

# CONCEPT CHANGE OF PREGRADUAL COURSES ON MECHANICAL ENGINEERING FACULTY TU OSTRAVA AND EXPERIENCES FROM THEIR ACCREDITATION

Lubomir Smutny<sup>1</sup> and Antonín Víteček<sup>2</sup>

**Abstract** *¾Paper deals with summarization of the current stage of teaching programs for bachelor, master (engineer) and doctoral level of study and problems with his realization. It describes serial structure of pregradual study and its concept description by the Bologna declaration of the Europe Union countries. Modified traditional and new branches of bachelor and master study with concur requirements of restructuring industry in region of North Moravia and Silesia. It shows structure of branches and processing of Subject card and advantages of designed solution and condition of Mechanical Engineering Faculty of Technical University of Ostrava for his accelerated realization. Experience from accreditation of new study programs in National Accreditation Commission and comparison with study conception of other technical faculties at Czech Republic.*

**Index Terms** *¾Serial study structure, Bologna declaration, accreditation, technical faculty*

## INTRODUCTION

Moravia-Silesian region located in the east-north part of Czech Republic in the neighborhood of Poland and Slovakia with Ostrava as a regional center, is now in the critical phase of heavy restructuralisation. It is based on playing down the coal mining and metallurgical industry. The restructuring requires the development of tertiary sector in the region and mainly the intensive development of small and medium companies subsequently creating the new jobs for the people being unloaded from the region traditional industry. These new companies focused into the high-tech will be providing the space where the highly qualified university graduates can find their jobs too.

In this situation the role of VSB-Technical University of Ostrava is changing too. The University with long historical tradition (over 150 years) having the polytechnic character is now playing the important role in the region process by taking the responsibility in the support of innovation technologies. The focus is on the technologies leading to innovation process at the University itself but also in looking for other ways to support the technology transfer processes.

The Faculty of Mechanical Engineering was established in 1950. Originally focused on machines and equipment for mining and metallurgical industry, the Faculty ME has undergone substantial changes since then, adding new courses to the original curriculum of mechanical engineering, like control systems, robotics, CAD/CAM systems, transport equipment and technology, etc. At present, on FME study more than 1 700 full-time and 200 part-time students in pregraduate study programmes, and about 170 postgraduate Ph.D. students (see Fig. 1).

Problems with high failing namely in 1<sup>st</sup> and 3<sup>rd</sup> year of study negotiate to the new concept of study program on bachelor and master levels with utilization of serial pregradual study structure by the Bologna declaration of the Europe Union countries.

## BOLOGNA DECLARATION AND NEW UNIVERSITY STUDY CONCEPT

The direct predecessor of the Bologna Declaration was the joint declaration about harmonic construction of European educational system in higher educational establishments. It was signed in May, 1998 in Paris by ministers of the most famous countries of EU and is known as Sorbonne Declaration.. The Declaration underlines the irreplaceable role and responsibility of universities both in the development of European scales in the field of culture, and in the process of creating European sphere of higher education as the main method of developing citizens mobility and measure of population employment in the total continent's development.

Bologna Declaration further extends the ideas of Sorbonne Declaration. As a main objective it seeks to raise international competitiveness of European higher educational system and achieve its international attractiveness. This Declaration marks the year 2010 as the target year for implementation and shows concrete steps with the help of which it is possible to achieve the goal. For example, this program includes [ROUBICEK, V. 2001]:

- Adoption of descriptive and comparable academic ranks system, and also introduction of additional ranks system aimed at supporting measure of European citizens

<sup>1</sup> Lubomir SMUTNY, VSB - Technical University of Ostrava, Faculty of ME, Ostrava, CZ 708 33, CZECH REPUBLIC, lubomir.smutny@vsb.cz

<sup>2</sup> Antonin VITECEK, VSB - Technical University of Ostrava, Faculty of ME, Ostrava, CZ 708 33, CZECH REPUBLIC, antonin.vitecek@vsb.cz

employment and international competitiveness of European system of higher education.

