Master Courses in Surveying in the Light of the Bologna Process

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SUMMARY

According to the Bologna Process the intermediate stage of BACHELOR/ENGINEER ended with proper diploma-thesis is generally indispensable to start studies for higher MASTER degree. The universities constructing curricula for BACHELORATE in surveying are doing their best to supply students with as complete knowledge in the field of surveying as possible. Such an approach, even though right, leads to specific pitfall. Curricula for master studies become deficient comprising parts of additional knowledge in particular subjects pretending to be advanced but generally being an unnecessary burden in future personal development of graduate looking from both, professional and eventually scientific carriers. 'Advanced branches of mathematics', 'selected problems of physics', etc. added to curricula may serve as an example. Author advances a thesis that there is no clear concept in Europe of MASTER courses in surveying. Subordinating MASTER courses to master-diploma-thesis at the very beginning and offering almost entirely optional subjects regulated by certain obligatory established amount of ECTS might help to cope with programming of master courses in surveying. Such a proposal is discussed in the paper.

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1. INTRODUCTION

The 'Bologna Process' forces us to observe three-level-study-system: engineer (bachelor BSc), master (MSc.) and doctor (PhD). Each of the levels should be ended with proper diploma-thesis (doctor thesis for PhD). The universities constructing curricula for BACHELORATE in surveying are doing their best to supply students with as complete knowledge in the field of surveying as possible.

Such an approach is undoubtedly right looking from the point of view of professional interests of both: graduates and employers. It assures high professional level of surveying engineers well generally developed and well prepared for wide range of contemporary surveying tasks. An example programme is discussed in section 2.

But such an approach remains in specific conflict with a clear concept of the second MSc level of education.

Let us assume that the first study-level (BSc) lasts 7 semesters and that another 3 semesters remains for MSc course. It seems to be a standard for majority of European universities. How to program reasonably the last 3 semesters ? During this time certain of the European universities are trying to widen the basic knowledge of students offering them more advanced topics such as 'selected' problems of mathematics or physics etc. during two semesters. The last, third one is very often devoted for preparing the master's thesis. During two semesters preceding master's thesis student often is obligatory burdened by a portion of sophisticated knowledge being not necessarily his highest priority looking from his both, professional or scientific carrier. A concept enabling students optimising their master studies in surveying is proposed in section 4.

2. INGEENERING COURSES IN SURVEYING – WUT CASE

In the Warsaw University of Technology (WUT) Faculty of Geodesy and Cartography seven semesters are assigned for first level studies (engineer). The additional, eighth semester is devoted to diploma thesis. In each semester 30 ECTS are obligatory. There is no specialisation. But 'surveying' in WUT includes during first engineering level of studies wide range of subjects: geodesy, engineering surveying, photogrammetry and cartography, remote sensing and GIS, cadastre and land management, environment protection. Present curricula is not exactly adjusted to the Bologna Process: regular engineering studies last seven semesters and the eighth semester is devoted to the diploma thesis for those deciding to end studies at this level; others – wanting to get master degree – have the eighth semester for regular studies.

The table below displays the concept.

Subject	ECTS in individual semester							
	I	II	III	IV	V	VI	VII	VIII
General subjects								
Economic and humanistic subjects	2			2				4
Theory of negotiation								2
Law					3			4
Foreign languages		4	4	2	2	2		
Physical education	2	2	2	2	2	2		
Basic subjects								
Mathematics	6	5	6					
mathematical statistics				3				
spherical trigonometry		2						
numerical methods							3	
Physics			5	5				
Descriptive geometry and drawing	4							
Computer science (basic)		4	5					
Information Systems							2	2
Professional subjects								
Surveying	6	6	6	6				
Geodesy				2	6	4		
Geod. astronomy & geodynamics				3				
Theory of adjustment	4	4						
Photogrammetry				3	5		2	
Remote sensing						4	2	
Theory of cartographic projections					3			
Topographic cartography						3		
Maps reduction							4	
Cartograph. production processes							3	
Electronic measurements			4					
Earth sciences (basic)	2							
geomorphology	2							
soil science	4							
Environment protection		3						
Engineering surveying						5	2	
displacements measurements							4	
civil engineering					4			

