

Issues Concerning the Integration of the Romanian Geodesic Education into the European One, Under the Stipulations of the Bologna Agreement

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SUMMARY

This paper performs initially a comparative analysis of the university curriculum of the 10 specialty universities from Romania.

The paper also analyzes whether these percentages correspond to the European academic norms, and compare them to the percentages of these groups of courses in other European member countries.

The 2005-2006 academic year brings most of the changes in the organization and functioning of the Romanian technical higher education, since 1989. The academic training is developed on cycles of studies: undergraduate education – 4 years, graduate Master's degree – 1-2 years, Doctoral studies – 3 years. Thus, engineering was changed from 5 to 4 years of studies. Implementing the Bologna Agreement is a priority objective of the current government and therefore it imposed radical changes in the structure of academic studies, in the structure of fields and specialties, and in the assessment mechanisms. Introducing these new regulations, the Romanian higher education is sought to be brought in line with the European education. These regulations have been applied since October 2005. During this year, the Ministry of Education and Research has issued the normative framework for the application of this Agreement.

The Bachelor's Degree is for now on granted by field of study and will be accompanied by a Supplemental Diploma specifying the specialization. The undergraduate specialties offer the students a wide range of knowledge and competences, so that they can benefit of the number of opportunities that exist on the labor market.

This paper was determined by the concerns of the authors to integrate the Romanian geodesic academic education into the European one, without destroying the tradition and changing essentially the elements that have been proven to be competitive worldwide.

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1. CURRENT STIPULATIONS CONCERNING THE ORGANIZATION OF ACADEMIC STUDIES IN ROMANIA, WITHIN THE CONTEXT OF EUROPEAN INTEGRATION

According to the last provisions of the Ministry of Education and Research from Romania, established in October 2006, through the HIGHER EDUCATION LAW project, the organization of higher education is ensured through higher education institutions, namely: universities, institutes or academies. The mission of the higher education institution is to ensure the development of teaching, learning and research in the areas of sciences, as well as, teaching, learning, creating and performing in arts and sports, such that it supports the personal development of the beneficiaries and the welfare of the society and communities.

Higher education institutions can be public or private. In order to satisfy the various requirements of people, communities and society, concerning efficient organization, management and operation, the higher education institutions are autonomous and are accountable for their own management.

In fulfilling their mission, higher education institutions adhere to the following principles:

- Ensuring academic freedom in scientific research, artistic creation, teaching courses, study and learning;
- Training students in adequate qualifications for their employment in a professional carrier;
- Involving students in discussing and making decisions concerning the quality of teaching and learning, the organization of studies and the conditions of academic life;
- Promoting relations of cooperation between all members of the academic community;
- Promoting the ethical and moral values of democratic society;
- Integrating the Romanian institutions in the European space of higher education;
- Ensuring optimal financial and logistic conditions for national and international mobility of students, researchers and faculty members;
- Respecting the conditions and criteria of equal opportunities and chances for study, without any kind of discrimination;
- Efficient management of higher education institutions.

In fulfilling their mission, higher education institutions ensure:

- High quality of teaching and learning;
- Knowledge, technology and artistic creation production, which participates in the personal development of students, and the welfare of society and communities;

- A higher education based on scientific research or on artistic creation and sport performance, respectively;
- Training students in academic qualifications that correspond to professional carriers specific to an economy based on knowledge and to a society based on democratic principles and practices;
- Extending the opportunities in order to train and develop young students;
- Adequate conditions for continuous educations for those interested;
- National and international cooperation in research and quality higher education;
- Knowledge and technology transfer that participates in social, economical and cultural development of the communities and regions;
- Respecting the rights of intellectual property;
- Developing as close as possible relations with graduates;
- Transparent institutional management, by publishing information concerning how the principles and values mentioned in this article are applied.

Higher education institutions, public or private, have juridical personality and are juridical persons of national interest.

Each higher education institution operates based on an institutional charter, adopted according to the legal provision.

Every three years, the Ministry of Education and Research presents a report to the Parliament. This report is based on the performance reports of higher education institutions concerning the status of the national higher education system and its future development strategy, in European and global context. Such a report has to address all aspects that are related to fulfilling the mission of the higher education institution, the financing status of the higher education, the quality of teaching and research, the quality of learning and life of students, employing teaching and research personnel with special reference to young university staff. The teaching positions from higher education institutions are as follows: assistant, lecturer, and professor.

The curricular projection in higher education institutions is accomplished by organizing and structuring study programs, compatible with the European framework of qualifications. The national qualification framework is established by law.

The program of academic studies represents a set of curricular units for teaching, learning, practical applications and evaluation, organized and designed such that they would lead to an academic qualification, certified through a diploma of studies. The program of studies is individualized by the set of learning results that have to be accomplished in order to obtain a certain number of credits.

