2SC5591 – Synchrotron Beamline design

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Department: DOMINANTE - PHYSIQUE ET NANOTECHNOLOGIES
Language of instruction: FRANCAIS
Campus: CAMPUS DE PARIS - SACLAY
Workload (HEE): 40
On-site hours (HPE): 27,00

Description

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Each team shall be supported by experts working in French and European synchrotrons, through daily video interviews.

One of the team shall design a beamline able to perform angiography on a human patient and the other team shall design a beamline able to detect the presence of a cancer-inducing isotope of Chromium in a frog ovarian cells.

Quarter number

ST5

Prerequisites (in terms of CS courses)

Basic knowledge in modern physics and heat transfer. Mechanical engineering skills will be useful

Syllabus

This module is a project-based learning activity, with emphasis on the following topics:

- Crystallography, radiation by an accelerated particule, fluorescence, absorption, scattering, diffraction of short wavelength radiation
- Heat transfer: convection, radiation, conduction, fluid mechanics
- Computer-Aided Design (CAD), numerical modeling, design pre-project, pre-scaling of mechanical systems.

- Selection of materials, standard mechanical properties, strength of materials in an extreme environment, surface states, elaboration and shaping processes

Experiencing teamwork under time pressure, chairing a meeting, oral expression

Class components (lecture, labs, etc.)

Students will work in project mode during the one-week module and will attend preparation and debrief sessions on prior and subsequent weeks.

The students enrolled in this course must attend the final defense, at synchrotron SOLEIL; it is followed by a visit of the SOLEIL facility.

Grading

1/2 on the involvement during the week (evaluated by the profs as well as the other team members) and evaluation of the C1, C2, C4, C6 skills
1/4 on the final presentation (one presenter per group, everybody in the group gets the same grade) and evaluation of the C7 skill
1/4 on the final report (common grade for the entire team) and evaluation of the C7 skill

Course support, bibliography

Reference textbooks and databases. ShareDoc (asynchroneous collaborative platform), Adobe Connect (video-conferencing and synchroneous collaborative work platform), Spaceclaim (CAD) and Comsol (heat transfer).

Resources

The use of CAD tools (e.g. SPACECLAIM or SOLIDWORKS) is encouraged. Students who wish to learn these tools will be given access to a license of SPACECLAIM and will be provided with online tutorial sessions. Alternate design tools (drawings, models,...) are also very useful, in particular for the design of specific components of the beamline.

Learning outcomes covered on the course

- apply design concepts using basic notions of modern physics
- identify the key heat transfer modes to model and design systems. Use Comsol.
- know the key points for a pre-project study in a multidisciplinary context

- master the use of Ashby diagrams for materials selection
- understand orders of magnitude for mechanical and physical properties of usual materials
- develop teamwork abilities, know and identify different roles in a team (on the basis of Belbin tools); manage a workgroup, collect and share information, shape and defend the results of the work in front of an audience / a jury.

Description of the skills acquired at the end of the course

C1 : Analyze, design, and build complex systems with scientific, technological, human, and economic components

C2 : Develop in-depth skills in an engineering field and a family of professions

C4 : Have a sense of value creation for his company and his customers

C6 : Be operational, responsible, and innovative in the digital world

C7 : Know how to convince