NATIONAL TECHNICAL UNIVERSITY OF ATHENS

SCHOOL OF RURAL AND SURVEYING ENGINEERING

SCHOOL HANDBOOK

ATHENS

2020-2021

About this Handbook:
This handbook is intended to provide a practical guide for the undergraduate student *at the School of Rural and Surveying Engineering* at the National Technical University of Athens. Effort is made to have this handbook updated annually.

1. NATIONAL TECHNICAL UNIVERSITY OF ATHENS

1.1 The structure of NTUA

The ***National Technical University of Athens*** (NTUA) is a Greek Higher Education Institution (HEI).

The history of NTUA dates back to 1836 when the *Royal School of Arts* was founded and was operating initially on Sundays and holidays. The first reformation took place in 1843; the *School* shifted to daily operation, and its aim was the teaching of industrial and 'fine' arts. A second major change occurred in 1863 with the introduction of theoretical and applied education for managers and technicians in building construction, metal industry, sculpture, painting, ceramics, tanning, soap manufacturing, etc. In 1887, the *School* was upgraded to a higher education establishment for Building Construction Engineers, Architects and Mechanical Engineers. Since then the evolution of NTUA follows the technical and financial development of Greece.

The last major reformation in the organization and administration of NTUA took place in 1917 when NTUA obtained a new structure and established the Schools of Civil, Mechanical & Electrical, Chemical and Surveying Engineers as well as the School of Architecture.

The current legal framework for higher education came into effect in 1982. In accordance with this, NTUA is divided into 9 **Schools**, as follows:

1. **School** of ***Civil*** Engineering
2. **School** of ***Mechanical*** Engineering
3. **School** of ***Electrical*** Engineering
4. **School** of ***Architecture***
5. **School** of ***Chemical*** Engineering
6. **School** of ***Rural & Surveying*** Engineering
7. **School** of ***Mineral & Metallurgic*** Engineering
8. **School** of ***Naval Architecture & Marine*** Engineering
9. **School** of **Applied Mathematics and Physical Science**.

As prescribed by law, each School is administered by a *General Assembly* comprising **the Teaching and Research Personnel** (TRP: Professors, Associate Professors, Assistant Professors and Lecturers) and the representative of the **Scientific and Teaching Personnel** (STP: Assistants and Research Associates), the **Administrative and Technical Personnel** (ATP) and the **Students**. Certain matters of minor importance are handled by an *Executive Board*.

A Special Electorate elects a professor or associate professor as *President* of the Department and another member of the same rank as *Deputy President.*

Each School is subdivided into **Departments** covering scientific areas. Departments are also administered by General Assemblies which are similar to the School's

assembly. The Head of a Department, called *Director*, is elected amongst professors and associate Professors by the Departments's General Assembly.

Finally, there may be further subdivisions in the form of **Laboratories** which deal with specific scientific areas. Each Laboratory is headed by a professor, or an associate professor or an assistant professor but administratively it belongs to a Departments or directly to the School.

NTUA's general administration is established by the University **Senate** which consists of the Deans of the Schools, representatives of STP, the Special Research Personnel (SRP), representatives of ATP, the administration staff and the students.

The Senate is headed by the *Rector* and two *Vice Rectors* who are professors or associate professors elected by a special electorate comprising NTUA TRP and representatives from the remaining groups of staff and students.

1.2 Structure, Mission and Objectives of Undergraduate Studies

The main strategic choice of NTUA is to maintain and strengthen its position, as a distinguished HEI of Science and Technology nationally and internationally. Thus, its main mission is to maintain a high level in the undergraduate studies. The term "Undergraduate" indicates the time before the award of the *Diploma*, taking into account the equivalence of the NTUA diploma with Integrated M.Sc. and M.Eng. NTUA prepares the Undergraduate Studies Programs and implements them based on the following structure, mission, and objectives:

A. *Maintaining the solid structure and enriching the studies with a modern vision and a specific mission*:
The structure of the five-year studies is maintained with emphasis on strong theoretical foundation courses, core courses in the scientific area of each Diploma, a competent set of in-depth courses and the elaboration of a high level Diploma Thesis.
B. *Realizing the wider social role of NTUA graduates. in the 21st century studies provide*:

- Systematic and continuous development for the effective utilization of science and technology
- Balanced shape of NTUA student's personality during the period of undergraduate studies

1.3 Structure of Studies

Studies in all the Schools of NTUA cover a full and uniform five-year duration. They are subdivided into ten (10) independent academic semesters, of which the odd represent the winter semesters and the even represent the spring semesters.

The 10th semester is dedicated for the elaboration of the diploma thesis, the assignment of which is performed at the 9th semester.

‘Internship’ is an Elective course (8th semester) of the School of Rural and Surveying Engineering (SRSE) of NTUA included in the curriculum of the School [course code: 6240].

With regards registrations, transfers, etc. for a candidate to be accepted in the Schools of NTUA, the semester (winter or spring) of the academic year is determined by a decision of the School.
e. The structure of studies within the semester is defined in detail by the Academic Calendar, which is decided and approved by the Senate of the NTUA. every year.

1.4 The Academic Calendar

The academic year begins on the *1st of September* of each calendar year and ends on the *31st of August* of the following year. The education period of each academic year is structured in two semesters, the ‘*winter’* and the ‘*spring’*. All undergraduate course programs in every School of NTUA, are part of a single "Academic calendar". According to the existing provisions, each semester includes at least thirteen (13) full weeks for the teaching of the courses.

During the winter and spring semesters, there are no courses and exams on the following dates:

a*. Winter semester*
• 28th of October
• 17th of November
• Christmas and New Year holiday season from December 23rd to January 6th
• 30th of January

b. Spring semester
• Clean Monday
• March 25th
• Easter holidays, which begin on Holy Monday and end on St. Thomas Sunday
• May Day
• Day of the Holy Spirit

1.5 Consulting Professor

Following the publication of the list of the first -year enrolled students, the Dean of the School appoints a faculty member as a Study Advisor for each new student, with the essential duties of guiding and supporting him / her in matters related to his / her entire academic career and the duration of his / her studies at the School.

