UCLouvain

lbnen2021

2019

Advanced Nuclear Materials (Centre d'étude nucléaire-Mol)

In view of the health context linked to the spread of the coronavirus, the methods of organisation and evaluation of the learning units could be adapted in different situations; these possible new methods have been - or will be - communicated by the teachers to the students.

3 credits		Q2

Language :	English
Place of the course	Autre site
Main themes	The ex cathedra part of the course covers the following main topics: * Functional requirements of materials in a nuclear environment (J. Lecomte-Beckers 1 ECTS) • Nuclear materials: fuel, fuel cladding, moderator/reflector, coolant • Structural materials: reactor internals and vessel, piping, valves * Advanced treatment of irradiation effects in materials: radiation damage mechanisms at microscopic level (E. van Walle 1 ECTS) * Corrosion problems in nuclear reactors: material behaviour and material requirements, technological aspects and environment-sensitive damage, with emphasis on light water reactors, in general, and steam generators, in particular (W. Bogaerts 1 ECTS) Some of these topics are further elaborated during seminars and visits to the SCK'CEN laboratories (incl. hot cells) (E. Van Walle) * Basic measurements: source strength, neutron flux (activation analysis, neutron counting), neutron spectrum (time of flight methods, unfolding methods), reaction rates * Activity, dose and cross-section measurement * Measurement of neutron transport parameters: stationary methods, pulsed neutron experiments * Measurement of reactivities (and reactivity coefficients): survey, static methods, dynamic measurements, inverse kineticsStatistical fluctuation method: reactor noise, mathematical analysis, applications (Rossi-alpha, sign correlations, zero crossings)
Aims	1 To provide the students with advanced treatment of the corrosion and embrittlement degradation mechanisms of materials in nuclear environments. - - - - *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.** Oral examination; written preparation.
Inline resources	https://www.sckcen.be/fbnen
Bibliography	The PowerPoint presentations of the lectures are available on the BNEN website. Other useful references: • Fontana, M.G., Corrosion Engineering, 3rd Ed., McGraw-Hill, 1986. • Bogaerts, W.F., Active Library on Corrosion (CD-ROM), 2nd Ed., Elsevier, 1998. • Benjamin, M., Nuclear Reactor Materials and Applications, Van Nostrand Reinhold, 1983. • Glasstone, S. & A. Sesonske, Nuclear Reactor Engineering, 4-th Ed, Vol 1, Chapman & Hall, New York, 1994 (Chapter 7: Reactor Materials, pp 406-462). • Cahn, R.W., Haasen, P., Kramer, E.J., Materials Science and Technology, Volume 10 B, Volume editor Frost B.R.T. , Chapters 7-9
Other infos	This course is part of the Advanced Master programme in nuclear engineering organized by the Belgian Nuclear Higher Education Network (BNEN). BNEN is organised through a consortium of six Belgian universities and the Belgian Nuclear Research Centre, SCK-CEN and takes place at the SCK-CEN in Mol. **Prof. Jacqueline Lecomte-Beckers** ' Université de Liège **Prof. Eric van Walle** ' Katholieke Universiteit Leuven **Prof. Walter Bogaerts** - Katholieke Universiteit Leuven

Faculty or entity in charge	EPL

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Aims
Advanced Master in Nuclear Engineering	GNUC2MC	3		