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CENTRALE NANTES

MASTER OF SCIENCE, TECHNOLOGY AND HEALTH

CITY AND URBAN ENVIRONMENTS

ATMOSPHERE, WATER AND ENVIRONMENT

YEAR 1
SPRING 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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HYDROLOGY AND TRANSFERS IN SOILS

CITY AND URBAN ENVIRONMENTS – ATMOSPHERE, WATER & ENVIRONMENT

YEAR 1 SPRING 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:

- List the different components of the water cycle
- Calculate a hydrological budget
- Analyze catchment response to rainfall, linked to soil type, catchment morphology, climatic conditions
- Demonstrate a good understanding of the laws governing water flow in soils and groundwater flow
- Apply simple quantitative analysis techniques to solve subsurface water transfer problems
- Know about a few basic mass transport processes

Course contents

This course aims to present the water cycle with its different components, their formations and their driving conditions. The delineation of catchment will be explained and the concept of water budget at the catchment scale will be detailed. Some modelling concepts will be presented. Moreover, this course covers the fundamentals of subsurface flow and transport. Class topics to be addressed: natural porous media, flow in saturated porous media, groundwater flow, variably saturated flow in soils, non-reactive solute transport in porous media and reactive transport in soils.

Course material

Bear, J., 1972: Dynamics of Fluids in Porous Media, Elsevier, New York
Bird, R. B., W. E. Stewart and E. N. Lightfoot, 1960: Transport Phenomena, John Wiley & Sons, New York
Pr. A. Musy web course: http//www.echo2.epfl.ch/e-drologie

Keywords

Water cycle, catchment scale rainfall, evapotranspiration, surface runoff, surface interception, drainage, flow in porous media, Darcy's law, groundwater flow, non-reactive transport, reactive transport

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

INTRODUCTION TO COMPUTATIONAL FLUID DYNAMICS

CITY AND URBAN ENVIRONMENTS – ATMOSPHERE, WATER & ENVIRONMENT
YEAR 1 SPRING 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 basic concepts of Computational Fluid Dynamics
- Solve 1D partial derivative equations using finite difference or finite volume methods
- Have a critical view of various schemes in terms of stability and errors
- Design and perform simulations for incompressible laminar flow in simple configurations
- Analyse CFD results according to the mesh, boundary conditions and schemes

Course contents

This course is an introduction to Computational Fluid Dynamics, a discipline that students will be led to use in their career as engineers or researchers in the fields of hydrology or atmospheric sciences. The objective is to provide basic knowledge about CFD through the presentation of the:

- mathematical model used in finite difference and finite volume approaches
- finite difference method and schemes to approximate spatial derivatives
- finite volume method and approximation of surface and volume integrals
- methods to solve unsteady problems
- application to the solution of the Navier-Stokes equations (variable arrangement on the grid, boundary conditions, pressure terms issues etc)

Lab sessions will be organized throughout the course in order to improve the appropriation of lecture contents. In addition, the students will have their first experience on the numerical simulation of simple flows through the use of a commercial CFD code.

Course material

- Ferziger and Péric, 2002, Computational Methods for Fluid Dynamics, Springer-Verlag Eds.

Keywords

CFD, finite difference method, finite volume method, Navier-Stokes equations

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT	EXAM
English	5	10 hrs	4 hrs	8 hrs	8 hrs	2 hrs

URBAN REALITIES REVIEW

CITY AND URBAN ENVIRONMENTS – ATMOSPHERE, WATER & ENVIRONMENT
YEAR 1 SPRING 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 formation and transformations of a city.
- More specifically, analyze the issues that govern a large city.
- Identify and work on urban environmental issues.

Course contents

What do we know about a city? What are its origins?
From what size of agglomeration can one speak of city?
How does it develop?
How is its space organized and distributed?
Why do streets and buildings have such shapes?

The course attempts to answer these questions through a case study on one or two cities (probably Bordeaux and Rochefort sur Mer, both south of Nantes). These cities will be the subject of a two-day study visit (in March or April).

An introduction in the form of lectures and tutorials will work on the definition of a city (geography, urban planning, architecture, etc.). Then the trip will be prepared beforehand with the students who will be entrusted with a thematic team presentation on site. On-site visits will be an opportunity to meet those responsible for urban management, architectural heritage and promoters of urban projects.