Satellite geodesy						4		
Cadastre					5			
networks o techn. facilities							2	
basic map of town				2				
Physical planning					2			
Rural land management						5		
Real estate management							3	
Real estate valuation							3	
Diploma seminar								18
F i e l d t r a i n i n g s								
1st year field training			2					
2nd year field training				2				
Photogrammetry and cartography					1			
Geodesy and satellite surveying					3			
S u m m a r y								
Number of examinations	1	3	1	3	4	5	3	-
No of teaching hours (weekly)	27	27	24	30	27	27	25	8
No of ECTS	30	30	30	30	30	30	30	30
Total successive No of teaching hours	405	810	1170	1620	2025	2430	2820	2940

3. PRESENT MASTER COURSES – SPECIALISATION: GEODESY AND SATELLITE NAVIGATION

Present master's courses at the Warsaw University of Technology comprise a set of obligatory subjects and optional subjects. Those obligatory are subdivided into two groups: group of subjects common for all specialisations (180 hours) and specialising subjects (600 hours). Subjects are listed below.

Subject	ECTS in semester		
	VIII	IX	X
Subjects common to all specialisations			
Selected problems of business law			2
Principles of auto-creation			2
Geodetic and cartographic law			2
Numerical methods	4		
Geophysics	2		
Computer graphics and CAD systems		3	

Obligatory subjects				
Satellite geodesy			5	
Celestial mechanics			4	
Marine surveying				3
Physical geodesy and gravimetry		4		
Geodesy		4		
Geodynamical basis of reference systems		4		
Geodynamics		2	3	
Satellite navigation			4	
Spatial information systems		4		
Selected problems of astronomy		2		
Selected problems of mathematics			2	
Diploma seminar				19
Optional subjects				
Optional I		2		
Optional II			4	
Optional III				4
Total	lecturing hours (weekly)	25	24	11
	ECTS per semester	30	30	30

Optional subjects in details are as follows:

Semesters VIII and X		Semester IX	
Subject	ECTS	Subject	ECTS
Landscape architecture	2	Linear estimation in geodesy	2
Numerical signals processing	2	Engineering photogrammetry	2
Landscape ecology	2	Generalising the spatial data	2
Elements of applied mechanics	2	Multimedial cartography	2
Geodetic reference systems	2	Carto-graphics	2
Geoinformatics	2	Geophysical prospecting	2
History of cartography	2	Soil systematisation, graduation and valorisation	2
Numerical surfaces in statistics	2		
Geodetic networks processing	2	Testing of surveying instruments	2
Bathymetric surveys	2	Selected branches of navigation	2
Designing of observational systems	2	Advanced methods of satellite data processing	2
Urban designing	2		
Natural basis of land management	2		

Satellite methods of data acquisition	2
Satellite methods of positioning	2
Neuron networks	2
Network operational systems	2
Local Information Systems	2
Selected problems of geodesy	2

Each subject on the list of obligatory subjects for any specialisation can be chosen as optional subject for other specialisation.

4. A PROPOSAL OF NEW APPROACH TO MASTER COURSES

As one can see, the curricula for master studies become deficient comprising parts of additional knowledge in particular subjects pretending to be advanced but generally being an unnecessary burden in future personal development looking from both, professional and eventually scientific carriers. 'Advanced branches of mathematics', 'selected problems of physics', etc. added to curricula may serve as an example. Even if we accept a number of optional subjects, student more often is composing his study program considering first the easiness in getting the credits. This is also because student knows in advance his specialisation.

New approach to master courses should be aimed at personal development of each student. The courses should be programmed considering student's personality. Mostly individualised approach is necessary. The following initial terms should be taken into account:

1. Student should start his individual development as early as possible,
2. An individual supervisor/adviser of academic staff is necessary,
3. Student should formulate the subject of his master's thesis cooperating with supervisor,
4. Study programme is subordinated to master's thesis,
5. Study program is composed entirely of optional subjects, but providing 30 ECTS per semester,
6. Supervisor and dean accept study programme.
7. It is necessary to allow a choice of the subjects from the list offered by other specialisations or even faculties,
8. Student's specialisation can be decided after the master's thesis and study programme are completed.

5. CONCLUSION

Subordinating MASTER courses to master-diploma-thesis at the very beginning and offering entirely optional subjects regulated by certain obligatory established amount of ECTS might help to cope with programming of master courses in surveying in European universities.

BIOGRAPHICAL NOTES

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