The general principles that guide the curricular definition of academic study programs are the following:

- The principle of relevance of the academic qualification on the labor market – assumes that the study programs offer a relevant qualification on the labor market;
- The principle of professional functionality and fitness – refers to the adjustment of study programs depending on the needs of professional training of students, in a society going through continuous changes, and refers also to the enlargement and expansion of areas of knowledge;
- The principle of transferability – at the level of specific competences, it outlines the need to ensure the transfer of professional competences and abilities;
- The principle of consistency – takes into consideration the degree of horizontal and vertical integration of specialization modules, and within their framework, the courses that are studied. The principle of consistency refers in general to how the credit system is applied, intra and inter modules.
- The principle of accessibility and continuity – assumes adjusting the educational offer depending on the initial training level of the students.
- The principle of equal educational and professional chances – takes into consideration ensuring a system that gives each student the right to discover and to completely fructify his/her potential.
- The principle of flexibility and personal development – assumes curricular decentralizing.

The programs of academic studies are organized on academic courses, interdisciplinary and professionally, progressively, according to the cycles of academic studies: undergraduate education, master's degree and doctoral studies.

The programs for undergraduate education offer preliminary academic training, which qualifies students for professions that require applying knowledge and professional abilities. The diploma granted after successfully finishing a program of academic studies for undergraduate cycle is called "license diploma", on which the field of specialty is also mentioned.

The programs of academic studies plan and organize the specific workload of the teaching, learning, practical application and assessment activities, in terms of credits of study, in accordance to the European Credit Transfer System.

The measurement unit of academic study periods is the semester. The quantity of individual intellectual work of one student, corresponding to one semester is equivalent to 30 credits of study.

In Romania, the academic studies are organized on three cycles: undergraduate education, master's degree and doctoral studies, respectively.

The programs of academic studies for undergraduate education require a volume of intellectual work equivalent to at least 180 credits and at most 240 credits. Finishing the undergraduate studies ascertains assimilating the general and specialty knowledge and competences, as well as the cognitive skills specific to the profession.

2. THE STUDY OF GEODESY IN ROMANIAN UNIVERSITIES

The area of study of Sciences of Terrestrial Measurements is the Geodesy and the specialization is Terrestrial Measurements and Cadastre. At present, there exist 11 universities that are organizing such studies, shown in Table 1.

Table 1. The universities that are organizing academic undergraduate studies in the field of Geodesy

1	"1 December 1918" University	Alba-Iulia
2	The Northern University	Baia Mare
3	"Transylvania" University	Brasov
4	The Technical Constructions University	Bucuresti
5	The University of Agronomic Sciences and Veterinary Medicine	Bucuresti
6	The University of Agricultural Sciences and Veterinary Medicine	Cluj-Napoca
7	The University from Craiova	Craiova
8	"Southern Danube" University	Galati
9	The "Gheorghe Asachi" Technical University	Iasi
10	The University from Oradea	Oradea
11	"Politehnica" University	Timisoara



Figure 1. Romanian academic centers

3. THE STRUCTURE OF EDUCATION DESIGNS, IN THE FIELD OF GEODESY

The technical specialty education of academic level in Romania is regulated by very strict stipulations concerning the percentages that each group of courses has to respect, as it follows:

- Fundamental courses: at least 17% of the total hours for the four years of study, distributed in the years I, and II,
- Technical engineering specialty courses: at least 38%, distributed in the semesters 2, 3, 4, 5, and 6,
- Specialty courses: at least 22.5%, distributed in the semesters 7, and 8,
- Optional courses – offered by choice of the university: 12%, distributed in the years I, II, III, and IV,
- Complementary courses: at most 8%, distributed in the years I, and II.

In what follows, we shall present the structure of the educational plan of the specialization of Terrestrial Measurements and Cadastre, within the Northern University from Baia Mare (Table 2).

Table 2. The structure of the educational plan of Terrestrial Measurements and Cadastre specialization at Northern University from Baia Mare

