Nuclear reactor physics

Lecturer
Pierre-Etienne LABEAU (Coordinator)

Course mnemonic
PHYS-H406

ECTS credits
5 credits

Language(s) of instruction
English

Course period
First term

Campus
Solbosch

Course content

Introduction to the physics of nuclear reactors, transport equation, elements of Monte Carlo simulation applied to transport problems, diffusion approximation, multigroup model, criticality, diffusion and neutron slowing down, resonance integrals, reactivity control, elements of reactor kinetics.

Objectives (and/or specific learning outcomes)

Understand the physical concepts underlying how a nuclear reactor works. Model the evolution of the neutron population in a reactor. Understand the associated numerical methods.

Teaching method and learning activities

Oral lectures + tutorials. General introduction on how a nuclear plant (mainly a pressurized water reactor, PWR) works, given by someone from the nuclear industry. Oral lectures with powerpoint support aiming to emphasize on the physical interpretation of the mathematical modeling. Tutorials allowing to use the concepts developed during the lectures, and presenting simplified reactor design problems.

The course is also available online, given the sanitary situation.

Contribution to the teaching profile

Contribution to the bridge between microscopic (i.e. nuclear) physics and the application of nuclear reactor physics. Development of the skills of the students in the mathematical modeling of systems.

References, bibliography and recommended reading

J.J. Duderstadt and L.J. Hamilton, "Nuclear Reactor Analysis", Wiley et Sons, New York, 1976. P. Reuss, "Précis de Neutronique", EDP Sciences, Collection Génie Atomique, Les Ulis, 2003. I. Lux and L. Koblinger, " Monte Carlo Particle Transport Methods: Neutron and Photon Calculations ", CRC Press, Boca Raton, 1991.

Other information

Place(s) of teaching

Solbosch

Contact(s)

Métrologie nucléaire Bât D, Porte B, Niv 3, local 153 Tél : 02/650 20 60 - Mail : pierre.etienne.labeau@ulb.be

Evaluation method(s)

Other

Evaluation method(s) (additional information)

The exam (written for the 1st session, potentially oral for the 2nd session if the number of students is limited) covers both theory and exercises. A group project is done at the end of the course.

A first part of the exam, in closed-book format, covers the theory of the first 6 chapters. A second part, in open-book format, consists of questions of reflection and understanding on the whole course, as well as exercises.

Determination of the mark (including the weighting of partial marks)

Theory (closed-book) 40%, project 10%, questions of reflection and exercises 50%

Main language(s) of evaluation

English

Programmes

Programmes proposing this course at the Brussels School of Engineering

MA-IRPH | Master of science in Physical Engineering | finalité Professional/unit 1