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Integrated Course in Environmental Engineering

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The joint inter-faculty project was focused on the integration of existing approaches to environmental engineering of buildings for students of mechanical engineering, civil engineering and architecture at CTU in Prague.

Given the (increasing) complexity of energy/environmental systems, computer modeling and simulation is emerging as a viable approach to the design and performance evaluation of buildings and HVAC (heating, ventilating, air-conditioning) systems. The course, which has been introduced into curricula at the Faculties of Mechanical Engineering, Civil Engineering and Architecture aims to give an understanding of the theoretical and operational principles underlying this new technology.

The course presents the concepts, assumptions and limitations, which underline the methods currently used to appraise the energy performance of buildings and their associated environmental control systems. Particular attention is given to methods for representing and integrating building energy and mass transfer processes. The subjects are developed from basic principles assuming limited knowledge of computers and application software. The laboratory work is designed to demonstrate theoretical concepts introduced in the lectures, and to gain practical 'hands-on' experience in using information technology.

On successful completion of the course, students should appreciate the capabilities and limitations of the various methods for assessing the thermal behavior of buildings and HVAC systems, including energy efficiency and indoor comfort. They should also:

- appreciate that environments result from complex interactions of many energy and mass transfer mechanisms;
- have a basic knowledge of how to apply computer modeling and simulation to address this complexity;
- understand the theoretical and operational principles of contemporary modeling and simulation programs;
- appreciate the limitations of current design support and performance evaluation tools and the issues to be addressed to bring about their improvement;
- possess practical skills in using the technology in an environmental engineering context.

The course comprises 14 hours of lectures (either oral or self-study) and 42 hours of practical work. The computer laboratory work is aimed at learning how to use a UNIX workstation, and to become familiar with the practical aspects of energy and environmental

modeling and simulation. In the project part of the course, these technologies are used to evolve a practical environmental engineering problem of the student's own choice.

The course is taught in English using modern information technology, which improves the quality of education process at CTU and helps the students to become competitive at international level. All class materials are available in electronic format, either as hypertext (for self-study) on the Internet, or in the form of modeling and simulation software. The course consists of 2 main parts as outlined below.

Part 1: Design Tools in Energy Efficient Building Design

http://www.bwk.tue.nl/fago/hensen/courseware/class-tools/

Based on self-study of Web-based course material with assignments the students get an understanding of low energy design tool applications and capabilities. Although the course provides an understanding of design tool capabilities, it does not attempt to rigorously categorize, present definitive case studies or recommend a particular tool, but rather attempts to show the key concepts involved with a variety of tools and their possible applications.

Part 2: ESP-r Practical Training Course

http://www.bwk.tue.nl/fago/hensen/courseware/class-mod+sim/

This part comprises sets of practical exercises, which will make the students familiar with the main features of the ESP-r energy simulation system. The exercises are designed to progress every student from the category of novice up to intermediate level.

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