2 SCHOOL OF RURAL AND SURVEYING ENGINEERING

The **School of Rural and Surveying Engineering** was founded in 1917 as *'Higher School of Surveying Engineering'*. Initially, three years of study were required to obtain a diploma, but in 1930 this was increased to four years with the Department renamed as *'Higher School of Rural and Surveying Engineering'*

The leading professor of the *School of Rural and Surveying Engineering* as well as the inspirer of the changes that occurred in 1930 was **Demetrios Lambadarios**. Prof. Lambadarios was a member of the *Academy of Athens,* Rector of NTUA during 1928 to 1933 and Dean of the School for many years. Today, the School's main building in Zographou campus carries his name.

In 1974, the School's curriculum was extended to five years under the leadership of Emeritus Professor George Veis, and in 1982 the School's title was changed to *'School of Rural and Surveying Engineering'*. In 2001, in recognition of the Emeritus Professor Mr. G. Veis' offer to the School and NTUA, the second building of SRSE was named as 'Veis Building'. To date, the official name is SCHOOL OF RURAL AND SURVEYING ENGINEERING (SRSE).

The SRSE Heads served since 1983 are a follows:

Academic Year	*President*	*Deputy President*
1983-84	D. Balodimos	---
1984-86	D. Balodimos	---
1986-88	D. Balodimos	E. Marketos
1988-90	C. Koutsopoulos	G. Veis
1990-92	H. Billiris	C. Koutsopoulos
1992-94	H. Billiris	G. Veis
1994-96	D. Balodimos	G. Veis
1996-98	D. Balodimos	H. Billiris
1998-00	A. Balodimou	A. Georgopoulos

The School of Rural and Surveying Engineering according to law N4009 / 2011 is considered as one-part School and is administered by the one, elected by the School and appointed by the Rector, Dean.

The Deans of SRSE since 2003 have been

Academic Year	**Dean**
2013-2014	A. Siolas
2014-2018	M. Kavouras
2018- to date	Ch. Ioannidis

In accordance with a decision of the general assembly taken on 26 April 1983, the School is divided into three Departments:

1. Department of ***Topography***

   Deals with the development of measurement methods and techniques, and their application in topographic, photogrammetric, hydrographic, geodetic and geophysical surveys.

2. Department of ***Geography and Regional Planning***

   Deals with the analysis, elaboration and interpretation of qualitative and quantitative entities in geographical space, and their inter-relationship and variation process in investigating problems of regional planning.

3. Department of ***Infrastructure Works and Rural Development***.

   Deals with planning and construction which contribute to the development of rural areas.

Department of Topography

Director: Prof. V. Gikas

LABORATORIES

- Laboratory of Geodesy
  Director: Prof. G. Pantazis
- Laboratory of Remote Sensing
  Director: Prof. D. Argialas
- Laboratory of Photogrammetry
  Director: Prof. A. Georgopoulos
- Laboratory of Cartography
  Director: Prof. M. Kavouras
- Dionysos Satellite Observatory
  Director: Prof. M. Tsakiri

FACULTY

PROFESSORS	**ASSOCIATE PROFESSORS**	**ASSISTANT PROFESSORS**	**LECTURES**
Argialas D.	Veskoukis V.	Arabatzi O.	Telioni E.
Georgopoulos A.	Doulamis A.	Kokla M.	
Gikas V.	Doulamis N.	Milas P.	
Dimopoulu E.	Karantzalos K.	Pateraki M.	
Ioannidis Ch.			
Kavouras M			
Karathanasi V.			
Nakos V.			
Pantazis G.			
Potsiou H.			
Tsakiri M.			

Scientific Collaborators	**Administrative and Technical Personnel**	
Makris G.	Andronis B.	Piniotis G.
Pournaras D.	Vamboukakis K.	Tapinaki S.
	Vassili-Vasiliou K.	Tomai E., Dr.
	Zisopoulos A.	Soile S.
	Iosifidis X.	Tsini D.
	Karamanou A., Dr.	Tsinis Δ.
	Kolokousis P., Dr.	Tsoutsoura A.
	Labropoulos A., Dr.	Hliveroy R.
	Marinou A., Dr	
	Bithas A.	
	Panopoulos G., DR.	
	Papagianni A.	

Technical Personnel

Galanis I.
Zacharis E.
Massinas B.
Bezerianou M.
Raptakis K.
Sioulsi A.
Stamou L.
Tzelepis N.

Administrative Personnel

Karidi H.
Koutrelakos D.

Department of Geography and Regional Planning

Director: Prof. G. Photis

LABORATORIES

- Laboratory of Geography
  Director: Prof. G. Photis
- Laboratory of Physical Geography and Environmental Impact
  Director: Prof. M. Papadopoulou

FACULTY

Professor

Papadopoulou M.
Photis G.
Stratigea A.

Assistant Professor

Bakogiannis E.

Administrative and Technical Personnel

Athanasopoulos K., Dr.
Darra A., Dr.
Dimitriou A.
Lekka A., Dr.
Papakonstantinou D., Dr.
Pigaki M., Dr.
Stamou D.
Hatzihrostos Th., Dr.

Technical Personnel

Kassiou S.
Kremizi, F.

Department of Infrastructure Works and Rural Development

Director: Ass. Prof. I. Nalbandis

LABORATORIES

- Laboratory of ***Reclamation works and water recourses management***
  Director: Prof. V. Tsihritzis
- Laboratory of ***Structural Mechanics and Technical Works***
  Director: Ass. Prof. M. Kattis

Laboratory of Transportation ***Engineering***

Director: Ass. Professor I. Spyropoulou

FACULTY

Professorsς	**Associate Professors**	**Assisant Professors**
Madoglou A.	Giakounakis S.	Aga E.
Tsihritzis V.	Kattis M.	
Psarianos V.	Kepaptsoglou K.	
	Nalbandis I.	
	Spyropoulou I.	

