Summary
This course is intended to understand the engineering design of nuclear power plants using the basic principles of reactor physics, fluid flow and heat transfer. This course includes the following: Reactor designs, Thermal analysis of nuclear fuel, Nuclear safety and Reactor dynamics.

Content

Brief review of nuclear physics
- Nuclear reactions and radioactivity - Cross sections - Introductory elements of neutronics.

Neutron diffusion and slowing down
- Monoenergetic neutrons - Angular and scalar flux - Diffusion theory as simplified case of transport theory - Neutron slowing down through elastic scattering.

Reactor dynamics
- Point reactor model: prompt and delayed transients - Practical applications - Reactivity variations and control

Nuclear safety principles
- Defense in Depth - Radiation protection - Design Basis Accidents - Beyond Design Basis Accidents phenomenology - Fukushima Accident

Nuclear Reactor Technology
- Gen-II/III, active & passive safety systems - Gen-IV - reactor concepts: SFR, LFR, HTR, MSR

Non-power applications of nuclear engineering
- research reactors - isotope production - medical and irradiation applications -

Waste Management
- transport, intermediate storage - waste conditioning - geological disposal and siting - reprocessing - Partitioning & Transmutation

Learning Outcomes
By the end of the course, the student must be able to:
- Elaborate on neutron diffusion equation
- Formulate approximations to solving the diffusion equation for simple systems
- Describe various nuclear reactors concepts
- Explain nuclear safety principles

Assessment methods

Resources
Bibliography

Ressources en bibliothèque

• Introduction au génie nucléaire / Ligou