		YEAR I				YEAR II				YEAR III				YEAR IV			
No	I. FUNDAMENTAL COURSES, >17%, years I, II	sem.1		sem.2		sem.3		sem.4		sem.5		sem.6		sem.7		sem.8	
		C	S	A	P	C	S	A	P	C	S	A	P	C	S	A	P
1	Mathematical Analysis*	2	1														
2	Linear Algebra, Analytic and Differential Geometry*	2	2														
3	Special Mathematics					2	1										
4	Numerical Methods in Geodesy-The Theory of Errors							2	1								
5	Soil Chemistry							2	2								
5	Physics			2	1												
6	Descriptive Geometry – Geometric Representation of surfaces	2	2	2	1												
7	Mechanical and infographic drawing		3														
8	Computer Programming and Programming Languages			2	1												
9	Infographics					2	1										
10	Geography	3	1														
11	The Use of Computers in Geodesy	2	2														
No	II. TECHNICAL-ENGINEERING COURSES >38%, semesters 2, 3, 4, 5, 6	sem.1		sem.2		sem.3		sem.4		sem.5		sem.6		sem.7		sem.8	
		C	S	A	P	C	S	A	P	C	S	A	P	C	S	A	P
1	General Course of Constructions					2	1										
2	Traffic Routes			2	1												
3	Mathematical Geodesy							2	1	2	2						
4	Physical Geodesy											2	2				
5	Astronomy			1	1												
6	General Topography			3	2	3	3	3	2	1							
7	Engineering Topography									3	2	3	2	1			
9	Cadastre									3	2	3	2	1			
10	Photogrammetry							2	1								
11	GIS Fundamentals							3	2								
12	GIS									1	1						
13	Geodesic and Topographic Tools			3	1												
14	Mathematical Cartography									2	2						
		YEAR I				YEAR II				YEAR III				YEAR IV			
No	III. SPECIALTY COURSES >22,5%, semesters 7, 8	sem.1		sem.2		sem.3		sem.4		sem.5		sem.6		sem.7		sem.8	
		C	S	A	P	C	S	A	P	C	S	A	P	C	S	A	P
COMPULSORY ENGINEERING SPECIALTY COURSES																	
1	Analytical Photogrammetry													1	1		
2	Map Editing													1	1		
3	Specialty Cadastre													2	1	1	

7.	Cartographic Drawing	-	-	2	-
8.	Foreign Languages 1	-	2	-	-
9.	Socio-Human Courses	2	2	-	-
10.	Physical Education 1*	-	(2)	-	-
Semester 2		C	S	A	P
1.	Higher Mathematics 2	2	2	-	-
2.	Analytical and Differential Geometry	2	2	-	-
3.	Physics 2	3	-	1	-
4.	Geometric Fundamentals of Photogrammetry	2	-	1	-
5.	Measuring Instruments and Methods 2	2	-	2	-
6.	General Course of CCIA	2	-	2	-
7.	Fundamentals of Physical Geodesy 1	2	-	-	-
8.	Geodesic Astronomy	2	-	1	-
9.	Foreign Languages 2	-	2	-	-
10.	Physical Education 1*	-	(2)	-	-
11.	Practice 1 (Topography)	-	-	-	-
Semester 3		C	S	A	P
1.	Higher Mathematics 3	3	2	-	-
2.	Automatic Processing of Geodesic Data	3	-	3	-
4.	Measurement Compensation and Statistics 1	3	-	2	-
5.	Fundamentals of Wave Geodesic Measurements	2	-	1	-
6.	Fundamentals of Physical Geodesy 2	2	-	1	-
7.	Mathematical Geodesy 1	2	-	-	-
8.	Topography 1	2	-	2	-
9.	Foreign Languages 3	-	2	-	-
10.	Physical Education 2	-	(2)	-	-
Semester 4		C	S	A	P
1.	Measurement Compensation and Statistics 2	3	-	2	-
2.	Topography 2	2	-	-	2
3.	Planimetric Photogrammetry	2	-	1	-
4.	Information Systems in Terrestrial Measurements	3	-	2	-
5.	Electronic Measurements of Distances	2	-	2	-
6.	Mathematical Geodesy 2	2	-	1	-
7.	Hydrotechnical Constructions and Technical-Urban Networks	2	-	2	-
8.	Foreign Languages 4	-	2	-	-
9.	Physical Education 2*	-	(2)	-	-
10.	Practice 2 (Geodesy)	-	-	-	-
Semester 5		C	S	A	P
1.	Sensors – Technique of Measurement and Processing	2	-	1	-
2.	Fundamentals of Engineering Measurements	2	-	2	-
3.	Mathematical Geodesy 2	-	-	-	1
4.	Mathematical Geodesy 3	2	-	-	-