Administrative Personnel	**Administrative and Technical Personnel**
Kotsi P.	Vaggelis H, Dr. Psaropoulos P., Dr.

3 FACILITIES

The School of Rural and Surveying Engineering is serviced by the following facilities:

- Computer Center
- Photo priniting unit
- Small technical unit
- Student restaurant
- Building caretaking
- School Secretariat

3.1 Computer Centre

The SRSE operates the Geoinformatics Center (GC) and the Personal Computer Laboratory (PCLab) to cover mainly the undergraduate educational needs but also the postgraduate - research activities of the students and the staff of the School. The GS and PCLab. operate daily from 9:00 to 16:30.

Director: Ass. Prof. V.Veskoukis
Managers: Vouloutakis Ch, Administrative and Technical Personnel
Koursaris Th., Asministartive Personnel.

3.2 Photo Printing Unit

Responsible: Kostorrizos V., Technical Personnel

3.3 SRSE Secretariat

The Secretariat takes care of the educational and administrative issues.

Secretary: Mrs Kremizi Th.

Administrative support: Mrs Missa A.
Undergraduate Studies: Mrs Koutsiouri G., Mrs Leontopoulou L., Mrs Sidiropoulou E.
Postgraduate Studies: Mrs Donta A., Mrs Paliatsou E., Mrs Papaloi E.
Financial: Mrs Patsiamani L.

Clerk: Mrs Tsirba K.

4 CENTRES

Center for Physical Risk Assessment and Preventive Planning

The purpose of the Center is research and education on the issues of natural hazard assessment and the formation of preventive planning based on space-time monitoring and simulation of their evolution in relation to the natural and socio-economic environment.

The research focuses on hydrological / climatic hazards (floods, droughts, water scarcity, desertification, sea level rise, etc.), geological / geotechnical (landslides, earthquakes, etc.) and technological hazards, aimed at protecting life, property, infrastructure, environment and cultural heritage. The center aims to support the state for rational decision-making as well as to inform and raise public awareness on issues of natural hazards.

Director: Prof. Tsichrintzis V.

5 CURRICULUM

The School's curriculum is based on the scientific and technical activities of Rural and Surveying Engineers, Greece's production and development goals, as well as future prospects in those areas.

The curriculum aims at providing students with the necessary scientific and technological education that will enable them to perform satisfactorily in a specific area of Rural and Surveying Engineering.

To succeed in his/her future goal, a graduate should be in position to comprehend technical developments in his/her own scientific field, cooperate constructively with fellow engineers, and indeed contribute to scientific development.

The School's curriculum also aims at preparing interested students for post-graduate studies.

Rural and Surveying Engineering activities may be divided into the following areas of specialization:

1. Collection, processing and presentation of space and environmental elements (determination of position on the earth's surface, survey, cartography)
2. Space analysis and organization
3. Transportation engineering
4. Reclamation and other hydraulic works
5. Construction and technical works

The wide range covered by these subjects leads to the necessity for considerable *specialization* of the curriculum. It should be stressed, however, that at present, such specialization does not appear to conform to prevailing professional conditions in Greece.

The School's curriculum aims at reaching a compromise between what appears to be two 'contradictory' tendencies. This is accomplished by recognizing specialized educational areas, and by dividing courses into *mandatory* and *elective*.

Mandatory are the courses required to lead the student into mastering the basic background in Rural and Surveying Engineering and prepare the undergraduate student for specialization in a certain field.

Elective are the courses dealing with specialized subjects and topics in an area chosen by the student, and providing the required knowledge for further studies and scientific research.

In accordance with the NTUA's educational system, studies last five years. Each year is divided into two *semesters*: the **winter** semester (September to January) and the **spring** semester (February to June). Out of ten semesters, the first nine are devoted to courses and practical exercise, while students spend the last one preparing their diploma thesis.

Under the current curriculum for the completion of the studies, and obtaining the Diploma of Rural and Surveying Engineering as an integral degree (integrated master Government Gazette 3987 / 14-9-2018), 61 courses are required and the elaboration of a diploma thesis as follows:

• 47 mandatory courses

a foreign language course is included

• 1 humanitarian

in case a student gets a promotional grade in a second course in this category, this course is not counted at 61

• 6 main in-depth courses

• 1 elective in-depth courses

• 4 secondary courses

• 2 free elective courses are selected from all other in-depth courses.

• Bachelor's Diploma thesis

Total: 61 courses and diploma thesis

The total number of courses of the undergraduate program corresponds to 300 credits (ECTS) of which 30 credits correspond to the Diploma Thesis

The diploma degree is calculated, with two decimal places, as the weighted average of all courses and diploma thesis, based on the relationship stated in the Internal Regulations of NTUA.

The performance of students in the individual courses and the diploma, is described based on the following scale as:

• EXCELLENT (9 to 10)

• VERY GOOD (7 to 8.99)

• GOOD (5 to 6.99)

For the successful completion of a course the grade should be at least 5.

The offered courses of the School are 131.

Mandatory courses: Students are taught a series of compulsory courses aimed at establishing knowledge and skills, both in the basic sciences of Engineering, and in the whole range of the specific field of activity of Rural and Surveying Engineering

In addition, courses are taught with an aim to cover knowledge in humanitarian issues, while in the first semesters, foreign language teaching is mandatory.

At the end of the 4th, 6th and 8th semester, summer courses are held. The 4th semester course is a compulsory one while the summer courses at the 6th and 8th semesters are elective.

Optional compulsory courses: From the 6th to the 9th semester, students are taught a series of core and secondary courses that they choose from 5 offered that provide further knowledge on specific scientific areas

Students must choose a Course-Theme subject, from the main area of their specilisation. The aim of this course is to help the student to complete interdisciplinary knowledge, which is already acquired during the first four years of studies.

In the 6th semester, students choose a Primary and a Secondary Area from the five (5) offered:

1. TOPOGRAPHY Area Option I: Emphasis is placed on specialized subjects of Geodesy through elective courses in both theory and application, in order to give the opportunity to formulate a scientific profile in the area of Geodesy.

