

DESIGNING AND IMPLEMENTING NEW COURSES AT ENGINEERING STUDIES

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Abstract. It has been assumed that the generic engineering skills will be reinforced by means of 3D design and modeling in the new engineering curriculum. Thus the most modern and up-to-date software has been introduced within the proposed courses. In the paper the outline of the new courses titles and contents will be described. Some examples of students works will be presented.

Keywords: New courses design, Engineering education, Bologna Declaration

1. Introduction

To become a well trained engineer means not only to possess a certain level of technical knowledge but also to have a well developed spatial imagination. The basic courses in descriptive geometry (DG) contain the problems, which require using spatial thinking [4]. In contemporary engineering curricula the quantity of DG teaching hours has been dramatically limited, if not reduced at all [1]. To reinforce the educational curriculum it is possible to offer to the students optionally chosen subjects such as “Engineering Computer Graphics” or “3D Modeling and Visualization of Engineering Structures”. In the development of a new engineering curriculum it has been assumed that the generic engineering skills will be reinforced by means of 3D design and modeling. Thus the most modern and up-to-date software has been introduced within the proposed courses. The described approach results in introducing new courses and teaching contents into educational process.

2. Bologna Declaration and its Implementation

General assumption of the resolutions of the Bologna Declaration (signed on June 19th, 1999) and their implementation cover the following agenda:

- Accreditation and the assessment of the quality of education,
- Implementation of ECTS system,
- Joint degree systems’ introduction,
- Social aspect of the Bologna declaration (students mobility),
- Lifelong learning.

Academic year 2007/08 has become a threshold for implementing in Poland a new educational system according to the Bologna Declaration. The new system divides engineering studies into two-levels(or two-tier system [2, 3]): the 1st tier, which includes 6 to 7 semesters of education graduating with the Bachelor or a License degree and the 2nd tier of education (3 to 4 semesters), where the students graduate with the M.Sc. degree.

Both at the Cracow University of Technology (later called CUT) and at the AGH University of Science and Technology (hereafter: AGH) the new system has brought in many changes. Additional factor, which must not be neglected if regards the teaching contents, has

become the most powerful and important. This factor is to be the set of the “Educational Standards”, which has been developed and introduced by the Main Council for Higher Education (Rada Główna Szkolnictwa Wyższego, RGSzW) in Poland. Many subjects, independent and self-standing in previous systems, have now been put together and organized into particular teaching packages (later so-called “Modules”). In this process particular subject names have either disappeared from the list of obligatory subjects or have been grouped within the other subjects into “modules” with one and more general title. Such situation became typical for so called “engineering graphics” courses such as descriptive geometry, technical drawing, CAD, computer graphics and many other subjects. Whereas the new subjects have appeared, the “old” ones have been cancelled. To these belongs “Descriptive geometry”, which name has been changed in the mentioned “Educational Standards” into “Engineering graphics”. The content of the standards for the last subject covers not only typical problems for descriptive geometry but also typical problems for technical drawing, engineering graphics with introduction of the Computer Aided Design (CAD) methods.

The new system has also brought in limitations of the teaching hours assigned to particular subjects. A new economical system introduced at Polish universities, where the Faculties had become economically independent and self-financing, has had great impact on the curricula. Polish universities are financed from many sources: among others the money comes from the National Budget, from the due payments made by the students for the “Weekend Studies”, from design projects developed for industry and finally from the grant projects. All this money is still not enough to cover the expenses.

3. Exemplary Teaching Modes at AGH and CUT

Table 1 presents the subject titles for our home universities in the old (before 2007/08) and the new systems.

Table 1

Major	Subject's Name before 2007	No of hours/semester – before 2007	No of hours from 2007/08	Subject's Name from 2007/08
Cracow University of Technology				
Faculty of Civil Engineering				
Building Construction	Descriptive Geometry	45	45	Descriptive Geometry
	Technical Drawing	45	45	Engineering Graphics
Transportation	Descriptive Geometry	60	0	X
	Computer Graphics and Multimedia Systems	45	45	Computer Graphics and Multimedia Systems
Informatics	Computer Graphics	60		Computer Graphics
	Multimedia Techniques	30		Multimedia Techniques
AGH University of Science and Technology				
Faculty of Mining and Geoengineering				
Building Construction	Descriptive Geometry & Technical Drawing	60	30	
Mining and Geology	Descriptive Geometry & Engineering Graphics	45	30	
Environmental Engineering	Descriptive Geometry & Technical Drawing	45	30	
Management and Production Engineering	Descriptive Geometry & Engineering Graphics	0	30	New major

