

3.00 credits

Q2

Language :	English
Place of the course	Autre site
Prerequisites	The following BNEN course is a prerequisite <ul style="list-style-type: none"> • Nuclear Materials
Main themes	<p>The ex cathedra part of the course covers the following main topics:</p> <ul style="list-style-type: none"> * Functional requirements of materials in a nuclear environment (J. Lecomte-Beckers 1 ECTS) <ul style="list-style-type: none"> • 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) <p>Some of these topics are further elaborated during seminars and visits to the SCK'CEN laboratories (incl. hot cells) (E. Van Walle)</p> <ul style="list-style-type: none"> * 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 kinetics Statistical fluctuation method: reactor noise, mathematical analysis, applications (Rossi-alpha, sign correlations, zero crossings)
Learning outcomes	<p>At the end of this learning unit, the student is able to :</p> <ol style="list-style-type: none"> 1 To provide the students with advanced treatment of the corrosion and embrittlement degradation mechanisms of materials in nuclear environments.
Evaluation methods	Oral examination; written preparation.
Inline resources	https://www.sckcen.be/fbnen
Bibliography	<p>The PowerPoint presentations of the lectures are available on the BNEN website.</p> <p>Other useful references:</p> <ul style="list-style-type: none"> • 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	<p>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.</p> <p>Prof. Jacqueline Lecomte-Beckers ' Université de Liège Prof. Eric van Walle ' Katholieke Universiteit Leuven Prof. Walter Bogaerts - Katholieke Universiteit Leuven</p>
Faculty or entity in charge	EPL

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Advanced Master in Nuclear Engineering	GNUC2MC	3		