2. TOPOGRAPHY Area Option II: Emphasis is placed on general topography through specialized courses in Remote Sensing, Photogrammetry and Cartography of both theoretical and applied technology, so that students can form state-of-the-art scientific profile in these areas.

3. REGIONAL-URBAN PLANNING & DEVELOPMENT: Refers to topics on development, planning and management of urban and suburban space and the wider environment.

4. TRANSPORT INFRASTRACTURE: Refers to the development of knowledge background on the design and management of transport infrastructure.

5. WATER RESOURCES MANAGEMENT: Aims to develop knowledge background on the design and management of hydraulic projects and water resources systems.

In each Main Area there are 7 courses, out of which 3 are compulsory and 4 elective courses (includes 1 Course-Theme subject). In each Secondary Area, there are 4 courses, out of which 2 are compulsory and 2 are elective courses.

It is not allowed to select Primary and Secondary subjects from the same Area.

Internship

In the 8th semester, students have the opportunity to choose an Internship (course code 6240).

The Internship corresponds to 4.5 Credits (ECTS) in the European Diploma Supplement, is counted in the required number of courses for the acquisition of the Diploma of Rural and Surveying Engineering and is indicated in the detailed course grading of the student.

Prerequisite for the participation in the Internship is that the number of courses prior to obtain the Diploma for a student should not exceed 12.

The Internship grading is evaluated as "success" or "fail".

The Internship is held every year, in the period between the months of April to October. It can be performed only once during the undergraduate studies. It has a duration of two (2) calendar months and takes place in the public sector or private bodies or in recognized research centers of the country. The activity of the Internship should fall within the scientific activities of the School.

The scientific head for the SRSE's Internship course must be a member of the School's faculty staff. In addition, a number of 'Supervising professors' are appointed which are faculty members (Lecturer, Assistant Professor, Associate Professor, Professor). The role of the Supervising Professor is to monitor, assist and evaluate each trainee.

For this reason, the list of faculty members of the School who participate as Supervising professors' is determined each year, with the respective approvals of the SRSE bodies.

The Internship student in the workplace should follow the working hours of the organisation, the occupational safety and health regulations, as well as any other regulations apply to the organisation's staff.

The administrative support of the SRSE's Internship is provided by the Central Office of Internship of NTUA, in collaboration with the respective scientific and administrative staff appointed by the General Assembly of SRSE.

The aims and program of the Internship of each student of the School, is defined by the Supervising Professor in collaboration with the supervisor of the host organisation.

The course is evaluated by the scientific officer or the supervising professor of the school by submitting:

• Detailed Report of the work performed by the student, which will describe in detail all the stages of the Internship. This report will be submitted in the SRSE Registrar within one week after the end of the Internship.

• Evaluation report by the supervisor of the host organisation.

The School makes every effort to satisfy the request of all students who wish to do an internship. However, all prospective students wishing to participate in the Internship are ranked based on an algorithm. The ranking is used in the case of limited places for Internship or where the demand for positions in a certain organisation exceeds the number of offered places.

In the 9th semester the students choose one (1) Course-Theme from the choices of their main specialisation. The aim of the course is to help the student integrate interdisciplinary knowledge already acquired during the first four years of the studies, in an application case. For the student to choose the specific course must must have successfully attended a series of courses in the previous semesters, the list of which is compiled after the collaboration of the coordinator of each subject-subject with the Undergraduate Studies Committee and is available from the School Secretariat. In any case, the student should not have more than 12 courses (including the 9th semester courses) prior to receive the diploma.

Erasmus educational exchange program

The European Union ERASMUS program for education, training, youth and sport aims to enhance skills and employment as well as to modernize education, training and youth systems in all areas of Lifelong Learning (Higher Learning). Education, Vocational Education and Training, Adult Education, School Education, youth

activities, etc.). The program combines all EU education, training and youth programs such as the Integrated Lifelong Learning Program (LLP / Erasmus, Leonardo da Vinci, Comenius, Grundtvig), the Youth in Action Program and International cooperation programs (Erasmus Mundus, Tempus, Alfa, Edulink, cooperation programs with industrialized countries, etc.)

Under the ERASMUS + program, students can travel for studies and internships. It is pointed out that it is possible to participate in both programs.

Detailed information is provided by the ERASMUS office of NTUA, on the website http://erasmus.ntua.gr/el/node/1 and on the website of the School, where the current announcements are posted.

1st Semester

A/A	Code	Course	Hours	ECTS
1.	6209	Linear Algebra and Analytical Geometry	4	4,0
2.	6210	Mathematical Analysis	5	4,0
3.	6211	Introduction to Computer Programming	4	4,0
4.	6003	General geology	4	4,5
5.	6212	Descriptive and perspective Geometry	4	4,0
6.	6176	Technical and Topographical design and Drawing	4	4,0
7.	6029	Physical Geography and Environment	4	4,5
		Total	**29**	29

II. The choice of one course is mandatory (possible change on 3rd semester)

A/A	Code	Courses	Hours	ECTS
1.	6053	English language	2	0
2.	6054	French language	2	0
3.	6055	German language	2	0
4.	6060	Italian language	2	0

2ndt Semester

A/A	Code	Courses	Hours	ECTS
1.	6004	Differential Equations	4	4,0
2.	6042	Probability Theory and Statistics	4	4,0
3.	6143	Geodesy I (Introduction to Geodesy)	4	4,5
4.	6009	Physics I (Mechanics)	5	4,0
5.	6032	Cartography I (General Cartography)	4	4,5
6.	6213	Computer Programming Applications	4	4,0
7.	6178	Projective Geometry	4	4,0
		Total	**29**	29

II. The choice of one course is mandatory (possible change on 3rd semester)

A/A	Code	Courses	Hours	ECTS
1.	6110	English language	2	0
2.	6111	French language	2	0
3.	6112	German language	2	0
4.	6113	Italian language	2	0

