



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

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Romania  
NORTH UNIVERSITY BAI A MARE

**EUROPE**  
Continent Size:  
9,938,000 sq km  
3,837,081 sq miles  
Percent of Earth's Land: 6.7%



Population:  
729,000,000 (2006)



Map of united Europe



Capital	Bucharest(Bucuresti)	44°25'N, 26°06'E
Area	Total	238,391 km <sup>2</sup> (82ND) 92,043 sq miles
Water(%)		3%
Population		22,303,552
Density		91/km <sup>2</sup>
Time zone		EET(UTC+2)
Ascension to UE		January 1, 2007

### Structure

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.
- Engineering was changed from 5 to 4 years of studies.
- Implementing the Bologna Agreement 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.

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

#### PRINCIPLES IN FULFILLING THE MISSION OF HIGHER EDUCATION INSTITUTIONS

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

### General principles that guide the curricular definition of academic study programs

1. 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;
2. 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;
3. The principle of transferability - at the level of specific competences, it outlines the need to ensure the transfer of professional competences and abilities;
4. 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;
5. The principle of accessibility and continuity - assumes adjusting the educational offer depending on the initial training level of the students;
6. 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;
7. The principle of flexibility and personal development - assumes curricular decentralizing.

### 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 North 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

### ROMANIAN ACADEMIC MAP



### 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.

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

#### I. FUNDAMENTAL COURSES, >17%, years I, II

C-courses, S-seminars, A-applications, P-projects

1. Mathematical Analysis (2C 1S)
2. Linear Algebra, Analytic and Differential Geometry (2C 2S)
3. Special Mathematics (2C 1S)
4. Numerical Methods in Geodesy-The Theory of Errors (2C 1S)
5. Soil Chemistry (2C 2S)
6. Physics (2C 1S)
7. Descriptive Geom.-Geometric Representation of surfaces (4C 3A)
8. Mechanical and infographic drawing (3A)
9. Computer Programming and Programming Languages (2C 1A)
10. Infographics (2C 1A)
11. Geography (3C 1A)
12. The Use of Computers in Geodesy (2C 2A)

#### II. TECHNICAL-ENGINEERING COURSES >38%, semesters 2, 3, 4, 5, 6

12. General Course of Constructions (2C 1A)
13. Traffic Routes (2C 1A)
14. Mathematical Geodesy (4C 3A)
15. Physical Geodesy (2C 2A)
16. Astronomy (1C 1A)
17. General Topography (9C 8A 1P)
18. Engineering Topography (6C 4A 1P)
19. Cadastre (6C 4A 1P)
20. Photogrammetry (2C 1A)
21. GIS Fundamentals (3C 2A)
22. GIS (1C 1A)
23. Geodesic and Topographic Tools (3C 1A)
24. Mathematical Cartography (2C 2A)

C-courses, S-seminars, A-applications, P-projects

III. SPECIALITY COURSES  
 >22.5%, semesters 7, 8  
 COMPULSORY ENGINEERING SPECIALTY COURSES

25. Analytical Photogrammetry (1C 1A)
26. Map Editing (1C 1A)
27. Specialty Cadastre (2C 1A 1P)
28. Cadastral Land Legislation (2C )
29. Digital Cadastre (2C 1A)
30. Cadastral Mapping and Quality Control (1C 1A)
31. Monitoring Land and Construction Behavior (1C 1A)
32. Tracing Investment Works in Cinematic Regime (1C 1A)
33. The Organization of Geodesic Works (1C 1A)
34. Management (2C)
35. Urbans Management (2C 1A)
36. Under ground Measurements (1C 1A)
37. Eco-management (2C 1A)
38. Space Geodesy (1C 1A)
39. Remote Sensing (1C 1A)
40. Global Positioning Systems GPS (1C 1A)
41. O1- Geodesic Spatial Technologies - Cartographic Modeling (1C 1A)
42. O2- Technique of Topo. Eng. Measurements - Dynamic Topography (1C 1A)
43. O3- Special Topo. Surveys - Topographic Tracing of Special Works (1C 1A)
44. O4- Capital Goods Assessment - Land Assessment (1C 1A)
45. Land Organization (1C 1A)
46. Geodesic Wave Measurement (2C 1A)
47. Projection and Optimization of Geodesic Networks (1C 1A)