- Implementation of a two-stage (pregraduate and postgraduate) model of education in higher educational establishments (for instance 3-2-3 years). To enter the second stage of education it is necessary for students to finish successfully three years of pregraduate education. The degree of qualification received by students after the first stage of education (Bachelor) should have the level adequate for the European labour market. The second stage of education should bring student to Master's diploma (2 years) or to obtaining Doctor degree (3 years).
- Creating credit systems analogous to the European Credit Transfer System as a means of students mobility support in the broad sense of the word. Credits could be received in the context of the university education, including life-long education. It is supposed that the credits will be accepted by those universities that admit the student who apply to them.
- Support of European cooperation in providing quality in development of comparative criteria and methodological approaches.
- Creation of necessary European scales in higher education, taking into account, primarily, development of educational programs contents, programs of inter-institutional cooperation, programs of mobility support, and also integrated programs of education, professional training and research.

The Declaration was signed by the representatives of 29 countries of Europe, and though it expresses political will to create a European sphere of higher education based on inter-governmental cooperation, it requires the involvement of other governmental and non-governmental organizations active in higher education and the universities themselves.

### THE PRESENT CONCEPT OF STUDY SYSTEM ON THE FME

Traditionally, the FME offers master degree (ING-diploma programmes) in mechanical engineering and, since the academic year 1992/93, also study programmes for bachelor degree (parallel or letter I structure of study with two independent study programs). The M.Sc. programme is divided into two stages. The first stage, in a standard time period, continues two and half years and represents a base of the mechanical engineering knowledge. It is closed by the First state examination. [SMUTNY, L. & VITECEK, A. 1999].

The first stage of M.Sc. study is identical for all students and consists of universally oriented subjects as represented by the following percentage distribution:

- |  |      |
|--|------|
| • Mathematics and descriptive geometry   | 21 % |
| • Mechanics of solids, fluids and gasses | 16 % |
| • Engineering                            | 13 % |

- |                           |      |
|---------------------------|------|
| • Mechanical technology   | 10 % |
| • Strength and elasticity | 8 %  |
| • Electrotechnics         | 7 %  |
| • Computer science        | 6 %  |
| • Foreign language        | 5 %  |
| • Social sciences         | 5 %  |
| • Material science        | 5 %  |
| • Physics                 | 4 %  |

The universal concept of this stage of study enables, in the second stage, the implementation of new courses according to the present and future market demands. The standard duration of the second stage is two and half years and the state-of-the-art implementation of courses is guaranteed by 12 specialized Faculty Departments. The Final state examination and the defense of student's diploma thesis close the master degree (ING-diploma study programme).

The bachelor study (Bc.) represents a new form of study at the Czech universities from the 1992 year. At the FME, two study programmes run in parallel, i.e. bachelor and master degree programmes now. It is not easy for bachelor degree students continue on the master degree study level. They must first successfully finish the bachelor programme, pass the "bridge" year and the First state examination, and only then they can join the second stage of master degree programme (the last two years of study).

The standard duration of bachelor study programme is three years and it is oriented not only towards the grounding acquisition of theoretical subjects but also towards acquiring experience that is more practical. It is finished by the Final state examination and the defense of the bachelor diploma (degree) thesis. From the school year 1998/99 there was a new study programme for master's degree, with 5 "study directions" and 10 branches, with better arrangement of subjects and study organization [SMUTNY, L. & VITECEK, A. 1999].

The experiences from the study reconstruction are rather good and problems with high failing namely in 1<sup>st</sup> and 3<sup>rd</sup> year of study there were lesser. New study plan for masters degree study on Faculty of Mechanical Engineering remove big problems with students failing and it also carry saving a lot of teaching hours without reducing of education quality.

### TYPES OF STUDY PROGRAMMES AND DEGREES AWARDED ON FME

The Faculty of Mechanical Engineering on VSB-Technical University of Ostrava provides by the new study concept (3-2-3 years) the following study programmes and awards these degrees:

- Bachelor's Degree Programme (Bc.) – 3 years of study
- Master's Degree Programme (M.Sc.) – 2 years of study
- Doctoral Degree Programme (Ph.D.) – 3 years of study

**Bachelor's Degree Programme**

Name of study programme	Standard length of study		Note
	FTS	PTS	
<b>Mechanical Engineering 2341 – R</b>	Full Time S	Part Time S	
Mechanical Engineering Technology	3	3	CZ
Environmental Engineering	3	3	CZ
Energy Management	3	3	CZ
Hydraulics and Pneumatics	3	3	CZ
Robotics	3	3	CZ
Technical Diagnostics, Service and Maintenance	3	3	CZ
Transport Equipment	3	3	CZ
Transport Technology	3	3	CZ
Applied Informatics and Control	3	3	CZ/Eng
Design of Machines and Equipment	3	3	CZ
Transport Machinery and Materials Handling	3	3	CZ
Applied Mechanics	3	3	CZ/Eng