Faculty of Geology, Geophysics and Environmental Protection				
Mining and Geoengineering	Descriptive Geometry & Engineering Graphics	45	30	
Environmental Engineering	Technical Drawing & Descriptive Geometry	45	30	
Environment Protection	Descriptive Geometry & Engineering Graphics	45	30	
Applied Informatics	Descriptive Geometry & Computer Graphics	0	45	New major
Faculty of Drilling, Oil and Gas				
Mining & Geoengineering	Geometry & Engineering Graphics	45	30	
Faculty of Physics and Applied Computer Science				
Technical Physics	Computer Engineering Graphics		60	
Applied Computer Science	Computer Engineering Graphics		60	

Since many years a new offer to the students from the faculties' side includes also the "elective subjects". The offer is wide and the students choose one or two of them per semester. At CUT the offer from our institution includes such subjects as: "Engineering Computer Graphics" (5th or 6th semester) or "Visualization of Engineering Structures" (5th semester). Our students (CUT) work with Computer Aided Design software such as follows: AutoCAD, ArchiCAD, 3D StudioMax, Viz Render, CADWork. The AGH students work with AutoCAD and Cabri.

4. Some Examples of Students' Works

New concepts for graphic subjects include Computer Aided Design software introduction into the teaching process. Realization of these courses is highly demanding both to the students and to the faculties. Let us give some examples. In the computer-lab hours the students learn ArchiCAD software by means of building a virtual model of a family house (Fig.3) within the "3D Visualization" course at the CUT. The ArchiCAD software provides a rich library of ready-for use constructions and furniture elements. Rendering engine enables production of advanced renders of the design structure. As a homework assignment the students' task of 2007/08 course was to model an individually chosen architectural structure such as a petrol station (Fig.1) or a chosen real-life building. In Fig.1÷4 we have the renderings of some structures. Computer Engineering Graphics courses include also 3D modeling in AutoCAD. A 3D model of a room-interior together with the real-life photo of the room is a challenge for modeling in AutoCAD as there is no 3D library of interior elements such as cabinets, furniture, bed, chairs. Only the AutoCAD Architecture 2008 and higher version provide some library for ready-for-use models.

5. Conclusions

There is no doubt that the new idea of the "European Higher Education Area" creation has had significant impact on the development of new curricula at Polish technical universities. The quantities of teaching hours assigned to certain subjects have decreased. The students of today are facing even greater challenge than their older colleagues had experienced only a few years ago as they are suppressed to conceive the same quantities/qualities of ideas within engineering graphics courses but in definitely shorter time. There is no time for teaching (=understanding) the principles of projections, there is no time for training "spatial

skills”. The students with no basic education start working in a 3D virtual environment and become suddenly lost in a 3D world as they do not have their visualization skills well trained.



Fig.1: Petrol Station (ArchiCAD)



Fig.2: Virtual Model of a Room-interior (AutoCAD)



Fig.3: Family House Model (ArchiCAD)

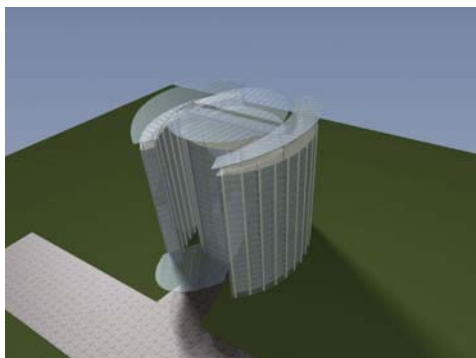


Fig.4: Virtual models of Engineering Constructions (ArchiCAD)

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PROJEKTOWANIE I IMPLEMENTACJA NOWYCH PRZEDMIOTÓW DLA STUDIÓW INŻYNIERSKICH

Wprowadzenie w życie Deklaracji Bolońskiej (1999r) zaowocowało nie tylko poszerzeniem wspólnej przestrzeni edukacyjnej w obszarze Europy, ale też głęboko sięgającymi zmianami organizacyjnymi w strukturze kształcenia na poziomie studiów wyższych. W polskich uczelniach technicznych rok akademicki 2007/08 stał się przełomowym rokiem, bowiem wprowadzono dwustopniowy system nauczania. Wcześniej opracowano nowe Standardy nauczania dla poszczególnych kierunków kształcenia (Rada Główna Szkolnictwa Wyższego). Niektóre przedmioty zostały połączone w tzw. Moduły, a to z kolei pociągnęło zniknięcie nazw takich przedmiotów jak "geometria wykreślna" na niektórych kierunkach technicznych. Równocześnie powstała możliwość wprowadzenia nowych przedmiotów pod nazwą przedmiotów wybieralnych. Autorzy przedstawiają w niniejszym artykule proporcje godzin przeznaczonych na przedmioty "graficzne" w dwóch uczelniach krakowskich przed i po wprowadzeniu dwustopniowego systemu nauczania oraz przedstawiają prace studentów wykonane w ramach następujących przedmiotów wybieralnych: Komputerowa Grafika Inżynierska oraz Wizualizacja Komputerowa.