IV. OPTIONAL COURSES - OPTIONS OF UNIVERSITY  
 =12%, years I, II, III, IV

48. Geomorphology (2C 1A)
49. Fundamentals of Cartographic Representations (2C 1A)
50. Fundamentals of Geodesy and Topography (3C 1A)
51. Geometric Fundamentals of Photogrammetry (2C 1A)
52. Fundamentals of Engineering Measurements (2C 1A)
53. Work Safety in Topo-Geodesic Works (2C )
54. Accountancy (1C 1A)
55. O5- Geomechanics - Tunnels and Metropolitan Networks (2C 1A)
56. O6- Mining Fundamentals - Environmental Protection and Land Reclamation (2C 1A)
57. O7- Risk Management - Project Management (2C 1A)

V. COMPLEMENTARY COURSES <8%, years I,II

58. Communication Theory (1C )
59. Foreign Language (E,F,G,R) (4A)
60. Physical Education (2A)

C-courses, S-seminars, A-applications, P-projects

The fundamental structure of the plan is given by a series of 8 courses:

- Geodesy,
- Cartography,
- General Topography,
- Engineering Topography,
- GIS,
- Photogrammetry,
- Remote Sensing, and
- Management.

On their turn, these courses include other courses.  
 Geodesy include

- Mathematical Geodesy,
- Physical Geodesy,
- Astronomy,
- Satellite Geodesy,
- Global Positioning Systems - GPS,
- Ellipsoidal Geodesy.

From among the total of 47 technical and specialty courses, which are studied in the university, 39 are components of the 8 fundamental courses

THE COMPARATIVE ANALYSIS OF EDUCATIONAL PLANS FROM THE UNIVERSITIES WHERE GEODESY IS STUDIED

Being considered the most prestigious field faculty, and being also the oldest one and until 1990 the only one, the Geodesy Faculty from Bucharest, offers a position for studying for those who wish to obtain a specialization in techniques and methods for "measuring and representing the surface of the Earth" [Helmert 1880], as well as for those who wish to integrate in "the unitary and mandatory system of technical, economical and juridical recording of all buildings in the entire country, regardless of their intent or owner" [Law 7/1996of cadaster].

The structure of the educational plan of Terrestrial Measurements and Cadastre specialization at Technical University from Bucurest

I. FUNDAMENTAL COURSES,  
 >17%, years I, II

C-courses, S-seminars, A-applications, P-projects

1. Higher Mathematics 1(2C 2S) Higher Mathematics 2(2C 2S)
2. Algebra(2C 2S) Analytical and Differential Geometry(2C 2S)
3. Higher Mathematics 3(3C 2S)
4. Measurement Compensation and Statistics 1(3C 2S) Measurement Compensation and Statistics 2(3C 2S)
5. Physics 1(3C 1A) Physics 2 (3C 1A)
6. Geometric Representations of Topographic Surfaces(2C 2A) Cartographic Drawing(2A)
7. Physical Geography(2C)
8. Automatic Processing of Geodesic Data (3C 3A)

## II. TECHNICAL-ENGINEERING COURSES

>38%, semesters 2, 3, 4, 5, 6

9. General Course of CCIA(2C 2A)
10. Hydrotechnical Constructions and Technical-Urban Networks(2C 2A)
- Traffic Routes and Artworks(2C 2A)
11. Mathematical Geodesy 1,2,3(4C 2A 2P)
12. Fundamentals of Physical Geodesy 1(2C) Fundamentals of Physical Geodesy 2(2C 1A) Physical Geodesy(2C 1A)
13. Geodesic Astronomy(2C 1A)
14. Topography 1(2C 2A) Topography 2(2C 2A)
15. Engineering Measurements in Constructions and Industry 1(3C 2A) Engineering Measurements in Constructions and Industry 2(2C 2A)
16. Cadastre 1(2C 1A) Cadastre 2(3C 2A)
17. Planimetric Photogrammetry(2C 1A) Stereo-photogrammetry and Photo-interpretation(4C 1A) Engineering Photogrammetry(3C 1A)
18. Information Systems in Terrestrial Measurements(3C 2A)
19. Geographic Information Systems(2C 2A)
20. Measuring Instruments and Methods 1(2C 2A) Measuring Instruments and Methods 2(2C 2A) Electronic Measurements of Distances(2C 2A)
21. Cartographic Modeling 1(2C 2A) Cartographic Projections(4C 2A) Cartographic Modeling 2(2C 2P)