3rd Semester

A/A	Code	Courses	Hours	ECTS
1.	6085	Numerical Analysis	4	4,0
2.	6106	Differential Geometry	4	4,0
3.	6010	Physics II (Electromagnetism & Optics)	5	4,0
4.	6215	Data based	4	4,5
5.	6027	Geodesy II (Geodetic Methods and Instruments)	4	4,5
6.	6216	Engineering Mechanics	6	4,5
		Total	**27**	25,5

II. The choice of one course is mandatory (possible exemption)

A/A	Code	Courses	Hours	ECTS
1.	6057	Αγγλική Γλώσσα	2	0
2.	6058	Γαλλική Γλώσσα	2	0
3.	6194	Γερμανική Γλώσσα	2	0
4.	6195	Ιταλική Γλώσσα	2	0

4th Semester

A/A	Code	Courses	Hours	ECTS
1.	6102	Principles of Geoinformation and G.I.S	4	4,5
2.	6090	Geodesy III (Land surveying)	5	4,5
3.	6091	Photointerpretation-Remote sensing	5	4,5
4.	6193	Cartography II (Analytical Cartography)	4	4,5
5.	6083	Highway Engimeeering I	4	4,5
6.	6174	Geotechnical Engineering	4	4,5
7.		Foreign Languages	2	3,0
	6114	English language		
	6115	French language		
	6116	German language		
	6117	Italian language		
		Total	**28**	30

II. Compulsory Summer course (17 days / 8 hours)

A/A	Code	Courses	Hours	ECTS
8.	6013	Field Course in Geodesy I		4,5

5th Semester

A/A	Code	Courses	Hours	ECTS
1.	6214	Introduction to Economic Analysis	4	4
2.	6018	Geodesy IV (Higher geodesy)	4	4,5
3.	6043	Theory of errors and Adjustements I	4	4,5
4.	6031	Photogrammetry I (Introduction to Photogrammetry)	5	4,5
5.	6025	Geography and Spatial Analysis.	4	4,5
6.	6044	Fluid Mechanics	3	4,5
7.	6188	Transportation Infrastructure Design-Economic aspects.	3	4,5
		Total	27	31
(the choice of one course is mandatory)				
A/A	**Code**	**Courses**	**Hours**	**ECTS**
1.	6138	History of civilisation	2	4
2.	6103	Urban Sociology	2	4
3.	6170	Philosophy of science	2	4

6th Semester

A/A	Code	Courses	Hours	ECTS
1.	6217	Geodesy V (Satellite Gedoesy)	4	4,5
2.	6122	Photogrammetry II (Analytical Photogrammetry)	4	4,5
3.	6099	Applied Hydraulics	3	4,5
4.	6076	Engineering Hydrology	4	4,5
		Total	15	18

7th Semester

A/A	Code	Courses	Hours	ECTS
1.	6049	Cadastre	4	4,5
2.	6153	Digital Image Analysis for Remote Sensing	4	4,5
3.	6120	Urban Planning	4	4,5
4.	6166	Hydraulic Works	4	4,5
		Total	16	18

8th Semester

A/A	Code	Courses	Hours	ECTS
1.	6130	Regional Planning	4	4,5
2.	6129	Design and Construction with Armed Concrete	4	4,5
		Total	8	9

Internship *(Code 6240)* (it is counted in the total number of courses for the Diploma and is graded as 'success' or 'fail'	**ECTS**
	4,5

9th Semester

A/A	Code	Courses	Hours	ECTS
1.	6177	Business Administration	3	4
2.	6125	Introduction to the Legal System and Elements of Technical Legislation	3	4
		Total	6	8

Offered Inter-School Seminar course at the 8th semester that is not counted for obtaining the Diploma

A/A	Code	Courses	Hours	ECTS
1.	6227	Environment and Development	3	-

POSSIBLE OPTIONS FOR MAIN AND SECONDARY AREAS

Main: Topography Option I - Secondary: Regional urban planning & Development
Main: Topography Option I - Secondary: Transport Infrastructure
Main: Topography Option I - Secondary: Water resources management

Main: Topography Option II - Secondary: Regional urban planning & Development
Main: Topography Option II - Secondary: Transport Infrastructure
Main: Topography Option II - Secondary: Water resources management

Main: Regional urban planning & Development - Secondary: Topography Option I
Main: Regional urban planning & Development - Secondary: Transport Infrastructure
Main: Regional urban planning & Development - Secondary: Water resources management

Main: Transport Infrastructure - Secondary: Topography Option II
Main: Transport Infrastructure - Secondary: Regional urban planning & Development
Main: Transport Infrastructure - Secondary: Water resources management

Main: Water resources management - Secondary: Topography Option II
Main: Water resources management - Secondary: Regional urban planning & Development
Main: Water resources management - Secondary: Transport Infrastructure

The declaration of the Elective Courses is made:
1. based on the combinations that result from the selection of the main and Secondary areas of the student (the choice of both Topography Streams (I and II) is not allowed as the Main and Secondary areas)
2. The condition for receiving a scholarship is that ALL the Compulsory Core, Main and Secondary in-depth Courses (excluding foreign language courses) have grading equal or over 5.

COURSE CONTENT

- **6209- Linear Algebra and Analytical Geometry**

Linear Spaces: Base and dimension of linear space. Internal product and rectangle. Tables. Linear illustrations. Linear table. Inversion of a square table. Linear systems. Vectors. Equation of line and plane. External vector product. Eigenvalues and eigenvectors of square tables. Square table bidding. Typical polynomial table. Cayley - Hamilton Theorem. Rectangular, symmetric and Hermetic arrays. Square shapes. Second degree curves and surfaces.

- **6210- Mathematical Analysis**

Numerical series. Derivative and differential of a function of a variable. Definite and indefinite integral, calculation methods and applications. Taylor series function development. Typical developments and applications. Functions of many variables. Partial derivative, differential, derivative of a complex function. Taylor formula, intertwined functions. Extremes of Functions. Integral calculus (double, triple, curvilinear and surface integrals) applications. Vector analysis (field theory, basic vector analysis, applications).