Course material

- Kevin Lynch, 1999, L'image de la Cité, trad. par Marie-Françoise Vénard et Jean-Louis Vénard de The Image of the City (1960), Paris, Dunod, 221p.
- Camillo Sitte, l'Art de bâtir les villes, Le Seuil
- Philippe Paneray, Analyse Urbaine. Editions Parenthèses

Keywords

Town planning, urban forms, relative density, architecture

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT	EXAM
English	4	6 hrs	8 hrs	16 hrs	0 hrs	2 hrs

URBAN MANAGEMENT AND PLANNING

CITY AND URBAN ENVIRONMENTS – ATMOSPHERE, WATER & ENVIRONMENT

YEAR 1 SPRING SEMESTER

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

Objectives

At the end of the course (30 hours + personal work) the students will have acquired knowledge on:

- French public policies and local authorities
- urban services
- urban planning and public development
- waste management
- mobility
- climate and energy
- water management
- urban risks management

Course contents

The aim is to propose - after a general introduction and a presentation of the local context by theme - an illustration of the coordinated implementation of Nantes Métropole's public policies in a specific area: the Pré-Gauchet / Malakoff district.

Course material

- Presentation based on slide show
- Brochures (activity report, news documents)
- Field visits
- Illustrations (plans, diagrams etc)

Keywords

urban services, urban planning, public development, waste management, mobility, climate and energy, water management, urban risks management

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT	EXAM
English	4	16 hrs	0 hrs	8 hrs	6 hrs	2 hrs

FLUID MECHANICS 2

CITY AND URBAN ENVIRONMENTS – ATMOSPHERE, WATER & ENVIRONMENT
YEAR 1 SPRING 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:

- Apply the potential flow theory to simple configurations in fluid dynamics.
- Identify the limitations of the potential flow theory.
- Identify the sources of head loss in an internal flow.
- Evaluate the necessary power of a pump in a hydraulic system.
- Calculate the forces exerted on an object in a flow using Euler's theorem.
- Design experimental facilities for head loss identification and force measurements.

Course contents

This course is a follow-up to 'Fluid Mechanics 1', which presents the fundamentals and general principles of fluid mechanics. The aim is now to provide simple tools/formula to extract global information useful from an engineering point of view for a fluid mechanics' problem. The lectures cover the following topics:

- Potential flows
- Transport theorems and integral balances in fluid mechanics
- Head losses and the generalized Bernoulli's equation
- Momentum balance: Euler's theorem

In addition to those lectures, tutorials and different 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, Potential flows, Integral balances, Head losses, Force, Viscosity, Pressure, Navier-Stokes, Hydraulic system.

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT	EXAM
English	5	8 hrs	10 hrs	12 hrs	0 hrs	2 hrs

ENVIRONMENTAL DATA ANALYSIS

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

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

Objectives

The course objectives are to:

- Introduce students to the complexities and challenges of characterization of natural systems and atmospheric flows in particular
- Provide the scientific basis for how environmental sensors work
- Evaluate and select appropriate measurement methods and sampling design to quantify key environmental variables & processes
- Study how sensors are deployed in the field, acquire and analyze data,
- Interpret and analyze laboratory and field data and report main findings

Course contents

Measurements provide an essential basis for understanding or deduction of physical processes and for validation of theory or numerical models. The present course aims to provide the students with an introduction to experimental methods in the framework of the study of atmospheric flows and micrometeorology, including both measurements techniques and data analysis methods.

Course material

Handbook of Experimental Fluid Mechanics, Springer;
Handbook of Micrometeorology, Kluwer;
Design and Analysis of Experiments, Springer.

Keywords

Atmospheric measurements, Micrometeorology, Sensors, Statistical analysis

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT	EXAM
English	4	12 hrs	10 hrs	8 hrs	0 hrs	2 hrs

MODERN LANGUAGES - FRENCH

CITY AND URBAN ENVIRONMENTS – ATMOSPHERE, WATER & ENVIRONMENT

YEAR 1 - SPRING 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

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 - SPRING SEMESTER

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

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.

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