Development of the compatible electrical power engineering curricula of the Central Europe universities

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Abstract *— University of West Bohemia in Czech Republic, represented by the Department of Electric Power Engineering and Environmental Engineering, has extensive experience in the co-operation with the partner universities from the neighbouring countries - Germany and Slovakia. The aim of described Erasmus project is to support curricula compatibility and comparability of the existing Electrical Power Engineering MSc. study programmes offered by each partner university. The duration of project activity will carry over a period of three years. After three years, a total of three re-designed courses and three newly designed courses will have been introduced at each partner university. The partner universities will prepare a common textbook in English for each newly designed course. The curricula will be harmonized and the study requirements standardized. This will lead to the compatibility and comparability of study programmes and bigger competition of European higher education institutions. In addition, the project will promote student and staff mobility and improve language knowledge both students and staff.*

Index Terms *— Central Europe, compatible curricula, electrical power engineering, Erasmus project, tri-university partnership*

INTRODUCTION

Fifteen years after political changes in Central Europe (CE) took place, the harmonization of the educational systems in CE countries with European union (EU) standards is still a current issue. Even though university curricula and study programmes in these countries have undergone changes (e.g. the introduction of credit systems like ECTS) and as a result have approached EU standards, compatibility of entire curricula in CE and EU universities is still lacking. Hence, it is in the interest of the Czech Republic, especially in view of its accession status, to ensure a European dimension in university education through the continuous development of curricula compatibility. The uniform teaching in the field of electrical power engineering is necessary, in view of the rapid globalization and the monopolization of products and equipment in the field of power engineering.

University of West Bohemia (UWB) in Czech Republic, represented by the Department of Electrical Power Engineering and Environmental Engineering, has extensive experience in the co-operation with the partner universities from its neighbouring countries - Germany, Austria and Slovakia. They have been co-operating in student and staff mobility and in research over a long period of time. The EU programs as Socrates-Erasmus or Tempus have played a significant role in their Cupertino.

BASIC INFORMATION ABOUT UNIVERSITY OF WEST BOHEMIA

The University of West Bohemia in Pilsen (UWB) is the only institution of higher education in this part of the Czech Republic which prepares students for careers in engineering (electrical and mechanical), science (computer science, applied mathematics, physics, mechanics), education (for both primary and secondary school teachers in a wide range of subjects), fine arts, economics, humanities (philosophy, sociology, foreign languages, social and cultural anthropology, archaeology), law and public administration. Although it attracts students from all over the country and also from abroad, its main focus is on students from West Bohemia. In academic year 2003/2004 the university has 13 030 students and about 500 PhD. students.

UWB was established in 1991 when the Institute of Technology in Pilsen and the College of Education were merged. The Institute of Technology was founded in 1949 as the first institution of higher education offering electrical engineering courses in West Bohemia. During its history it was divided into two faculties - the Faculty of Electrical Engineering and the Faculty of Mechanical Engineering. At present the Faculty of Electrical Engineering is divided into five departments. The

Department of Electrical Power Engineering and Environmental Engineering belongs to the original departments. The Faculty offers the Bachelor, Master and PhD study programmes.

CO-OPERATION IN FRAMEWORK OF CLOSE CO-OPERATION

Participation of the Faculty in the EU programme ERASMUS was significant achievement. The total grant of EUR 8,000 obtained through this programme was used to organise student and staff mobility and an intensive courses entitled "Use of measurement methods in the solution of environmental problems" and "The effective use of physical theories of conversion of energy" [2], [3].

The University of West Bohemia in Pilsen (UWB), represented by the Department of Electrical Power Engineering and Environmental Engineering, has been co-operating with the neighbouring universities - Fachhochschule Regensburg (FHR), Germany, and Technical University Kosice (TUK), Slovakia, over a long period of time. International and European co-operation has played an essential role in the innovation and development of both education and research at all the partner institutions. In the years 2001-2003 the UWB initiated the harmonisation of courses offered at each partner university (Erasmus project "Harmonization of Electrical Power Engineering Curricula") [1].

PROJECT OBJECTIVES

New project "Integration of topical problems into electrical power engineering curricula" follows on the above project. Duration of this project is 3 years. The aim of this new project is to integrate topical problems related to power generation and distribution into electrical power engineering curricula and to harmonize teaching in this field within a tri-university partnership (UWB, FHR, TUK). The project complements the existing Electrical Power Engineering MSc. study programmes offered at each partner university. The proposed three core courses already exist, but their structure needs to be re-designed so as to include new topics and to ensure their compatibility. The three newly designed courses will enrich the existing MSc. study programmes of partner institutions. In terms of official recognition of the project results, the courses will be introduced into the MSc. study programmes and become compulsory courses at all the partner institutions.

PROJECT DESCRIPTION

The full degree programme "Electrical Power Engineering" at UWB is divided into two part: first degree programme (Bc. study programme) and second one (MSc. study programme). UWB offers also third one (PhD. study programme).
In the first period of study (1st and 2nd year) the students pass through in the following topic areas: Mathematical Analysis, Physics, Circuit Theory, Electrical Measuring and Materials, Electronic Elements, Theory of Electromagnetic Field and obligatory one foreign language (English, German, Russian, French, Spain, etc.), non obligatory the second foreign language.
In the second period of study (3rd – 5th year) the students pass trough in the following topic areas: Electronics, Electrical Machines, Transmission and Distribution of Electric Power, High Voltage Engineering, Transient Processes in Power Engineering, Electrical Drives and Power Electronics, Power Plants, Electrical Apparatus, Power Substations, Measurement Methods in H-V Engineering, Unconventional Power Sources.

