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CENTRALE NANTES

MASTER OF SCIENCE, TECHNOLOGY AND HEALTH

CITY AND URBAN ENVIRONMENTS

ATMOSPHERE, WATER AND ENVIRONMENT

YEAR 1
AUTUMN SEMESTER

PROGRAMME SUPERVISORS: LAURENT PERRET & ISABELLE CALMET

Établissement public sous tutelle du ministère de l'Enseignement supérieur, de la Recherche et de l'Innovation

GROUPE CENTRALE

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FLUID MECHANICS 1

CITY AND URBAN ENVIRONMENTS – ATMOSPHERE, WATER & ENVIRONMENT
YEAR 1 AUTUMN SEMESTER

LEAD PROFESSOR: Guillaume Ducrozet, *guillaume.ducrozet@ec-nantes.fr*

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 fundamentals 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 the 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.

Keywords

Fluid Mechanics, Viscosity, Pressure, Dimensional analysis, Reynolds number, Froude number, Mach number, Newtonian fluid, Navier-Stokes, Fluid static, Turbulent, Laminar, Perfect fluid

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

PROGRAMMING AND ALGORITHMS

CITY AND URBAN ENVIRONMENTS – ATMOSPHERE, WATER & ENVIRONMENT

YEAR 1 AUTUMN SEMESTER

LEAD PROFESSOR: Alexis Salzman, *alexis.salzman@ec-nantes.fr*

Objectives

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

- Handle the creation and compilation of simple programmes in C++ with basic algorithms (loop, function, computing with array, etc)
- Understand programmes using all kind of variables (standard, pointer reference, array and enumeration)
- Understand programmes using object-oriented paradigm (basic concept, Inheritance, Polymorphism) and associated algorithms (encapsulation, etc)
- Understand programmes using template paradigm (template function, template class) and associated algorithms (generality, etc)
- Understand programmes using STL library and associated algorithmics (linked list, trees, hash function, etc)
- Acquire knowledge on development tools.

Course contents

Lectures present, step by step, all programmatic and algorithmic components of a rich programming language, the C++. This language first offers a way to learn the key concept of structured programming and compilation which are rather common in other languages (C, Fortran, Basic etc). Some advanced aspects such as pointer and reference will also be studied in this first part. Basic algorithmic concepts (bloc, scope, loop, function, etc) are provided in this introduction. Then, based on this knowledge, student will learn other programming paradigms that are also available in this language:

- Object-oriented programming. Basic concept and design are first presented. Then two important aspects, Inheritance and Polymorphism, are explained to have a general idea of object-oriented strength.
- Template programming. Function and class template are briefly presented to understand the concept of genericity in a strongly typed language like C++.

Finally, associated to C++ standard, the STL Library is explained. Understanding of the two previous paradigms are mandatory to follow this last part. It is an introduction designed to help students to navigate in this vast library that offers really efficient tools and encapsulates complex algorithms.

The course concludes with a lecture on development tools that help programmers. Homework and lab sessions will provide a way to assimilate lecture contents.

Course material

- The C++ Programming Language (4th edition), Bjarne Stroustrup, Addison-Wesley Professional ISBN 978-0-321-56384-2

- The C++ Standard Library: a tutorial and reference (2nd edition), Nicolai M. Josuttis ISBN 978-0321623218

Keywords

C++, operator, loop, array, pointer, function, object-oriented programming, template programming, STL, development tool.

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

ENERGETICS AND BUILDING HEAT TRANSFERS

CITY AND URBAN ENVIRONMENTS – ATMOSPHERE, WATER & ENVIRONMENT

YEAR 1 AUTUMN SEMESTER

LEAD PROFESSOR: Laurent Perret, *laurent.perret@ec-nantes.fr*

Objectives

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

- apply basics in heat transfer and thermodynamics
- identify and calculate comfort parameters (sensible and latent)
- identify and consider outdoor weather conditions
- do an energy balance
- pre-design an air conditioning system
- propose solutions for energy efficient actions in buildings
- acquire their first experience in using an energy and building simulation tool

Course contents

This course aims to present the different parameters that affect the energy efficiency of buildings, the necessary integrated approach between envelope performance, occupancy and energy systems. An introduction to energy and building simulation tools is also provided.

