PhD intensive course

SIMULATION OF ACCIDENTAL THERMAL-HYDRAULIC PROCESSES

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4 - 15 February 2019

About the course:

The objective of this Course is the transfer of knowledge to the students in the fields of the principles of modelling of thermal hydraulic process; the mass, momentum and energy balance solution; the modelling of one phase and two phase flow. The state-of-the art best-estimate codes for analysis of unsteady thermal hydraulic process in the Nuclear Power Plants (NPP) will be introduced. The students will be learned on the main concept of design basis accidents in NPPs, the principle of deterministic safety analysis. The short overview of the state-of-the art best-estimate codes RELAP5, RELAP-SCDAPSIM, ASTEC will be presented.

Aim of the course:

The main aim of Course is to gain knowledge about the principles of the deterministic safety analysis of accidents in Nuclear Power Plants, modeling of the single and two-phase flow and the design and beyond design basis accident analysis in the nuclear energy.
The expected outcome of this Course is the background knowledge and understanding of the students on:

- transient and accidental processes in NPPs, main principles of deterministic safety assessment;
- modeling of processes in reactor core; heat transfer mechanisms in reactor systems;
- two-phase flow dynamics and heat transfer; limits on safe power removal from reactor cores;
- computational methods for simulation of reactor design basis and accidental processes (thermal-hydraulic).

Target group:

The target group of this Course is the students of master degree, PhD students, who are working (planning to work) involved in nuclear safety activities. Basic knowledge in the fields of reactor physics and thermal-hydraulics are pre-requisites for attending the Course.

The Course can also be useful for the master degree or higher educational level professionals employed in Nuclear Regulatory Authority and Technical Support Organizations.

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Course format, ECTS credits:

The module will be provided in the form of interactive lectures, and individual work (working classes performed by trainees). The Interactive lectures consist of two-thirds of the Course time. The remaining one-third will be covered by working classes.
To unify the initial background level of all trainees, the individual study of specified literature sources is necessary before the Course. The course reading materials will be e-mailed to the registered participants 3 weeks before the course.
On the last day of one week (lectures and working classes) course the home assignments to each participants will be distributed. The six (four) weeks period will be provided for the completion of this individual task. The on-line individual consultations (through e-mail) between the lecturer and trainees are foreseen.
Evaluation procedure of knowledge and abilities: in the end of Course the Exam will be organised.
Ten grade and gathered evaluation system will be applied. The work performed during the working classes, exam and individual work at participants home (home assignments) will be evaluated by grades. The final grade will be given after evaluation of home assignments of participants. The student will receive the final score after multiplication of particular grades by the lever coefficient and summation the products.

Study load: 9 ECTS credits

Main topics of the course:

- Transient and accident processes in nuclear energy (Deterministic safety assessment; Basic steps in accident analysis; Categorization of initiating events; Acceptance criteria).
- Description of heat and mass transfer processes (Mass, impulse and energy laws; Specific of single-phase flow modeling; Specific of two phase flow modeling; Modeling of heat transfer processes).
- Modeling of thermohydraulic processes in transients and accidents (System best estimate codes; Modeling of thermohydraulic processes in reactor cooling circuit and in compartments of NPP).
- Model development (Nodalisation; Nodalisation qualification; Validation & verification).

Examples of the transients modeling (Reactor operational occurrences; Loss-off coolant accidents; Anticipated transients without scram; Beyond design basic accidents).

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References:

1. International Atomic Energy Agency, Accident analysis of nuclear power plants, Safety Report Series No. 23, IAEA, Vienna, 2002.

2. Uškuras E., Kaliatka A., Basis of Modeling of Thermal Hydraulic Processes in Nuclear Reactors, e.ISBN: 978-609-02-0935-6

3. Uškuras E., Kaliatka A., Accident and transient processes at NPPs with channel-type reactors: monography // Kaunas: Lithuanian Energy Institute, 2006. Thermophysics: 28. 298 p. ISBN 9986-492-87-4.

Course schedule:

Start date: 4 February 2019, 9 a.m.

End date: 15 February 2019, 4 p.m.

Course fee:

12-day 9 ECTS course fee is 810 EUR . Travel and accommodation expenses *are not* included in course fee.

Course is free of charge for students who come to study under the Erasmus+ program.

Registration to the course:

Send inquiry to phd@ktu.lt
Registration deadline: 14 January 2019

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