

# INTRODUCING OF 3-5-8 STUDY SYSTEM IN CZECH TECHNICAL UNIVERSITY OF PRAGUE

Vaclav Havlicek<sup>1</sup>,

**Abstract**  $\frac{3}{4}$  Traditional Central European Universities have offered engineering study programmes as one-stage long programmes (usually 10 semesters). The global trends of tertiary education harmonisation and increasing of mobility possibilities need to change these programmes corresponding the Bologna declaration as structured two or three-stage study system. Czech Technical University discussed deeply the strengths and weakness of the structured study system and finally decided to rearrange engineering courses in all faculties according to the general requirements approved by the scientific council of the university. The general rules and common requirements are given here. The last section shows the new curricula in Electrical and Information Engineering.

**Index Terms**  $\frac{3}{4}$  Bologna process, structured study system, Bachelor study, Master study, PhD study.

## INTRODUCTION

The Czech Technical University in Prague is one of the oldest universities of technology in Europe. The Czech Estates Engineering School was founded on the base of the rescript of the Holy Roman Emperor Joseph I. from 1707 the classes began in 1718. The studies were directed toward military engineering but the orientation moved soon toward engineering for civilian purposes. In the early 19<sup>th</sup> century the studies were thoroughly re-organised by F.J.Gerstner as the modern Prague Polytechnic, opened in 1806. From 1863 the studies and the administrative structure had the status of a technical university under leadership of an elected rector.

After the establishment of the Czechoslovak Republic in 1918 the school adopted the name “Ceské vysoké učení technické” which is translated as the Czech Technical University in Prague. Its seven faculties offered “engineer” (i.e. master) level study programs until 1952 in civil engineering, architecture and building engineering, mechanical and electrical engineering, chemistry, agriculture and forestry, surveying, safety engineering and also business and economics.

In the period from 1948 to 1989 development of the university was under the influence of changes of political system, the spectrum of study programs was strongly limited and all university life was under the central state control. After 1990, CTU began to transform itself in the spirit of its

own traditions, while the same time making use of the latest scientific findings and technologies.

The present CTU is now the largest technical institution in the Czech Republic with more than 20 000 students, 1400 teaching and research staff, and courses covering not only engineering and natural science disciplines, but also economics and management, and social sciences. At present it represents the typical Central European university consisting from 6 faculties: Civil Engineering, Mechanical Engineering, Electrical Engineering, Technical and Nuclear Physics, Architecture and Transport Sciences.

## DEVELOPMENT OF THE STUDY SYSTEM

During all long history of the CTU only “long” engineering study programs were practised. Corresponding to the new trends in higher education the strong tradition should be done over and the study system have to be harmonised with global tertiary education systems, i.e. with diversified structured study systems. The prepared transformation to the three-stage study (Bc., MSc., PhD.) is one of the greatest changes in the university history.

The ideas of Bologna process were deeply discussed between the university management and academics because this basic change of the study system has many positive but of course any negative aspects. The new system will have the positive influence in harmonisation of curricula in the European higher education space, it will create more flexible open structure of study branches and we hope it will decrease the student dropout rate. On the other hand the necessary separation of basic theoretical courses into two different consecutive study levels will probably decrease of learning process efficiency in these courses and also it will create some difficulties in applied engineering courses during the bachelor stage due to smaller theoretical background of undergraduate students.

Implementation of the new system should take into account also the fact that the stakeholders in our country are not prepared to accept Bachelors as “full value” university graduate. After the complex analysis of all these aspects the top management of the CTU decided to accept the recommendations of Bologna summit and implement them in all faculties and departments of the university.

The implementation of Bologna ideas started by general formulation of first graduate’s profile as people having very

<sup>1</sup> Vaclav Havlicek, Czech Technical University of Prague, Zikova 4, 166 35 Praha 6, Czech Republic, havlicek@feld.cvut.cz

good practically oriented knowledge and also the sufficient theoretical background for continuation in Master courses. The next period dealt with categorisation of subjects into four groups, those were theoretical and preparatory courses, specialised engineering courses, managerial courses and humanities. The percentage of each group in common curriculum was determined. The third main recommendation for implementation of new ideas in the learning process gave the general constraints for the length of study, counting of credit points and ratio of obligatory and facultative courses both for Bachelor and Master level of study.

According to the general recommendations three faculties have prepared the new curricula for the national accreditation and other faculties will finish this difficult task during this year. The first experience has been found within the Faculty of Mechanical Engineering that started the fundamental changes as the first part of the university.

### THE MAIN PRINCIPLES

#### Glossary of Terms, Abbreviations

Structured graduate programme is the three-level university education (Bachelor, Master, PhD) arranged as a serial chain of three independent accredited study programmes. The progress to the higher stage is determined by the successful finishing of the previous stage and passing of entrance interview (it may be in special causes excused).

