# RTU Course "Experiment planning and simulation of processes"

**11509 Vides aizsardzības un siltuma sistēmu katedra**

*General data*

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| Code | EAS715 |
| Course title | Experiment planning and simulation of processes |
| Course status in the programme | Compulsory/Courses of Limited Choice |
| Course level | Post-graduate Studies |
| Course type | Academic |
| Field of study | Environmental Engineering and Management |
| Responsible instructor | Claudio Rochas |
| Volume of the course: parts and credits points | 1 part, 4.0 Credit Points, 6.0 ECTS credits |
| Language of instruction | LV, EN |
| Possibility of distance learning | Not planned |
| Abstract | This course covers the basic aspects of experimental planning and provides an overview of different simulation tools for process simulation in energy and environmental engineering. The course is then centered on simulation of dynamic energy systems using TRNSYS computer tool. |
| Goals and objectives of the course in terms of competences and skills | The aim of the course is to give students and insight in experimental planning and knowledge of dynamic simulation techniques and information on different simulation tools and their advantages and disadvantages. Specific attention is paid for to give student knowledge of the dynamic simulation tool TRNSYS and transfer experience using TRNSYS to simulate different types of systems and buildings. |
| Structure and tasks of independent studies | This will involve the development of a system model in TRNSYS and the preparation of a seminar presentation and report including the description of the model and its components as well as any other important items. The student decides together with a instructor the contents of the project. In the seminar each student will present his/her own project for a maximum of 20 minutes. The presentation should include the background, implementation and results. The system should be demonstrated “live” in TRNSYS. |
| Recommended literature | 1. Course notes and compendium<br>2.TRNSYS, A Transient System Simulation Program - Version 16.0. Program Manuals. Klein, S.A., Beckman W.A. et.al, Solar Energy Laboratory, University of Wisconsin-Madison, USA, 2003.<br>3.ASHRAE. 2001. Handbook of Fundamentals. American Society of Heating Refrigeration, and Air Conditioning Engineers, Atlanta, Ga.<br>4.Meteotest (2003). Meteonorm handbook, Parts I, II and III. Meteotest, Bern, Switzerland. http://www.meteotest.ch<br>5.P. Wesseling, Principles of Computational Fluid Dynamics. Springer, 2001.<br>6.S. Turek, Efficient Solvers for Incompressible Flow Problems: An Algorithmic and Computational Approach, LNCSE 6, Springer, 1999.<br>7.J. Donea and A. Huerta, Finite Element Methods for Flow Problems. John Wiley & Sons, 2003.<br>8.James S.Clark, Alan E.Gelfand. Hierarchical Modelling for the Environmental Sciences. Oxford University Press, 2006. |
| Course prerequisites | Mathematic, physic, information technologies, thermal engineering and energy systems, basics knowledge on the analysis of dynamic systems and systems simulation. |

*Course outline*

| Theme | Hours |
|---|---|
| Experimental planning. | 6 |
| Introduction and presentation of simulation tools of energy and environmental engineering. | 4 |
| Dynamic simulation basics for energy and environmental engineering. | 2 |
| TRNSYS basis. | 6 |
| Standard model components and non-standard model components. | 4 |
| Fault finding. | 2 |
| Building simulation using TRNSYS. | 4 |
| Developing new components – basic of computer and routing programming. | 4 |
| Laboratory and practical work. | 32 |

*Learning outcomes and assessment*

| Learning outcomes | Assessment methods |
|---|---|
| The student will acquire the capability to planning methodologies and to the process of experimental planning. | Examination: Home works, exam, course work.<br>Assessment criteria: the student is able to develop a details plan adapted to the specific experimental situation. |

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| The student will be able to select appropriate simulation tools for a given field of application. | Examination: Home works, lab./pract.works, exam, course work.<br>Criteria: Given a certain application thea proper tool will be selected based on a qualitative and quantitative analysis of the problem. |
| The student will be able to build up complex TRNSYS models for energy and environmental engineering, including the possibility to develop new components for advance simulation and research studies. | Examination: Home works, lab./pract.works, exam, course work.<br>Criteria: Student is able to compile the system in TRNSYS selecting and program new components to be used in TRNSYS environment. |

*Study subject structure*

| Part | CP | ECTS | Hours per Week | | | Tests | | |
|---|---|---|---|---|---|---|---|---|
| | | | Lectures | Practical | Lab. | Test | Exam | Work |
| 1. | 4.0 | 6.0 | 2.0 | 1.0 | 1.0 | | * | |