, students will be able to:
- Identify the wave theory adequate to model a given regular wave.
- Describe in detail the physics of dispersive waves.
- Develop or use numerical models for the wave propagation.
- Interpret and use Metocean data in the context of ocean engineering.

Course contents

Lesson 1 - Introduction to marine environment
Description of the ocean and the different kind of waves. Focus on gravity waves and the processes responsible for their generation.

Lesson 2 - Gravity wave modelling
Derivation of the governing non-linear equations and introduction of the multiple scale method to generate a particular subset of equations

Lesson 3&4 - Dispersive waves
- Airy Potential; derivation of the solution by separation of variables. Expression of all the related physical quantities: group velocity, energy density, energy flux, limits of the linear model.
- Higher order Stokes solutions (3rd order, 5th order). Sequential construction of the Stokes higher order solutions. Specific nonlinear features of Stokes waves.
- Wave refraction and shoaling in coastal regions.

Lesson 5 – Shallow water (non-dispersive) waves
Derivation of the governing equations and analytical solutions to the problem: solitons and cnoidal waves.

Lesson 6 - Statistical models for wave field description
- Random sea state modeling.
- Usual wave spectra models.
- Wave generation.

Lesson 7 - Random responses of structures at sea
- Random responses of a linear system.
- Review of the results for ship responses by a deterministic theory.
- Motion on a real sea state.
- Extreme responses, and design factors.

Course material

- Robert G. Dean & Robert A. Dalrymple, Water wave mechanics for engineers and scientists, Advanced Series on Ocean

Engineering (vol.2).
▪ A.J. Hermans, Water waves and ship hydrodynamics: an introduction.
▪ C.C. Mei, M. Stiassnie & D.K.P. Yue, Theory and application of ocean surface waves, Advanced Series on Ocean Engineering (vol.23). Part I: Linear aspects; Part II: Non-linear aspects

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	14 hrs	4 hrs	12 hrs	0 hrs	2 hrs

Master Programme - Marine Technology - Hydrodynamics for Ocean Engineering

YEAR 2 - Autumn Semester

Cultural and Communication English [CCE3]

LEAD PROFESSOR(S): David TROYA

Objectives

Team-building and Communicational English:
- Understand the general concepts of team-building
- Build a team-building project
- Understand and nurture the creative process
- Enhance self-belief and self-empowerment

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
Field-related or inter-cultural project.

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 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	2	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs

Master Programme - Marine Technology - Hydrodynamics for Ocean Engineering

YEAR 2 - Autumn Semester

Spanish Language [ESP3]

LEAD PROFESSOR(S): 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

French Language [FLE3]

LEAD PROFESSOR(S): 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, 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. Those who already completed the first year of the French course will be prepared for working in a French business environment.

Course contents

Two different tracks are proposed: track 1 for students newly arrived at Centrale Nantes and track 2 for students who have completed the first year of the French course. Track 1:
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

Track 2:
This track follows on directly from the first-year French course, developing and completing the concepts studied thus far. The main themes are: housing, health and work. These topics will help prepare students for their future work environment. For example, housing is explored in the form of a search for accommodation upon arrival in a new city. Special workshops for CVs and cover letters, elevator pitches and job interviews.

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 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	2	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs

Master Programme - Marine Technology - Hydrodynamics for Ocean Engineering

YEAR 2 - Spring Semester

Master Thesis or Internship [THESIS]

LEAD PROFESSOR(S): Zhe LI

Objectives

- Be exposed to and adapt to an industrial or research environment
- Put in practice the scientific and technical skills acquired in the previous semesters
- Strengthen interpersonal and communication skills
- Be part of or manage a project
- Organize tasks, analyze results and build deliverables

Course contents

Students should be pro-active and career-oriented in the search for their thesis/internship. The topics are validated by the program supervisor to ensure an adequate Master level. The thesis/internship is evaluated through the submission of a written report and an oral defense.

Course material

- Turabian Kate Larimore, Booth Wayne Clayton, Colomb Gregory G., Williams Joseph M., & University of Chicago press. (2013). A manual for writers of research papers, theses, and dissertations: Chicago style for students and researchers (8th edition.). Chicago (Ill.) London: University of Chicago Press.
- Bui Yvonne N. How to Write a Master's Thesis. 2nd ed. Thousand Oaks, Calif: Sage, 2014.
- Evans David G., Gruba Paul, et Zobel Justin. How to Write a Better Thesis. 3rd edition. Carlton South, Vic: Melbourne University Press, 2011.

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	30	0 hrs	0 hrs	0 hrs	0 hrs	0 hrs