Summary

In this course, one acquires an understanding of the basic neutronics interactions occurring in a nuclear fission reactor as well as the conditions for establishing and controlling a nuclear chain reaction.

Content

• **Brief review of nuclear physics**
  - Historical: Constitution of the nucleus and discovery of the neutron - Nuclear reactions and radioactivity - Cross sections - Differences between fusion and fission.

• **Nuclear fission**
  - Characteristics - Nuclear fuel - Introductory elements of neutronics.
  - Fissile and fertile materials - Breeding.

• **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.

• **Multiplying media (reactors)**
  - Multiplication factors - Criticality condition in simple cases.

• **Reactor kinetics**
  - Point reactor model: prompt and delayed transients - Practical applications.

• **Reactivity variations and control**
  - Short, medium and long term reactivity changes. Different means of control.

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

• Classify nuclear reaction cross sections

Transversal skills

• Access and evaluate appropriate sources of information.
• Collect data.
• Use both general and domain specific IT resources and tools

Teaching methods
Lectures, numerical exercises

Assessment methods
oral exam (100%)