## III. SPECIALITY COURSES

>22.5%, semesters 7, 8

### COMPULSORY ENGINEERING SPECIALTY COURSES

23. Analytical Photogrammetry(2C 1A)
24. Information Systems in Cadastre(2C 2P)
25. Cadastral-Land Laws and Legislation(3C 2A)
26. Digital Photogrammetry(2C 1A)
27. Monitoring Land and Constructions Behavior(2C 1A)
28. The Organization of Geodesic Works(2C 2A)
29. Land Reclamation and Urbanism(2C 1A)
30. Underground Measurements(2C 1A)
31. Land Organization and Ecology(2C 1A)
32. Spatial Geodesy 1(2C 1A) Spatial Geodesy 2(2C 1A)
33. Remote Sensing(2C 2A)
34. Special Topographic Surveys(1C 1A)
35. Capital Goods Assessment(2C 1A)
36. Sensors - Technique of Measurement and Processing(2C 1A)
37. Projection and Optimization of Geodesic Networks(2C)

C-courses, S-seminars, A-applications, P-projects

## IV. OPTIONAL COURSES - OPTIONS OF UNIVERSITY

=12%, years I, II, III, IV

38. Fundamentals of Wave Geodesic Measurements(2C 1A)
39. Fundamentals of Photogrammetry(2C 1A)
40. Fundamentals of Engineering Measurements(2C 2A)
41. Accountancy(2C 1A)

## V. COMPLEMENTARY COURSES <8%, years I,II

42. Socio-Human Courses(2C 2A)
43. Foreign Languages 1(2A) Foreign Languages 2(2A) Foreign Languages 3(2A)
44. Physical Education 1-2(4A)

C-courses, S-seminars, A-applications, P-projects

The structure of the educational plan of Terrestrial Measurements and Cadastre specialization at Northern University from Baia Mare-Bucarest

## I. FUNDAMENTAL COURSES,

>17%, years I, II

C-courses, S-seminars, A-applications, P-projects

1. Mathematical Analysis (2C 1S) Higher Mathematics 1(2C 2S) Higher Mathematics 2(2C 2S)
2. Linear Algebra, Analytic and Diff. Geometry (2C 2S) Algebra(2C 2S) Analytical and Differential Geometry(2C 2S)
3. Special Mathematics (2C 1S) Higher Mathematics 3(3C 2S)
4. Numerical Methods in Geodesy-The Theory of Errors (2C 1S) Measurement Compensation and Statistics 1(3C 2S) Measurement Compensation and Statistics 2(3C 2S)
5. Soil Chemistry (2C 2S)
6. Physics (2C 1S) Physics 1(3C 1A) Physics 2 (3C 1A)
7. Descriptive Geom. Geometric Representation of surfaces (4C 3A) Geometric Representations of Topographic Surfaces(2C 2A) Cartographic Drawing(2A)
8. Mechanical and infographic drawing (3A)
9. Computer Programming and Programming Languages (2C 1A)
10. Infographics (2C 1A)
11. Geography (3C 1A) Physical Geography(2C)
12. The Use of Computers In Geodesy (2C 2A) Automatic Processing of Geodesic Data (3C 3A)