- **6211- Introduction to Computer Programming**

Introduction to computer science and programming, numerical systems, elements of computer architecture. Operating systems, software development environments, programming languages, algorithms. The concept of the program, the C ++ programming language. Structures and syntax of the C ++ language. Structured programming elements, memory variables, command blocks, selection and iteration structures, tables, functions, parameter passing, methods of passing table type variables into functions, input / output of data to / from files, pointers, structured analysis and design elements, related applications the object.

- **6003- General Geology**

The earth in our solar system. Atmosphere, Hydrosphere, Climate. Structure and composition of the earth. Properties of the earth (Gravity, Magnetism, Geothermal). Isostasis. The earth relief. Geological time. Theory of tectonic plates. Volcanism. Decomposition and Corrosion. Wind action. Glacial action. Minerals. Pyrenean, Sedimentary and Metamorphic rocks. Territories. Hydrographic systems and groundwater. Oceans, coasts, coastal changes. Mass movements, landslides and subsidence. Seismic action. Folding action. Ruptured action. Branches. Cracks - Active cracks. Geotectonic regime of the Greek area. Geodynamic status of the Greek area.

- **6212- Descriptive and perspective geometry**

Relevant positions of lines and planes. Parallelism and perpendicularity of lines and planes. Point and line view in level. Two-sided - three-sided angles. Prism, pyramid, cone, cylinder and sphere. Introduction to the system of the two projection levels. Representation of point, line and level. Problem solving methods. Pyramid representation, intersection with a straight line or plane. Prism representation, straight or flat section. Pyramid and prism developments. Introduction to the system of one level projection and altitudes. Representation of point, line and level. Problems of intersection of lines and planes. Applications. Introduction to perspective. Points and lines of escape. Perspective image of polygonal shapes of the base plane on a vertical table. Perspective image of a polyhedral shape.

- **6176- Technical and topographical design and drawing**

Description of drafting tools. Principles of drafting. Establishment of drafting scales, graphic scales. Lettering, notes, line types and line weights. Harmonic and basic geometric operations and construction of various geometric shapes. Presentation of objects and shapes found in the built environment using “orthographic projection”.
Scaled drafting of solid geometric objects (floor plan, sections, elevations, axonometric projection). Application in an architectural design. Topographic drawing and its general rules. Accuracy of the topographic drawing. Grid, frame, legend, scale. Drawing a topographic diagram via Cartesian and polar coordinates. Representation of the of the earth’s relief (contouring). Notion of interpolation. Drawing rules for cadastral and topographic diagrams. Longitudinal section and Cross-section representation. Computer aided topographic drawing.

- **6029- Physical Geography and Environment**

Introduction to Physical Geography and Environment, Atmospheric condition and atmospheric pollution, meteorological phenomena, climatic distinctions, hydrological phenomena, physiographic and geomorphological conditions, soils, soil classification, flora and vegetation distribution, bio-climate, fauna and its distribution, quality of the natural space with emphasis on the landscapes aesthetic characteristics, protected natural areas of Greece – Laboratory exercises and educational excursions. The course has weekly two hours theory and two hours exercises.

- **6004- Differential Equations**

First Order Differential Equations: linear, separable, homogeneous, Bernoulli and exact equations. Existence and uniqueness of solutions. Higher Order Linear Equations: the homogeneous equation, the methods of undetermined coefficients and of variation of parameters. Euler’s equation. Systems of Differential Equations: solutions of a linear homogeneous system, the method of undetermined coefficients. Power Series Solutions: existence of solutions near an ordinary point and near a removable singularity, Bessel’s and Legendre’s functions. Laplace Transform:

Definition and basic properties, sectionally continuous functions, the Dirac function, the initial value problem. Convolution. Partial Differential Equations: linear equations, the basic equations of mathematical physics, classification of second order equations, boundary value problems, the method of separation of variables. Complex Functions: elementary complex functions, differentiation and integration, Cauchy's Theorem and integral formula, power-series, Laurent series, basic theorems of complex functions, the Residue Theorem, conformal mappings, linear fractional transformations.

- **6042- Probability Theory and Statistics**

Descriptive statistics. Concept of probability, laws and its properties. Conditional probability, probability independence, Bayes' theorem. Random variable and its distribution. Average value, dispersion and their properties. Special distributions and their applications. Variable distributions, independence of random variables. Central Limit Theorem. Sample distributions. Spot assessment, confidence intervals and case studies. Linear model: parameter estimation and controls, adjustment factor, forecast. Criterion x2 and graphical distribution control. Relevance tables. Applications using a statistical package.

- **6143- Geodesy I (Introduction to Geodesy)**

Introduction and historical review. The planet Earth (structure, principal motions, shape and size). Reference surfaces (geoid, spheroid, sphere, horizontal plane). Basic definitions. Units of measurement. Measurements of distances, angles and height differences. Simple surveying calculations on the planar. Elementary error theory. Reference systems – The Hellenic Geodetic Reference System. Computations on the plane and sphere. Coordinate transformations.

- **6009- Physics (Mechanics)**

Kinematics and dynamics of a point particle. Work, energy, momentum, conservation and applications. Kinematics and dynamics of a rigid body, rotational motion, moment of inertia, angular momentum, conservation and applications. Gravity and central forces. Mechanical and electric oscillations, fundamental quantities, equation of motion and solution, resonance, coupling of oscillators. Relativistic mechanics: simultaneity, length and time measurements, relativistic momentum and energy, Lorentz’s transformation.

- **6032- Cartography I (General Cartography)**

Introduction to cartography. Basic cartographic principles, history and evolution of cartography, contemporary status and future trends of cartography. Map projections. Cartographic data collection and processing. Cartographic symbolization, cartographic generalization, landform representation and map labeling. Map composition and production. Development of mapping skills and cartometry, evaluating map distortions, designing cartographic symbols, applying generalization and map composition.