5.	Cadastre 1	2	-	1	-
6.	Stereo-photogrammetry and Photo-interpretation	4	-	1	-
7.	Cartographic Projections	4	-	2	-
8.	Traffic Routes and Artworks	2	-	2	-
9.	Foreign Languages 5	-	2	-	-
	Semester 6	C	S	A	P
1.	Mathematical Geodesy 3	-	-	-	2
2.	Cartographic Modeling 1	2	-	2	-
3.	Engineering Measurements in Constructions and Industry 1	3	-	-	2
4.	Analytical Photogrammetry	2	-	-	1
5.	Cadastre 2	3	-	2	-
6.	Geographic Information Systems	2	-	2	-
7.	Special Topographic Surveys	1	-	1	-
8.	Cadastral-Land Laws and Legislation	3	-	2	-
9.	Practice 3 (Photogrammetry + Engineering Topography)				
	Semester 7	C	S	A	P
1.	Spatial Geodesy 1	2	-	1	-
2.	Physical Geodesy	2	-	1	-
3.	Engineering Photogrammetry	3	-	1	-
4.	Engineering Measurements in Constructions and Industry 2	2	-	2	-
5.	Cartographic Modeling 2	2	-	-	2
6.	Land Organization and Ecology	2	-	1	-
7.	Information Systems in Cadastre	2	-	-	2
8.	Capital Goods Assessment	2	-	1	-
	Semester 8	C	S	A	P
1.	Spatial Geodesy 2	2	-	1	-
2.	Projection and Optimization of Geodesic Networks	2	-	-	-
3.	Digital Photogrammetry	2	-	1	-
4.	Remote Sensing	2	-	2	-
5.	Land Reclamation and Urbanism	2	-	1	-
6.	Underground Measurements	2	-	1	-
7.	Monitoring Land and Constructions Behavior	2	-	1	-
8.	The Organization of Geodesic Works	2	-	2	-
9.	Accountancy	2	1		-

The structure of the plan is the following:

– Basic Training	(BT)	47 hours / 19,9%
– General Technical Training	(GTT)	56 hours / 23,7%
– General Engineering Training	(GET)	45 hours / 19,1%
– Specialty Training	(ST)	62 hours / 26,3%
– Economical and Juridical Training	(EJT)	12 hours / 5,1%
– Complementary Training	(CT)	14 hours / 5,9%

It can be noticed that all eight basic courses are included in the educational plan of the Geodesy Faculty from Bucharest, as well as in the educational plans of the other 9 specialty faculties from the country. However, the name of some courses varies, also the year in which they are studied, the number of hours assigned to these courses and the structure of some supplementary courses are different, depending on the position of the specialization within the context of the faculty or university in which it is organized. For example, the department that organizes the specialization of Terrestrial Measurements and Cadastre in Baia Mare is the Mining Department, a large part of the topographic activity in the Baia Mare area belonging to the mining field, so it is natural that certain courses from this field will be included in the educational plan.

5. THE ROMANIAN GEODESIC EDUCATION IN EUROPEAN CONTEXT

Analyzing the organization of undergraduate academic studies from various European countries, it can be seen that they present a large diversity.

Academic Sites for Geomatic Engineering created by the Faculty of Civil Engineering and Geodesy at the Technical University from Munchen actively specify (each institution having its own site) faculties from the field of Geodesy from 80 countries, all around the world: 12 African countries, 15 Asian countries, 4 Australian and Oceanic countries, 6 North American countries, 12 South American countries and 31 European countries.

The Commission 2 – from FIG has established a database concerning topo-geodesic education (Surveying Education Database-SEDB). Each academic department, which is included in the SEDB database, offers academic and post-university training in any areas of Terrestrial Measurements Sciences, SEDB containing currently over 250 institutions from 70 countries, which offer 450 specialty courses. SEDB is considered to be a major benefit for the entire academic faculty from FIG, promoting a discussion group for academic dialog (FIG Discussion Groups) and proposing the development of a virtual academy in the field. Nevertheless, in 1998 FIG has established a new member category within the federation: organizations, institutions or agencies that promote education and research in the field; in September 2005 there were 84 academic members from 53 countries, their number increasing constantly.

It is difficult to find a common ground for geodesic educational systems in different countries, for the years of study, the diplomas being granted, the courses and the hours assigned to each

of them. But each educational plan contains the groups of courses (General Topography, Engineering Topography, Geodesy, Cartography, Photogrammetry, Remote Sensing, Cadastre, GIS, Urbanism, Land Organization and Systematization), particularized and developed differently.

The application of the Credit Transfer System, the mutual matching of diplomas requires certain clarifications, such as:

- The standardization of course names,
- Establishing the content and coverage of each course,
- Developing a common curricular area, in broad terms, namely 60-80% of the courses to be common,
- Implementing in all EU countries the three cycle academic education: undergraduate education, master's degree and doctoral studies,
- Developing a background of equivalent hours – for example, for undergraduate education, in Romania there are assigned 8 semesters of 14 weeks each, consisting in 24-28 hours of courses, practical applications, projects.

Of course, these measures should not alter the local and national traditions, and the adjustment of academic programs and plans in the field of Geodesy can be accomplished only in a subtle manner.

6. CONCLUSIONS

This paper wishes to prove that the Romanian geodesic education is following the right path, and that the intent of the authorities in higher education and of the responsible factors from the field is to produce graduates that could competently operate not only in the European space, but also everywhere in the entire world.

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Professional activity

Geodesy engineer,	1974-1980,	Energoconstructia Trust, Bucharest,
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