Serial chain of study programmes means consecutive arrangement of undergraduate (Bachelor) programme, Master programme and PhD programme each within other.

Bachelor (undergraduate) study represents the basic stage of university education

Master study is the second stage of university education

PhD study is the third an highest stage of university education

BSP is the bachelor study course/ programme,

MSP is the Master study course/ programme,

DSP is the PhD study course/ programme

P is the obligatory subject

PV is the obligatory eligible subject

V is the facultative subject

#### Undergraduate (Bachelor - BC) Course

Graduate profile:

*The graduate of this programme at the Czech Technical University in Prague (CTU), should obtain theoretical, preparatory, economic-managerial and professional knowledge needful for method of solution of technical practice and, in the same time he should obtain qualification for further development of his knowledge in harmony with the development of current stage of cognition in the corresponding area.*

- Duration of the standard Undergraduate course is 3 till 4 years. The Management of CTU prefers 4-year length undergraduate programme. With this fact should correspond the number of semesters.
- The number of credits recommended per semester is 30.
- The maximum of contact hours per week for the obligatory (P) and obligatory eligible (PV) subjects, which are quoted in the recommended study plans is 26 (including physical-training, languages, etc.).
- Any subject of P or PV study plans in another specialisation may be registered by student as facultative (V) in the frame of all subjects lectured at CTU.
- Recommended proportion of (theoretical + preparatory) courses : specialised engineering courses : managerial courses : humanities is: 40 : 40 : 10: 10 in the whole study programme.
- A student creates his course from the offer of obligatory (P), obligatory eligible (PV) subject and facultative (V) subjects personally with respect to main principles. The study plan created by this way is meant as obligatory.
- Professional practice is a part of course in the minimum length 8 weeks. The practice proceeds in addition to the teaching time. Students themselves ensure the practice (no by means of faculty).
- Study plans and subjects content have to ensure the needed level of theoretical and generally engineering basis of graduate's knowledge in conformity with his personal development.
- Exacting theoretical parts, which are necessary for research, development and next creative activity will be shifted to graduate study plans.
- Starting from the 5th semester the part of recommended study plans is dedicated to the 2 groups of obligatory eligible subjects. The reason for this procedure is the possibility to profile students in accordance with their interests: the first group create courses for immediate preparation to occupation; the second group serves for preparation for the higher stage of education. Student has the possibility to choose the individual subject from any group according to his personal choice.
- Standard duration of undergraduate programme is 8 semesters with the fact, that the bachelor diploma work is appreciated by the 10 credits.
- Undergraduate course is finished with proper state bachelor examination.

- The state bachelor examination consists from the written part and the bachelor work defence. The results of the written part can be discussed with members of the examination board.
- Undergraduate course should be also prepared and accredited for lecturing in English.
- It is recommended to students to pass through at least 1 month of their study time at the relevant university abroad in the scope of student exchange programmes.
- Undergraduate programme includes obligatory examinations of two foreign languages.

### Master course

#### Graduate profile:

*The graduate of Master course at the Czech Technical University in Prague (CTU), should obtain theoretical, preparatory, economic-managerial and professional knowledge needful for creative development and intensifying of previous knowledge corresponding professional branch and should obtain the ability to formulate problems in connection with his further development activity.*

- Duration of the standard Master course is 1.5 till 3 years. (In the case of the amendment of the Law No.: 111/98 Coll.).
- The number of ECTS credits recommended per semester is 30.
- Contact hours per week for the obligatory (P) and obligatory eligible (PV) subjects that are quoted in the recommended study plans are in maximum 26.
- Any subject of P or PV study plans may be registered by student as facultative (V) in the frame of all subjects pronounced at CTU.
- Recommended proportion of (theoretical + preparatory) courses: specialised engineering courses : managerial courses : humanities is: 35 : 50 : 15 in the whole study programme.
- Obligatory subjects of Master course have to ensure high claiming and quality of Master study.
- A student creates his course from the offer of obligatory (P), obligatory eligible (PV) subject and facultative (V) subjects personally with respect to main principles. The study plan created by this way is meant as obligatory.
- The last semester of master course includes diploma work (thesis) which is appreciated by 20 credits

- The integral part of Master course is research (inventive) activity in the frame of projects which is appreciated by belong credits.
- It is recommended to students to study at least 1 semester in another university (if possible abroad).
- The special attention is focused to the ability to presentation of knowledge and communicative and managerial skills of students.
- Master should be also prepared and accredited for lecturing in English.