Course material

- Lecture notes
- Heat and mass transfer books (e.g. Incropera et al.)
- Pleiades+COMFIE modelling tool

Keywords

Energy and building, heat transfer, thermodynamics, comfort, modelling tool, building energy systems

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT	EXAM
English	4	14 hrs	8 hrs	8 hrs	0 hrs	2 hrs

INTRODUCTION TO GEOGRAPHIC INFORMATION SCIENCES

CITY AND URBAN ENVIRONMENTS – ATMOSPHERE, WATER & ENVIRONMENT
YEAR 1 AUTUMN SEMESTER

LEAD PROFESSOR: Laurent Perret, *laurent.perret@ec-nantes.fr*

Objectives

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

- Understand the concepts inherent in geographic information systems,
- Exchange with geomaticians (experts in GIS), using the same vocabulary,
- Develop spatial reasoning (how spatial objects interact with each other? What are the relationships between them? ...),
- Manipulate GIS software (e.g Qgis and OrbisGIS),
- Create maps, following graphic semiology rules,
- Understand the concept of Spatial Data Infrastructure (SDI).

Course contents

This course aims to present the field of Geographic Information Sciences (GIS) from theoretical and practical points of view. The theoretical part will mainly be focused on the presentation of the main concepts related to GIS (definition, vocabulary, data type), Spatial analysis, cartography and Spatial Data Infrastructure. The practical part will focus on the use of two free and open-source GIS software tools (Qgis and OrbisGIS) and with the discovery and use of the Spatial SQL language, which will be used to manipulate and process geographic information.

Course material

- The GIS Primer, BUCKLEY D.J. (http://www.innovativegis.com/basis/primer/primer.html)
- Geospatial Analysis: A Comprehensive Guide to Principles, Techniques, and Software Tools Smith, Goodchild, Longley 2007 (http://www.spatialanalysisonline.com/)
- Principles of Geographic Information Systems, Burrough and McDonnell (https://www.amazon.co.uk/Principles-Geographic-Information-Systems-2nd/dp/0198233655)

Keywords

GIS, Spatial, Geography, Cartography, SQL

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

INTRODUCTION TO RESEARCH

CITY AND URBAN ENVIRONMENTS – ATMOSPHERE, WATER & ENVIRONMENT
YEAR 1 AUTUMN SEMESTER

LEAD PROFESSOR: Boris Conan, *boris.conan@ec-nantes.fr*

Objectives

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

- master the different steps of scientific dissemination
- conduct thorough bibliographic research using appropriate tools
- write a bibliographic review
- present his/her work in a congress-like situation
- elaborate a critical review of a peer's work, literature article, and his/her own work

Course contents

This course aims to present the common rules of scientific publication and to provide an overview of the scientific press. As part of the course, a mini-symposium is organised where students will experience conducting literature review using bibliographic research and scientific writing tools introduced in the course. In this exercise, students have to present a bibliographic study on a subject of their choice by writing a bibliographic article and by presenting it in a mini-symposia organized by students.

Course material

Keywords

Bibliographic research, scientific publications, symposium

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT	EXAM
English	4	8 hrs	8 hrs	0 hrs	14 hrs	2 hrs

BUSINESS ENVIRONMENT

CITY AND URBAN ENVIRONMENTS – ATMOSPHERE, WATER & ENVIRONMENT
YEAR 1 - AUTUMN SEMESTER

LEAD PROFESSOR: ***Spencer Hawkridge*** *– spencer.hawkridge@ec-nantes.fr*

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.

Keywords

business model canvas, Dolan Framework, SWOT analysis, etc.

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

MODERN LANGUAGES - FRENCH

CITY AND URBAN ENVIRONMENTS – ATMOSPHERE, WATER & ENVIRONMENT

YEAR 1 - AUTUMN SEMESTER

LEAD PROFESSOR: Silvia Ertl – *silvia.ertl@ec-nantes.fr*

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).

Keywords

reception (listening and reading), production (spoken and written), interaction (spoken and written), knowledge, skills, linguistic competence, sociolinguistic competence, pragmatic competence, register, cultural differences, non-verbal communication

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

MODERN LANGUAGES – CULTURAL AND COMMUNICATIONAL ENGLISH

CITY AND URBAN ENVIRONMENTS – ATMOSPHERE, WATER & ENVIRONMENT

YEAR 1 - AUTUMN SEMESTER

LEAD PROFESSOR: Spencer Hawkridge- *spencer.hawkridge@ec-nantes.fr*

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.

Keywords

Culture and communication, inter-cultural environment, team-building, digital tools, etc.

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT	EXAM
English	4	0 hrs	30 hrs	0 hrs	0 hrs	2 hrs