**Master's Degree Programme**

Name of study programme	Standard length of study		Note
	FTS	PTS	
<b>Mechanical Engineering 2301 – T</b>			
Mechanical Engineering Technology	5	5	CZ
Energy Engineering	5	5	CZ
Production Systems with Industrial Robots and Handling Equipment	5	5	CZ
Design and Process Engineering	5	5	CZ
Transport Equipment and Technology	5	5	CZ
Applied Mechanics	5	5	CZ
Automatic Control Systems and Engineering Informatics	5	5	CZ/Eng

**Doctoral Degree Programme**

Name of study programmes	Length of study		Note
	FTS	PTS	
<b>Mechanical Engineering 2301 – V</b>			
Mechanical Engineering Technology	3	3-5	CZ
Energy Engineering	3	3-5	CZ

Hydraulics and Pneumatics	3	3-5	CZ
Transport Equipment and Technology	3	3-5	CZ
Construction of Production Machines and Equipment	3	3-5	CZ
Transport and Materials Handling	3	3-5	CZ
Applied Mechanics	3	3-5	CZ/Eng
Automation of Technological Processes	3	3-5	CZ, Eng
Parts and Mechanisms of Machines	3	3-5	CZ
Environmental Engineering	3	3-5	CZ

**BASIC INFORMATION ABOUT ACADEMIC PROGRAMMES**

The Faculty of Mechanical Engineering of the Technical University of Ostrava accepts students into what is known as structured studies, which are rooted in a gradual acquisition of university education.

The first stage of education is the bachelor study program "Engineering", whose standard period of study in singular and combined forms of study is three years. The first three semesters of study have the same study plan for all study branches and specializations. In the content of this stage of study, oriented on a theoretical basis, there are lessons of mathematics, physics, computer science, the mechanics of solid bodies, classes in elasticity and strength, hydromechanics, thermomechanics and their applications.

The universal conception of this stage of study enables a practical reaction to the availability of new study branches in other studies or an orientation to immediate and supposed market needs. Lessons in the final semesters are oriented on practical problems solving and applications, which a technician will use in the daily operation of a production process.

The bachelor study program is completed with a final state exam and a defense of bachelor work. In accordance with the Law for Higher Education, students acquire the title "Bachelor", abbreviated as "Bc". Thus, the possibilities of several variants of other applications are opened to them. They could enter the workplace, finish their studies with a long-term stay abroad or continue in a connected master's study program.

The second stage of university education is the connected master's study program "Mechanical Engineering", whose standard study period in singular and combined forms of study is two years. Only graduates of the bachelor study program, already oriented in specialized studies, are able to enter into it.

The classes in the master's study program are founded on an acquisition of knowledge from fundamental engineering disciplines (lessons in materials, engineering production technology, machine parts...) and further from electrical engineering, energetics, transportation, computer science,

cybernetics, regulation and automation theory, and the use of computer support in construction and design.

The master's study program is completed with a final state exam and a defense of diploma work. In accordance with the Law for Higher Education, students acquire the title "Engineer", abbreviated as "Ing".

The third and highest level of university education is the doctorate study program "Mechanical Engineering", which is founded on a specialized, individual study plan and scientific research. The standard study period is set at 3 years.

The doctorate study program is determined for especially skilled and talented university graduates of master's study programs. Its aim is the preparation of new, scientifically-technically educated and university taught workers, who will be able to work with the most demanding scientific-technical tasks and to apply their abilities in international competition.

After bringing forth and defending original scientific work, which is the result of the research carried out, a graduate can acquire the title "Doctor", abbreviated as "Ph.D."

At the Faculty ME, the credit system of education has been adopted according to the European program ECTS (The European Credit Transfer System). This enables the mobility of students between universities and faculties of specialized orientation, and gives students the possibility of reducing the concentration of studies from the points of view of time and specialization, and of participating in the special formation of a choice of compulsory-elective and non-compulsory subjects.

The FME provides all above mentioned study programmes for foreign students in the Czech language. The tuition fee for foreign students in doctoral study programmes instructed in English is 5,200 USD per academic year. The foreign students are admitted on basis of the official verification of their secondary school certificate.

National Accreditation Commission accredited all these new study programs on June 2001 and faculty ME will realize it from 2001/20 academic years. By comparison with the similar new study conception of other mechanical engineering faculties at Czech Republic we can say that study structure has the same basic characteristics.