The following already existing courses will be re-designed according to standard principles and uniform content so as to ensure compatibility of study programmes at each partner university:

- **University of West Bohemia, Czech Republic**
  - Power Lines and Substations - design of power lines and substations, trends of development, outdoor and indoor substations, equipment at LV, MV, HV,UHV substations, operational control of substations, automatic control systems in substations, back-up operation, overhead lines, cables, line rating, maintenance, operational reliability
  - Electrical Apparatus - switching devices, their function in electrical circuits. Theory of the arc. VI-characteristics of the stationary arc and dynamic arc. Conditions for interrupting AC and DC current by contact circuit breaker. Kind of switching devices, circuit breakers, contractors, fuses, electromagnets.
  - High Voltage Engineering - HV electro/insulation system of electric devices, machines and transformers. The influence of degradation factors on the lifetime of insulation systems. The HV insulation behaviour in the high and weak electric fields. Electric discharges in gas, liquid and solid dielectric. Partial discharges. Electrophysical processes in the electric arc. Surface discharges and protection against them. Impulse phenomena. Voltage, current and impulse processes in electric machines. Overvoltage protections. Insulators and cables in HV engineering.

- **Fachhochschule Regensburg, Germany**
    - Power engineering appliances (Energetische Anlagen)
    - Power Engineering and Electrical Apparatus (Energietechnik und Anlageautomatisierung)
    - High Voltage Engineering (Hochspannungstechnik)
- **Technical University Kosice (TUK), Slovakia**
    - Power Substations
    - Electrical Apparatus
    - High Voltage Engineering

The following courses will be newly designed according to standard principles and uniform content so as to ensure compatibility of study programmes at each partner university:

- **Power generation** - Classic thermal, hydro-, nuclear- and unconventional power plants. Problem of operating these power plants, of their starting, operating states, fault states effectiveness improvements either of single parts of the plants or the whole power plant. Design of different types of solar, wind, hydro and geothermal power stations, space helioenergetics as well as the energy sources under development.
- **Power networks simulation and modelling** - Computer simulation, basis concepts and methods in the mathematical modelling and simulation of power system components (generators, transformers, lines, load etc.) and electric processes in un/balanced states, stable states. Electrical parts of generators and networks and control structures are simulated using computers
- **Reliability and quality of power supply** - Reliability of power system and components, models for reliability analysis, operational and maintenance reliability, power quality (commerce quality, continuity of supply, voltage quality), voltage characteristics (un/balance, interruptions, dips, swells, harmonics, overvoltages, voltage fluctuations, etc.) power quality and reliability control

The re-designed courses will be harmonized according to an agreed, uniform framework in the mother tongue of each partner country. The partner universities will prepare a common textbook in English for each newly designed course. The students will then read the textbook in English, but lectures will be held in the mother tongue. This approach will facilitate a European dimension in classroom teaching, since students will work in a bi-lingual environment. The courses will be ended by oral and/or written examination. The courses will be introduced into the MSc. study programmes and become compulsory courses at all the partner institutions.

ASSESSING OF THE PROJECT OUTPUTS

The project will be monitored and evaluated by several different parties:

- the senior management of all the partner institutions; as they contribute to the funding of the project, they are naturally greatly interested in the results achieved and in the impact of the project on the Europeanization of their curricula.
- the co-ordinator of the project, who will monitor the progress of the project, the step-by-step fulfilment of the objectives, and the Cupertino among the partner institutions,
- the staff will review the teaching materials designed under this project and teaching methods of all participating universities,
- the students will evaluate the teaching materials and the methods used in teaching; their recommendations will be taken into account in the preparations of courses.
- the experts from industry, who will evaluate the relevance of the course to practice from the point of view of potential employees of the participating students.

It is important that the final evaluation should take into account the views of all these groups as they will be playing different roles in the project and thus will be able to cover different aspects.

PROJECT BENEFITS

In view of the European dimension, the objective of this university partnership is to provide uniform educational standards in electrical power engineering that will ensure the competitiveness and flexible mobility of the human resources of the partner countries across Europe. The project will contribute considerably to the unification of educational content and standards in different European countries. It will result in mutual support in the development or revision current. All the partners involved in the project will restructure their curricula, so that the changes resulting from the project would be an integral part of new curricula. The jointly designed teaching materials will be used in the teaching at all the participating universities. The curricula will be harmonized and the study requirements standardized. This will lead to the compatibility and comparability

of study programmes and bigger competition of European higher education institutions. Due to harmonization of courses the study abroad should be more attractive for students of all partner universities. In addition, the project should promote student and staff mobility.

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FIGURES

FIGURE 1
TEXTBOOKS PUBLISHED UNDER THE PROJECT "HARMONIZATION OF ELECTRICAL POWER ENGINEERING CURRICULA" [5], [6].