- **6213- Computer programming Applications**

Revision of basic programming structures and components of the C ++ language: Using functions, input / output data from / to text files. Retrospective functions, table sorting and search algorithms. Data structures, user-defined types. Classes, field and method visibility, polymorphism, operator overload, heredity. Geometric entity management applications with classes. Edit strings. Indicators, dynamic memory allocation, dynamic array definition, applications.

- **6178-Projective geometry**

Central and parallel homology, homologous shapes, constructions in space. Second degree surfaces and conical sections. The Perspective depiction as a central confession. Properties and constructions. Construction of the perspective image of a plane and a solid (curvilinear) shape. Exercises. Applications.

- **6085-Numerical Analysis**

Introduction to Matlab and Mathematica, basic concepts and tools. Linear Systems: Direct methods (Gauss, derivation methods). Iterative methods (Jacobi method, Gauss-Seidel, SOR), calculation of eigenvalues. Interpolation and Polynomial Approach: Polynomial Taylor, Lagrange, Newton with split differences Newton with finite differences, Hermite interpolation and interpolation with splines functions. Solving Nonlinear Equations: Bisection Methods, Regula-Falsi, Fixed Point, Newton-Raphson, Intersecting, Schroder. Polynomial root calculation and Newton method for nonlinear systems. Numerical Derivation and Integration: Approximation of derivatives of different classes, basic types of integration, complex types of integration, Newton-Cotes integration types, Gaussian integration, infinite time integration. Differential Equations: Problem of initial values, generally about arithmetic methods, errors of arithmetic methods. Simple step methods (Taylor, Runge-Kutta), construction of Runge-Kutta methods. Multi-step methods, calculation of multi-step methods with integration (Adams, Prediction-Correction methods). Approach Theory: Discrete Approach with Minimal Squares, Polynomial and Exponential Approach, Function Approach and Minimal Squares with Rectangular Polynomials. Boundary Value Problem: Approximation of some derivatives, linear aiming method, finite difference methods, Galerkin method with finite elements. Matlab and Mathematica applications.

- **6106-Differential Geometry**

Curves of R3: The concept of curve. Tangential straight, proximal plane. Volume length - Physical curve parameter. Frenet trio. Curvature and torsion. Frenet equations. Near sphere and circle. Wrapped and Wrapped curve. Surrounding curve family. Surfaces of R3: Surface definition. Curves on a surface, tangent plane - vertical vector. First Class Fundamental Sizes. Surface area. Second Fundamental form. Surrounding surfaces. Applications in the sphere and the ellipsoid. Vertical Curvature, main curvatures, curvature lines. Geodetic Curvature. Geodetic Lines, Liouville Formula, Gauss - Bonnet Theorem. Surface Imaging: Isometric imaging,

conformal imaging, stereographic projection, Mercator projection, isobadic imaging, Laubert, Sanson and Bonnet imaging..

- **6010-Physics II (Electromagnetism & Optics)**

Electric charge, electric flux, potential and intensity of electric field. Magnetic dipole, magnetic flux, intensity and source of magnetic field. Interaction of magnetic and electric fields, induction, self-induction. General characteristic of waves, equation of wave. Transverse and longitudinal wave, wave superposition, standing wave. Maxwell'sequations and E/M wave, energy of E/M wave. Geometrical optics: reflection,refraction, mirrors, prisms, lenses, optical instruments. Wave optics: scattering, refraction, reflection, polarization, interference and diffraction of waves.

- **6215-Data base systems**

Introduction to databases and data modeling. Classic data models (hierarchical, network). The Entity-Relationship semantic model. Introduction to the relational data model. Transition from the E-R to the relational data model. Database Management Systems: principles, services and architecture. Database languages, introduction to the Structured Query Language (SQL). Design of databases, introduction to UML. Logical design and normalization. Database integrity, optimization and security. Client-server architectures, introduction to xDBC and middleware. Lab based on the MS Access personal DBMS.

- **6027-Geodesy II (Geodetic methods and Instruments)**

Elementary error theory- Definitions of basic measurable geodetic elements. Instruments of angle and direction measurement (optical and digital theodolites). Methods of angle and direction measurement, computations and corrections. Practical exercises. Instruments of distance measurement (tapes, EDM, basic principles of GPS etc.). Methods of measurement, computations and corrections. Practical exercises. Instruments and methods of height difference measurements (spirit levelling and trigonometric heighting). Computations and corrections. Practical exercises. Satellite positioning systems: basic principles, instruments. The meaning and the use of geodetic networks (horizontal and height control networks). The use of intersections and resections in geodetic networks. Measurements and computations. Practical exercises.

- **6216-Engineering mechanics**

Forces and moments: concentrated force, moment of a force about a point, addition of forces, rigid body equilibrium. Statically determinate beams and framed structures: geometrical stability, reactions, internal forces (normal-force, shear-force and bending – moment diagrams). Concepts of stress and strain: deformable body, normal stress and strain in axially loaded bar, stress and strain components in an infinitesimal orthogonal element of the body. Mechanical properties of a deformable body: stress-strain diagram, brittle and ductile behavior, Hooke law, Poisson ratio,

shearing stress-shearing strain diagram. Torsion: shearing stresses and deformation in structural members with circular and rectangular cross sections in the elastic and inelastic range. Bending: simple and skew bending of structural members with symmetrical cross section, bending of structural members made of several materials deflection of beams, statically indeterminate elastic beam problems. Shearing stresses in structural members: shearing stresses in structural member with symmetrical cross section, shearing stresses in thin walled members. Combined stresses in structural members: stresses from combined action of bending, transverse and axial loadings, transformation of plane stress, principal stresses, Mohr circle. Buckling of column: the Euler formula for a pin-ended column, elastic buckling of column with different end restraints. Laboratory tests: tensile and compressive tests for ductile and brittle materials, determination of elasticity modulus, torsion test.