### PhD course

#### Graduate profile:

*The graduate of PhD course at the Czech Technical University in Prague (CTU), should obtain theoretical, preparatory and professional knowledge needful for creative solution of the most exacting problems of technical practice, should be able independently work on research problems, should be prepared to develop and intensify the existing professional branch and should be able to formulate problems in connection with his further development activity.*

- The supervisor is the key personality during the Master course.
- The supervisor should be well qualified, i.e. he should be associated professor at minimum
- The supervisor has to be active in the research area. As a rule he has a leader person of grant or project.
- Recommended part of PhD course is attending at least one semester the corresponding course at the university abroad.
- All Masters courses at CTU in Prague must be accredited also in English.

### The transition from Bachelor courses to the Master courses

- The graduate of Bachelor course can apply for registration in the Master course.
- The dean of faculty will determine the requirements of entrance interview.
- Graduate of the Bachelor course continuing his study in the Master course in the same faculty of the CTU in Prague, can be registered without entrance interview under conditions providing by the dean of faculty (for example successfully passing prescribed PV subjects of the Bachelor programme).

## STRUCTURED STUDY IN ELECTRICAL AND INFORMATION ENGINEERING

During academic year 2001-2002 it was prepared and on the university level agreed the new structured study programme in Electrical and Information Engineering. The faculty decided to arrange this programme in 3-5-8 system, i.e. duration of Bachelor stage will be 6 semesters, Master stage 4 semesters and PhD stage 6 semesters. This programme is now processed by the National Accreditation Board.

The Bachelor curricula covering all electrical, electronic and information areas has been separated to 4 study branches: Power Engineering, Electronics and Telecommunication, Cybernetics and Measurement, Computer Engineering and Science. First year of study is common for all specialisations and contains the following subjects:

- Calculus 1 5 cred.
- Calculus 2 6 cred.
- Intro to Algebra 4 cred.
- Intro to El. Engineering 3 cred.
- Creation of Tech. Docc. 3 cred.
- Electrical Circuits 1 4 cred.
- Electrical Circuits 2 5 cred.
- Physics 1 6 cred.
- Electronics 5 cred.
- Economy 1 3 cred.
- Computer Science 1 5 cred.
- Computer Science 2 5 cred.
- Foreign Languages 6 cred.

The next two nominal years of study (the actual study is often longer) are different in the different study branches mentioned above. As an example it can be shown curriculum of the specialisation Electronics and Telecommunication:

- Physics 2 5 cred.
- Electrical Circuits 3 5 cred.
- Measurements and Instrument. 5 cred.
- Materials and Technology 4 cred.
- Intro to Computer Systems 4 cred.
- CAD in Telecommunications 4 cred.
- Economy 2 3 cred.
- Elmag. Field Theory 5 cred.
- Digital Circuits 5 cred.
- Electronic Components 4 cred.
- Signals and Systems 1 5 cred.
- Waves and Transm. Lines 5 cred.
- Fotonics 4 cred.
- Radiocomm. Systems 4 cred.
- Calculus 3 4 cred. \*
- Calculus 4 4 cred. \*

**Note:** courses \* are eligible but necessary for direct continuation in Master stage of studz programme.

The Master study programme is proposed as 2 year curricula that will be realised in Faculty of El. Eng. in 7 study branches: Power Electrical Engineering, Economy and Management of Electrical Technology and Energetics, Electronics, Telecommunication and Radioelectronics, Cybernetics and Measurement, Biomedical Engineering, Computer Engineering and Science. As an example it can be shown curriculum of the specialisation Telecommunication and Radioelectronics:

- Calculus 5 5 cred.
- Signals and Systems 2 5 cred.
- Antenas and Propagation 5 cred.
- Data Nets 5 cred.
- Economy and management 10 credits
- Team Project 5 cred.
- Individual Project 5 cred.
- Diploma Thesis 20 cred.
- Eligible Engineering courses 40 cred.

Bachelors with insufficient background in electrical engineering have possibility to attend the three years Master course consisting from special first year (selected obligatory courses from CTU Bachelor study programme) and the last two years with the same content as 2 years programme.

## CONCLUSION

The CTU in Prague decided to introduce the modern structural study system based on the common European approach given by the Bologna declaration. The results of all academics discussion were generalized in the common requirements within all university and appointed in the CTU scientific council. The main reason of proposed changes was the possibility to increase compatibility with the global education systems, to improve the student professional skills, to increase mobility of students and to decrease the great drop-out of freshmans. The case study of the Faculty of electrical engineering shows that general requirements were not completely fulfilled (e.g the professional practise is missing, the ratio of different courses types is not accurate) and all targets were not reached (the difficulties of freshman probably will not decrease and the efficiency of teaching will decrease). The actual results should be validated by practical experience.