## II. TECHNICAL-ENGINEERING COURSES

>38%, semesters 2, 3, 4, 5, 6

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13. Traffic Routes (2C 1A) Hydrotechnical Constructions and Technical-Urban Networks 2A) Traffic Routes and Artworks(2C 2A)
14. Mathematical Geodesy (4C 3A) Mathematical Geodesy 1,2,3(4C 2A 2P)
15. Physical Geodesy (2C 2A) Fundamentals of Physical Geodesy 1(2C) Fundamentals of Physical Geodesy 2(2C 1A) Physical Geodesy(2C 1A)
16. Astronomy (1C 1A) Geodesic Astronomy(2C 1A)
17. General Topography (9C 8A 1P) Topography 1(2C 2A) Topography 2(2C 2A)
18. Engineering Topography (6C 4A 1P) Engineering Measurements in Constructions and Industry 1(3C 2A) Engineering Measurements in Constructions and Industry 2(2C 2A)
19. Cadastre (6C 4A 1P) Cadastre 1(2C 1A) Cadastre 2(3C 2A)
20. Photogrammetry (2C 1A) Planimetric Photogrammetry(2C 1A) Stereo-photogrammetry and Photo-interpretation(4C 1A) Engineering Photogrammetry(3C 1A)
21. GIS Fundamentals (3C 2A) Information Systems in Terrestrial Measurements(3C 2A)
22. GIS (1C 1A) Geographic Information Systems(2C 2A)
23. Geodesic and Topographic Tools (3C 1A) Measuring Instruments and Methods 1(2C 2) Measuring Instruments and Methods 2(2C 2A) Electronic Measurements of Distances(2C 2)
24. Mathematical Cartography (2C 2A) Cartographic Modeling 1(2C 2A) Cartographic Projections(4C 2A) Cartographic Modeling 2(2C 2P)

C-courses, S-seminars, A-applications, P-projects

## III. SPECIALITY COURSES

>22.5%, semesters 7, 8

### COMPULSORY ENGINEERING SPECIALTY COURSES

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26. Map Editing (1C 1A)
27. Specialty Cadastre (2C 1A 1P) Information Systems in Cadastre(2C 2P)
28. Cadastral Land Legislation (2C) Cadastral-Land Laws and Legislation(3C 2A)
29. Digital Cadastre (2C 1A) Digital Photogrammetry(2C 1A)
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34. Management (2C)
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36. Under ground Measurements (1C 1A) Underground Measurements(2C 1A)
37. Eco-management (2C 1A) Land Organization and Ecology(2C 1A)
38. Space Geodesy (1C 1A) Spatial Geodesy 1(2C 1A) Spatial Geodesy 2(2C 1A)
39. Remote Sensing (1C 1A) Remote Sensing(2C 2A)
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43. O3 - Special Topo. Surveys - Topographic Tracing of Special Works (1C 1A) Special Topographic Surveys(1C 1A)
44. O4 - Capital Goods Assessment - Land Assessment (1C 1A) Capital Goods Assessment(2C 1A)
45. Land Organization (1C 1A)
46. Geodesic Wave Measurement (2C 1A) Sensors - Technique of Measurement and Processing(2C 1A)
47. Projection and Optimization of Geodesic Networks (1C 1A) Projection and Optimization of Geodesic Networks(2C)

IV. OPTIONAL COURSES - OPTIONS OF UNIVERSITY  
=12%, years I, II, III, IV

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- 49. Fundamentals of Cartographic Representations (2C 1A)
- 50. Fundamentals of Geodesy and Topography (3C 1A) Fundamentals of Wave Geodesic Measurements(2C 1A)
- 51. Geometric Fundamentals of Photogrammetry (2C 1A) Geometric Fundamentals of Photogrammetry(2C 1A)
- 52. Fundamentals of Engineering Measurements (2C 1A) Fundamentals of Engineering Measurements(2C 2A)
- 53. Work Safety in Topo-Geodesic Works (2C )
- 54. Accountancy (1C 1A) Accountancy(2C 1A)
- 55. O5- Geomechanics - Tunnels and Metropolitan Networks (2C 1A)
- 56. O6- Mining Fundamentals - Environmental Protection and Land Reclamation (2C 1A)
- 57. O7- Risk Management - Project Management (2C 1A)

V. COMPLEMENTARY COURSES <8%, years I,II

- 58. Communication Theory (1C ) Socio-Human Courses(2C 2A)
- 59. Foreign Language (E,F,G,R) (4A) Foreign Languages 1(2A)  
Foreign Languages 2(2A) Foreign Languages 3(2A)
- 60. Physical Education (2A) Physical Education 1-2(4A)

C-courses, S-seminars, A-applications, P-projects

THE STRUCTURE OF THE PLAN

• Basic Training (BT)	19,9%
• General Technical Training (GTT)	23,7%
• General Engineering Training (GET)	19,1%
• Specialty Training (ST)	26,3%
• Economic. and Juridic. Training(EJT)	5,1%
• Complementary Training(CT)	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.

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

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.

CONCLUSIONS

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.

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.



THANK YOU!