## CONCLUSIONS

Serial concept of pregradual and post gradual study via Bologna Declaration looks simple, but it's quite difficult to work out its contents and program. There are some aspects or goals we have to keep in mind [ROUBICEK, V. 2001], [SMUTNY, L. – VITECEK, A. 2000]:

- It's necessary to distinguish goals of separate stages of education (3-2-3) in connection with different profile of the graduates.

- We have to find proper mechanisms and criteria for assessing quality of education in separate stages.
- Implementation of structured education will demand creation of new curricula and to expand the programs in some subjects.
- In connection with the fact that graduates acquire a wide range of comprehensive knowledge, it will be possible for the universities to concentrate on scientific education.
- Mutual relations of educational programs mentioned above will allow students to make "horizontal" and, primarily, "vertical" transfers between different institutions.
- It's desirable to use our advantage of combination of economic department with technical departments on VSB-TU Ostrava in order to create a demand in the sphere of inter-departmental educational programs, especially in professionally oriented educational programs for Bachelors.
- It's necessary to economize in the education process through approximation curricula of technical departments in the first semesters of education. This is a necessary premise for introducing parallel education in foreign language and for implementation of distance learning elements.
- It's desirable to give more opportunities to foreign students to study in our universities, i.e. to introduce parallel education in the English language.

Faculty of Mechanical Engineering place in these new serial concept big expectations with decreasing of high student failing, innovation of study branches on Bc. Level and improving of education efficiency.

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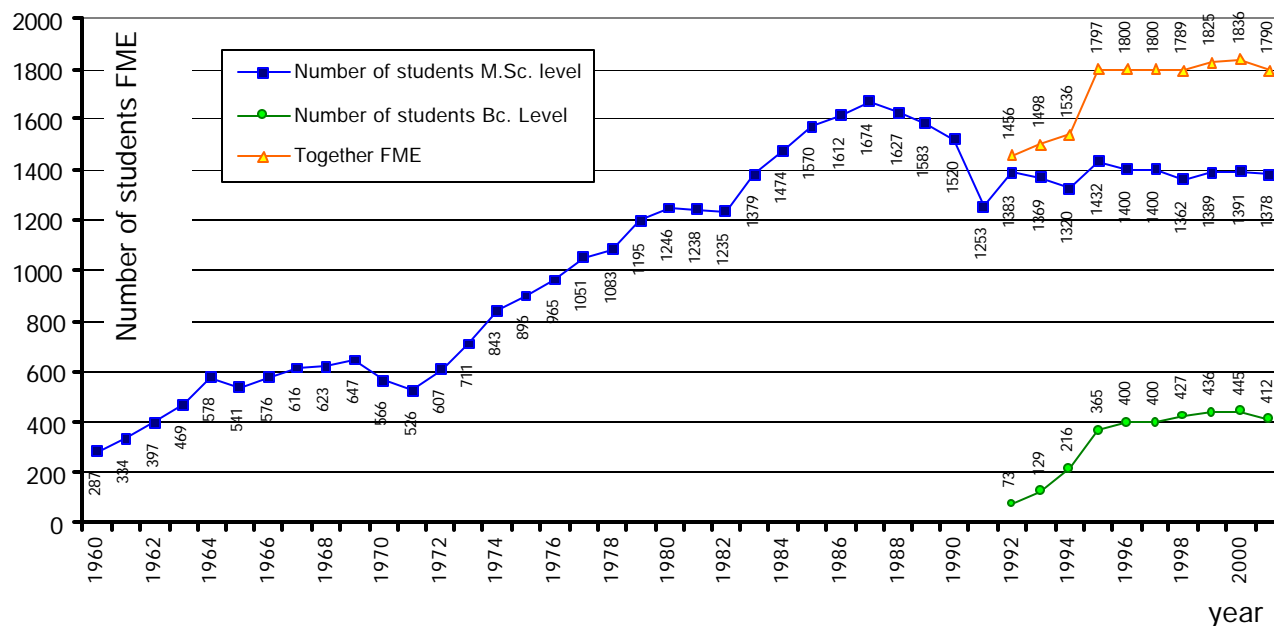


FIGURE 1  
NUMBER OF STUDENTS OF MECHANICAL ENGINEERING FACULTY TU OF OSTRAVA AT 1960 TO 2001