2SC5490 – Design project for an eco-neighborhood

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Department: DOMINANTE - GRANDS SYSTÈMES EN INTERACTION, DOMINANTE - CONSTRUCTION VILLE TRANSPORTS
Language of instruction: FRANCAIS
Campus: CAMPUS DE PARIS - SACLAY
Workload (HEE): 40
On-site hours (HPE): 27,00

Description
The purpose of the integration project is to make the preliminary design of an eco-district.
Projects are carried out in groups of about twenty students. However, they are also broken down into smaller elements, called district modules (residential buildings, public equipment, roads, and networks).
Each team should find solutions to satisfy several objectives (the eco-district referential). Some of these objectives are at the district level (urban shape, economic balance, ...).
Several deliverables are expected at all scales: individual level, team (sub-group), and group.

Quarter number
ST5

Prerequisites (in terms of CS courses)
Specific module : sustainable urban planning

Syllabus
(if the case is confirmed)

The Corbeville ZAC: what future in the short, medium, and long term for this space near the interchange of the N118? A project was submitted by the EPAPS to a public inquiry in the spring of 2019. One or more significant parameters of the existing studies are modified (political orientation, mobility solutions, the ambition of density, ...). We propose to analyze the consequences of these changes on the urban project.

Input data :
- Historical aerial photo

- Maps available on geoportal (in particular IGN with topography, watercourse, and existing building)
- Insee data available online
- Program and guide EPAPS of the district of Moulon

Class components (lecture, labs, etc.)
Sprint-based project (3 sprints of 1,5 days each).
Self-organized and connected teams within the group, sprint reviews with each group supervisor.
Opportunity to get specific expertise during some sessions.
Deliverables must be done throughout the week (detailed schedule presented the first day).

Grading
Continuous assessment, based on group deliverables. An individual deliverable is also assessed.

Resources
Supervisors and experts are professors, architects, urbanists, engineers, researchers, ...
Franck Marle, Frédérique Delmas, Ulisse Vizzardi, Romain Iliou, Loup Calosci, François Cointe, François Cluzel, Arnaud Lafont,

Learning outcomes covered on the course
Upon completion of this module, students will progress in:
- using a transdisciplinary approach to complex eco-districts design
- using scientific, technological, social, and economic knowledge to design and validate such a complex system
- applying a collaborative project management approach to attain desired results

Description of the skills acquired at the end of the course
C1.4 Design, detail and corroborate a whole or part of a complex system.
C1.5 Bring together broad scientific and technical concepts in a core structure that is nestled in an interdisciplinary approach.
C3.6 Evaluate the efficiency, feasibility and strength of the solutions offered.
C7.1 Persuade at the level of core values; to be clear about objectives and expected results. To apply rigour when it comes to assumptions and structured undertakings, and in doing so structure and problematise the ideas themselves. To make the added value known.
C8.4 Work using project management techniques appropriately tailored to the situation
C9.4 Demonstrate rigour and critical thinking in approaching problems from all angles, be they scientific, social or economic.

ST5 – 55 – LIGHT AND MATTER : DEVELOPMENT OF HIGH TECHNOLOGY INSTRUMENTS

Dominante : PNT (Physics & NanoTechnology)
Langue d'enseignement : French
Campus où le cours est proposé : Paris-Saclay

Engineering problem

Modern physics has many outlets through the control of the properties of matter and its functional engineering. In this ST, students will be confronted with the problem of innovation and product development when it is a high-tech instrument using physics, developed in small series for research or R&D. In particular, the students will answer the following questions
- how to qualify and respond to a customer need in this context?
- which approach to design, realization and evolution to implement?
- how to design a solution for an intermediate customer who has customers with various needs?

The integration courses concern devices at the cutting edge of physics requiring a real engineering approach since the theoretical concepts are applied to real devices that must integrate elements of feasibility both technical and economic.

Adviced prerequisites

It is recommended to have taken the SPI course of Wave Physics or Transfer Science

Context and issue modules: This part is structured around half-day training sessions aimed at presenting the sequence, the integration lessons and introducing the theme. The following lectures/presentations will be organized:
- Presentation of the theme and its challenges
- Round-table discussion on professions: What is a physics engineer?
- Visit of a company
- Presentation of the EI

Specific course (60 HEE): *Physics of Matter*

Brief description: The course will provide students with a basic understanding of the physics of solid state matter. Crystallography and wave diffraction (especially X-rays), lattice vibrations (phonons, thermal effects), electronic states (Sommerfeld model, band theory), as well as specific topics: semiconductors, defects, superconductivity will be covered. The goal

is to show students that the understanding and control of material properties requires studies at the microscopic scale**.**

Challenge Week n°1 : *Synchrotron Beamline Design*

- Associated partners: European Synchrotron Radiation Facility (ESRF, Grenoble), SOLEIL synchrotron (Gif-sur-Yvette), NSLS synchrotron (Brookhaven, USA)

- Location: Paris-Saclay campus

- Brief description:
The objectives are the following:
- To dimension a device using basic (modern) physics notions and to do functional modeling.
- Identify the relevant heat transfers, model them, and size these systems.
- Know the key points of a pre-project study in a multidisciplinary context
- Have realistic orders of magnitude on the standard mechanical and physical properties of "common" materials.
- Carry out a preliminary design of the scientific instruments studied, justifying the choices made.
- Work in a team, know and be able to identify the different roles of the members of a team, lead and coordinate a work group, collect and share information, format and present the work done (express oneself in front of an audience / defense)

Challenge Week n°2 : *Quantum cascade lasers*

- Associated partners: Airbus Defence and Space, Thales

- Location: Paris-Saclay campus

- Brief description: Quantum cascade lasers are nano devices invented about 20 years ago. Engineering miracles, their operation has been made possible by the latest advances in quantum mechanics, optics and thermics. Due to their very small size, operating wavelength and precision, they are a technological solution of choice for the detection of minute traces of pollutants as well as high-speed communications in free space.

In a team work, the students will be brought to familiarize themselves with these notions and to acquire the mathematical elements necessary to numerically model the behavior of these systems. They will have to implement an engineering approach to transform their theoretical knowledge into an object constrained by the reality of the world.