UCL Université catholique de Louvain

LMECA2648

2012-2013

Nuclear thermal-hydraulics.

6.0 credits	40.0 h + 7.5 h	2q

Teacher(s) :	Bartosiewicz Yann ;
Language :	Anglais
Place of the course	Louvain-la-Neuve
Main themes :	-- Reactor heat generation -- Transport equations (single-phase & mp; two-phase flow) -- Thermal analysis of fuel elements -- (Single-phase fluid mechanics and heat transfer)'usually already known -- Two-phase flow dynamics -- Two-phase heat transfer -- Single heated channel; steady state analysis -- Single heated channel; transient analysis -- Flow loops -- Utilisation of established codes and introduction to advanced topics (modelling and thermalhydraulics for GEN4 reactors)
Aims :	-- To be familiarised with various reactor types and their main design and operational characteristics -- To learn how to estimate the volumetric heat generation rate in fission reactor cores under normal operation and shutdown conditions -- To learn how to analyse the thermal performance of nuclear fuel elements -- To learn the basic fluid mechanics of single phase reactor cooling systems -- To learn to calculate pressure drop in reactor systems, including tube bundles, and spacer grids -- To learn to analyse the heat transfer characteristics of single phase reactor cooling systems -- To learn the basic fluid mechanics of two-phase systems, including flow regime maps, void-quality relations, pressure drop, and critical flow -- To learn the fundamentals of boiling heat transfer, and its implications for reactor design -- To learn the fundamentals of core thermal design, with attention to design uncertainty analysis and hot channel factors. *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 :	Closed book - oral
Teaching methods :	-- 2 t.m.: 40h teaching + seminar and 15h practical works in classroom -- SCK.CEN guidance for demonstrations with codes -- SCK.CEN + UCL TA for practical works The course takes place at the Nuclear Research Centre of Belgium (SCK.CEN) in gthe framework of the BNEN interuniversity programme (see: http://www3.sckcen.be/bnen/). One makes use of the software available at the research centre.
Content :	-- Reactor heat generation -- Transport equations (single-phase & mp; two-phase flow) -- Thermal analysis of fuel elements -- (Single-phase fluid mechanics and heat transfer)'usually already known -- Two-phase flow dynamics -- Two-phase heat transfer -- Single heated channel; steady state analysis -- Single heated channel; transient analysis -- Flow loops -- Utilisation of established codes and introduction to advanced topics (modelling and thermalhydraulics for GEN4 reactors)
Bibliography :	REFERENCE BOOKS ON THE CONTENT -- Todreas, N.E. and Kazimi, M.S. Nuclear System I: Thermal Hydraulic Fundamentals, Hemisphere Publishing Corp., New York, 1990 -- Todreas, N. E. and Kazimi, M.S. Nuclear Systems II: Elements of Thermal Hydraulic Design, Hemisphere Publishing Corp., New York, 1990.

Other infos :	Yann BARTOSIEWICZ yann.bartosiewicz@uclouvain.be Professor at the Université Catholique de Louvain (UCL ' Louvain-la-Neuve) Master in Turbulence modeling and Transfer Phenomena, Ecole Nationale Polytechnique de Grenoble, France, 1998. PhD in Mechanical engineering, Université de Sherbrooke, Canada, 2003: Modeling of supersonic plasma jets in non-Local Thermodynamics Equilibrium Research fields: Fluid mechanics, heat transfer, compressible flows, two-phase flows, thermodynamics, computational fluid dynamics Teaching duties in BNEN: Nuclear Thermal Hydraulics Other research activities: scientific leader for UCL in European projects in nuclear thermal-hydraulics: NURESIM: CFD Simulation of instabilities in a stratified two-phase flows relevant to PTS scenario NURISP: Simulation of two-phase chocked flows during LOCA: implementation of non-equilibrium models in CATHARE 3 THINS: Direct and Large Eddy Simulation (DNS/LES) of convective heat transfer for low Prandtl fluids (Liquid metals) UCL Promotor of other projects in energy Other duties: Member of the CFD group at OECD, Member of the European Nuclear Engineering Network (ENEN) SCK REFERENCE PERSONS Simon Vanmaercke: simon.vanmaercke@sckcen.be
Cycle and year of study :	> Master [120] in Electro-mechanical Engineering > Master [120] in Mechanical Engineering
Faculty or entity in charge:	MECA