

SHAKE THE FUTURE.



ENGINEERING PROGRAMME

SPECIALISATION

**ENGINEERING SCIENCE FOR
HOUSING AND URBAN
ENVIRONMENT**
AUTUMN SEMESTER

APPLIED THERMODYNAMICS

ENGINEERING SCIENCE FOR HOUSING AND URBAN ENVIRONMENT, ENGINEERING
PROGRAMME SPECIALISATION
AUTUMN SEMESTER

Professor: Jean-Francois HETET

Objectives

To acquire skills in applied thermodynamics and more particularly with applications to systems linked to urban engineering (energy production - building energy balance).

Course contents

The course builds on the first year course (semesters 5&6) in Applied Thermodynamics with specific applications to:

- gas turbines
- energy production cycles such as Rankine cycle
- thermal transfer
- reverse cycles such as heat pumps, AC systems

The course includes exercises and laboratory sessions. Students are also required to prepare presentations on energy issues.

Course material

Michel FEIDT - Energétique, concepts et applications, Dunod Ed. (2006)

Lucien BOREL et Daniel FAVRAT - thermodynamique et énergétique: de l'énergie à l'exergie, Presses polytechniques et universitaires romandes (2005)

Richard E. SONNTAG, Claus BORGNAKKE et Gordon J. VAN WYLEN - fundamentals of thermodynamics, Ed. Wiley & Sons (1998)

Renaud GICQUEL - systèmes énergétiques (3 volumes), presses des Mines Paris Tech (2009)

Keywords

energy - applied thermodynamics - energy production - cycles

Links with other programmes

First year course (semesters 5&6) in Applied Thermodynamics

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	3	20 hrs	10 hrs	0 hrs	0 hrs

URBAN ISSUES

ENGINEERING SCIENCE FOR HOUSING AND URBAN ENVIRONMENT, ENGINEERING
PROGRAMME SPECIALISATION
AUTUMN SEMESTER

Professor: Pascal JOANNE

Objectives

The main objective of this course is to take into account the complexity of the urban environment.

Course contents

Both the organic metaphor that compares the city to a living entity and the mechanistic metaphor, which sees it as a multifaceted system with multi-scale flows and exchanges, show, on the one hand, the fascination of man with the phenomenon of urbanization, and summarize, on the other hand, its great complexity. As an introduction to the following modules, the course aims to capture some of the keys to this complexity and tries to explain what makes the city today. It will highlight the problems of adaptation and response to natural and climatic phenomena of the urban environment.

Course material

Keywords

urban environment, urban management

Links with other programmes

Applied Thermodynamics

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	3	20 hrs	10 hrs	0 hrs	0 hrs

GEOGRAPHIC INFORMATION SYSTEMS AND DATABASES

ENGINEERING SCIENCE FOR HOUSING AND URBAN ENVIRONMENT, ENGINEERING PROGRAMME SPECIALISATION
AUTUMN SEMESTER

Professor: Jean-Yves MARTIN

Objectives

To introduce the main elements for understanding databases, especially spatial databases which are used in Geographic Information Systems (GIS).

Course contents

This course is divided into 2 parts: theoretical and practical work.

The theoretical aspects include:

- Introduction to functional analysis
- The relational model theory
- From functional analysis to physical models
- Introduction to SQL
- Database security
- Introduction to PL/SQL
- GIS and spatial databases
- Introduction to XML and Spatial Data Infrastructure
- Introduction to Bim

Practical work includes:

- Building, creating and using a database
- GIS use

Course material

Keywords

Databases, Geographic Information Systems, Spatial Data Infrastructures, BIM

Links with other programmes

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	3	14 hrs	16 hrs	0 hrs	0 hrs

BUILDING ENGINEERING

ENGINEERING SCIENCE FOR HOUSING AND URBAN ENVIRONMENT, ENGINEERING
PROGRAMME SPECIALISATION
AUTUMN SEMESTER

Professor: Yvon RIOU

Objectives

This specialisation was created in order to cover the physical problems encountered at building, neighbourhood and city level. Within that context, it is important to deal with mechanics and, in particular, construction-related mechanics. The most important construction rules and methods are covered in this course in the form of lectures and tutorials focusing on very practical considerations.

