UCLouvain

lbnen2003

2020

Safety of Nuclear Powerplants (Centre d'étude nucléaire-Mol)

Due to the COVID-19 crisis, the information below is subject to change, in particular that concerning the teaching mode (presential, distance or in a comodal or hybrid format).

5 credits		Q2

Language :	English
Place of the course	Autre site
Aims	To introduce the students to methods and practices supporting the defense-in-depth approach for nuclear power plants. More specifically: 1 • To present elements of nuclear safety philosophy. • To understand how to insure the link between nuclear safety and reactor operation. • To master all the contributors to the core reactivity balance and power distribution in normal operation. • To understand specific measurement and control issues in nuclear reactors. • To introduce the basic notions and techniques of system reliability engineering. • To understand the concepts of safety analyses (both deterministic and probabilistic), and the fundamentals of probabilistic safety analysis (PSA). • To present some PSA-based applications. - - - - *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** Operation & Control First and second session: Individual oral exam, closed book, written preparation Reliability & Safety First and second session: An oral examination (closed book) with one question on the concepts and one exercise
Content	Operation & Control (28h) • Cycle specific safety evaluation methodology. • Basic principles of the in-core fuel management based on the linear reactivity model. • Reactivity coefficients (moderator, Doppler), neutron poisons (xenon, samarium, '), their variation with burnup and core state parameters and their impact on core power distribution • Reactivity control means (boron, control rods, burnable poisons) and their sensitivity to the core burnup and in-core fuel management parameters. • Operating modes, operating limits and protection diagram. • Fuel rod design and thermal-mechanical behavior in normal operation and accidental conditions. • Thermal design procedures and elaboration of the core thermal limits and core protections. • Core control, surveillance and protection systems **Optional** visits and laboratory session: • Visit of a Nuclear Power Plant. • Two day session of compact and full scope Nuclear Power Plant simulator. Seminars: Overview of design basis accidents and severe accidents; Discussion of selected past nuclear (severe) accidents (TMI, Chernobyl, Fukushima-Daiichi...) Reliability & Safety (14h theory + 6h exercises) • Introduction to nuclear safety and defence in depth • concept of risk, individual and societal risk criteria, release limits, core damage frequency limit, safety goals at function or system level • deterministic vs. probabilistic safety analyses; • probabilistic safety assessment (PSA) methodology and PSA levels • Component reliability • Fault tree and event tree analysis • Markov analysis • Common cause failure analysis

	• Elements of human reliability analysis • Elements of the level 2 and level 3 PSA methodology • Limits of the classical PSA methodology • PSA-based applications
Inline resources	https://www.sckcen.be/fbnen
Other infos	Course location: SCK-Cen (Mol) **Prof. Greet Janssens-Maenhout** -Universiteit Gent NN - Universiteit Gent **Prof. Pierre- Etienne Labeau** -Université Libre de Bruxelles
Faculty or entity in charge	EPL

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Aims
Master [120] in Electro-mechanical Engineering	ELME2M	5		
Advanced Master in Nuclear Engineering	GNUC2MC	5		
Master [120] in Mechanical Engineering	MECA2M	5		