Course contents

- The stakeholders and "structure" professions within construction.
- Eurocode standards
- Review of material strength
- Behaviour of reinforced concrete structures - beams, piles, slab
- Introduction to geotechnical risks
- Soil mechanics - in-situ tests, shallow foundations, deep foundations

Course material

Précis de Structures de Génie Civil, Projets, Dimensionnements, Normalisation - D. Didier et al., Afnor, Nathan

Les Eurocodes: Conception des bâtiments et des ouvrages de Génie Civil - Jean Moreau de Saint-Martin and Jean-Armand Calgaro, Edition le Moniteur, ISBN 2-281-12560-8

Keywords

Construction, structures, concrete, geotechnics

Links with other programmes

Building Technology

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	3	20 hrs	10 hrs	0 hrs	0 hrs

PROJECT 1

ENGINEERING SCIENCE FOR HOUSING AND URBAN ENVIRONMENT, ENGINEERING
PROGRAMME SPECIALISATION
AUTUMN SEMESTER

Professor: Jean-Francois HETET

Objectives

To undertake group work on topics linked to urban and civil engineering.

Course contents

Examples of topics:

- inter seasonal energy storage
- positive energy houses
- logistic potential of the Loire river
- energy balance of the new Nantes international high school
- waste management
- micro algae and energy production
- human activity as an energy source
- collaborative design of a new district
- participation in the development of the SOLAR DECATHLON demonstrator

Course material

Keywords

project, teamwork

Links with other programmes

All the courses of the specialisation.

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	1	0 hrs	0 hrs	0 hrs	32 hrs

AUTOMATIC SYSTEMS

ENGINEERING SCIENCE FOR HOUSING AND URBAN ENVIRONMENT, ENGINEERING
PROGRAMME SPECIALISATION
AUTUMN SEMESTER

Professor: Jean-Francois HETET

Objectives

This class objective is to give a global vision of existing automatic systems, their constraints, their capabilities, limitations and benefits in the scope of the city and the dwelling. The issues these systems must face will also be addressed (comfort, energy use, travels, etc.) Finally, the factors of decisions and selection of those systems elements will be given.

Course contents

Starting from the most simple form of automatism, towards the most advanced and complex systems, the full scope of existing and future technologies will be explained. These explanations will be completed by information about the essential elements necessary to the good performance of those systems (sensors, actuators, PLCs, etc.)

Course material

Keywords

Automatic system, intelligent system, control, comfort

Links with other programmes

HVAC components

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	3	20 hrs	10 hrs	0 hrs	0 hrs

ACOUSTICS, LIGHT AND SOLAR RADIATION

ENGINEERING SCIENCE FOR HOUSING AND URBAN ENVIRONMENT, ENGINEERING

PROGRAMME SPECIALISATION

AUTUMN SEMESTER

Professor: Jean-Francois HETET

Objectives

Part 1) Physical acoustics and perception, room acoustics and building acoustics

The course focuses firstly on physical acoustic concepts (equations of propagation and classical solutions, magnitudes of energy, spectral analysis and thin band frequency band etc) that are fundamental to the understanding of the topics to follow. Secondly, concepts of acoustic perception (hearing thresholds, perceived intensity and frequency, localization of sound sources in space etc) are developed. The last section focuses specifically on the issue of construction; in addressing the topics of room acoustics (theory, acoustic characterization of a room, acoustic simulation etc) and construction (rules based, standards, measurement methods, acoustic treatment etc).

Part 2) Daylighting

This part of the course develops the understanding of daylighting in the fields of architecture and town planning. The objective is to know which physical and radiative phenomena are sources of natural light and its distribution. This leads to managing natural light strategies for architectural and urban projects, which implies analysing the control and distribution devices of natural light. These physical aspects will be completed by an analysis of visual comfort, which uses more subjective concepts mostly related to user behaviour. To estimate the photometric parameters related to the control of natural illumination, the course will focus on more or less complex design tools, from measurement in situ to predictive computing tools.

Part 3) Solar Radiation

This course deals with the nature of solar movements that reveal the potential of sunshine duration and the solar energy resources of a site or a constructed space. This theoretical knowledge of solar geometry facilitates the use of simple control techniques and the evaluation of the period of sunshine for the various components of the building and the urban spaces. To estimate solar contributions, a number of various techniques will be presented. They will describe the construction of manual drawings and the use of solar diagrams, as well as computing methods and tools. Practical sessions will focus on using these tools to build and analyse shade, to define sunshine durations; or to estimate the influence of distant masks and protective devices on energy contributions.

Course contents

Part1) Physical acoustics and perception, room acoustics and building acoustics

- Physical acoustics
- Perception of sound
- Room acoustics
- Building acoustics

Part 2) Daylighting

- Direct and diffuse light
- Normalized skies and simulation methods

- Light reflection: color and texture of materials
- Photometry
- Perception and comfort; contrast and glare
- Daylight factor

Part 3) Solar Radiation

- History of the consideration of the period of sunshine in the architectural and urban project
- Solar geometry
- Construction and use of solar diagrams
- Solar simulation algorithms
- Solar simulation examples using SOLENE software

Course material

Passive Solar Energy Book, Edward Mazria

The reasoning architect, Mathematics and Science in Design, Garry Stevens

Sol Power, the evolution of solar architecture, Sophia Behling, Stefan Behling

Glen Murcutt, Françoise Fromonot

Daylighting, Natural Light in Architecture, Derek Phillips, Elsevier, 2004

Daylighting, Architecture and Health, Mohamed Boubekri, Elsevier, 2008

Tips for Daylighting with Windows, Jennifer OConnor, LBNL, 1997

Keywords

Physical acoustics, perception of sound, room acoustics, building acoustics, sunshine, solar geometry, solar diagrams, simulation, natural lighting, direct, diffuse, skies, photometry, daylight factor

Links with other programmes

Noise management

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	3	20 hrs	10 hrs	0 hrs	0 hrs

VIRTUAL REALITY

ENGINEERING SCIENCE FOR HOUSING AND URBAN ENVIRONMENT, ENGINEERING
PROGRAMME SPECIALISATION
AUTUMN SEMESTER

Professor: Florent LAROCHE

Objectives

Today Virtual Reality technologies are widely used. Tools and models are developing exponentially in both everyday life as well as for professional use.

This course aims to introduce tools, methods and applications using virtual reality. From 3D scanning to modeling and simulation, to immersive visualization, students will have an overview of the possibilities offered by those technologies. They will not become experts, but they will be more aware of the virtual world and able to re-use these skills in their future profession.

Course contents

This course includes lectures and tutorials as well as the participation of industry experts and/or researchers on small projects alongside the students in acquire first-hand experience. The topics are: tracking, 3D modeling, ergonomics, sounding, photogrammetry.

Course material

Keywords

Links with other programmes

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	3	20 hrs	10 hrs	0 hrs	0 hrs

URBAN HYDROLOGY AND ATMOSPHERE

ENGINEERING SCIENCE FOR HOUSING AND URBAN ENVIRONMENT, ENGINEERING
PROGRAMME SPECIALISATION
AUTUMN SEMESTER

Professor: Béatrice BECHET

Objectives

To provide scientific concepts necessary to understand the atmospheric, hydrologic, geochemical and hydrodynamic processes, and their interactions with soil-surface-atmosphere interfaces influencing the microclimate and air, water and soil quality.

Course contents

Part 1 - Hydrology

- Water cycle: water fluxes and matter flows
- Hydrographic networks and water transfer processes (atmosphere-surface-soil)
- Biogeochemical cycles, components and soil reactivity, transfer processes of matter (surface-soil)
- Urban environment specificities: water cycle modifications, sewer networks, urban water, waste water, treatment processes

Part 2 - Atmosphere

- Urban atmosphere: issues and context
- Atmospheric boundary layer simplified equations
- Basic knowledge of turbulence, statistical tools and characteristic scales
- Dynamics of the atmospheric boundary layer: stratification, diurnal evolution, plume dispersion
- Surface layer processes: energy balance, similarity theory

Course material

Keywords

Fluid mechanics, energy budget, transfers, soil-surface-atmosphere interactions, waste water quality and treatment

Links with other programmes

Physics and fluid dynamics, Applied Urban hydrology and atmosphere, Noise and waste management

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	3	20 hrs	10 hrs	0 hrs	0 hrs