- **6102-Principles of Geoinformation and GIS**

The course covers the principles of geo-information and the technological subject of geographic information systems (GIS). It includes: Theoretical basis of geo-informatics- historical evolution - concepts of space and time - geospatial relations – representation and models of geospatial knowledge (object-oriented and continuous-field models) - implementation of geospatial concepts and models in a GIS - geospatial databases - vector, raster and other advanced data structures - metrics and topology. Furthermore, it addresses more complex topics such as: Data sources and collection techniques –Application development – Standards, integration, and interoperability. Due to its laboratory character, the course implements the above concepts with a series of consecutive laboratory assignments, which form an integrated project.

- **6090 -Geodesy III (Land surveying)**

State reference coordinate systems. The meaning and the use of a traverse.
Measurements and computations. High accuracy traversing. Urban traverse networks. Practical exercises. Detail surveying especially with modern methods-Surveying plotting. Field setting out of straight lines and basic curves. Land sharing. Longitudinal sections and cross sections of an axis. Area and volume computations. Practical exercises. Hydrographical surveying

- **6091- Photointerpretation-Remote sensing**

Introduction. Basic concepts and Principles of Photo-interpretation and Remote Sensing. Basics from physics and mathematics. Electromagnetic radiation. Sensors and images. Photo-interpretation and Remote Sensing instruments and measurements. Satellite Remote Sensing Programs and operational applications. Possibilities and constraints. Prospects. Photo-interpretation and Remote Sensing analogue and digital methods and techniques for Earth Observation and Monitoring by airborne and satellite systems. Applications in the scientific/technical and professional fields of the Rural and Surveying Engineer. Remote Sensing and GIS Integration, Applications for Land and Environment Inventories, Mapping and Monitoring..

- **6193-Cartography II (Analytical Cartography)**

Introduction (the relation between map and Earth surface). Scale, reference systems and coordinate systems. Distortions of lengths, areas and angles. Distortions of finite features. Principles of map projections. Normal projections (cylindrical, conical and azimuthal), Transverse and oblique projections. Projection systems in use in Greece and transformation between different projection systems. Cartometry and the relation between scale and measurements. Measurements of length and area and calculations of volumes. Geometric transformations. Interpolation and digital elevation models (algorithms for morphological analysis of landforms and hill-shading). Cartographic generalization (generalization operators and line simplification algorithms).

- **6083-Highway Engineering I**

Introduction. Determination and description of road geometry. Vehicle driving and braking forces. Vehicle movement in curves. Road-holding. Study elements of the horizontal alignment. Angular diagram. Marginal horizontal alignment element values. Study Speed. Operation speed. Speed limits. Calculation. Calculation of possible speed of heavy vehicles, travel time and fuel consumption. Safety criteria. Study elements of vertical alignment and marginal values. Road inclination and fitting. Visibility for stopping and overtaking. Administrative and functional categorization of roads. Parts of cross-section. Study elements of cross-section. Typical cross-sections. Calculation of soil needs with approximate and accurate methods. Corresponding cross-sections. Accuracy of soil calculations. Calculation of movement of grounds, graphically and with application of theory of linear optimization. Expropriations. Work budget.

- **6174-Geotechnical Engineering**

Geological environment: Plate tectonics, Seismicity, Structure, In situ stresses, Surface processes, Hydrological conditions, Geotechnical description of rocks and soils: Rock structure-rock material, Discontinuities, Stereographical projection, Mechanical properties. Site investigation-maps, Photointerpretation, In situ probes. Applications of Geotechnical Engineering-Slopes, Underground Constructions-Tunneling, Applications in Highway Engineering and Hydraulic Structures.

- **6214-Introduction to Economic Analysis**

Basic financial figures and definitions. The financial problem, the supply and demand of goods. Production theory and production costs. Market forms. Introduction to National Accounts. Kcynos's model, balance in the commodity market. Money. The IS-LM model. Balance in the market of goods and money. The model of Total Supply and Total Demand. Introduction to International and European Economic Developments.

- **6018-Geodey IV (Higher geodey)**

Introduction. Shape and size of the Earth. Reference surfaces. Geometry of the ellipsoid. Reference Systems: Terrestrial Systems, (WGS84, ITRF) Geodetic Systems, Astronomical systems. Geo-centric and topo-centric systems. Reference Systems used in Greece. Deflection of the vertical Astro-geodetic methods. Dynamic Theory of heights. Dynamic, orthometric and normal heights. Reductions of geodetic measurements to the reference ellipsoid. Geodetic computations on the ellipsoid and in 3D Cartesian systems. Map projections used in Greece. Reduction of Geodetic data to the projection plane and computations. Datum and coordinate transformations.

- **6043-Theory of errors and adjustments**

Introduction to adjustment theory. Principle of Least Squares. Statistical concepts. Estimation of a single variable from direct measurements (equally and unequally weighted). Estimation of standard errors. Multidimensional variables. Variance-Covariance propagation. Bivariate normal distribution, error ellipse. Least Squares adjustments by the methods of Indirect observations (observation equation), Estimation of Variance-Covariance matrices. Least Squares adjustments by the method of condition equations, Estimation of Variance-Covariance matrices. Geodetic applications.

- **6031-Photogrammetry I (Introduction to Photogrammetry)**

Introduction - Definitions. Photogrammetry and Surveying. Applications and implementation fields of Photogrammetry, Pros and Cons. The photogrammetric procedure. Data acquisition. Photogrammetric cameras. Camera geometry, Central projection - Interior orientation - reconstruction of the bundle of rays. Measuring and correcting image co-ordinates. Reference systems. Geometric relations between image and space. 2D and 3D transformations. Vertical images - radial displacement. Collinearity condition. Exterior orientation. Photogrammetric Resection and Intersection. Co-ordinate determination. Single image Photogrammetry. Single image procedures. Stereo-photogrammetry - Geometry of stereo-pair. Parallax and height determination. Basic of principles of photogrammetric instruments. Functions and possibilities of analytical and digital photogrammetric workstations. Relative and Absolute orientation.

- **6025-Geography and Spatial Analysis**

Understanding and being able to make effective use of the individual quantitative methods and techniques of geographical analysis, are a crucial part of the training of those who will be involved in the process of spatial planning. Spatial analysis is a scientific field that has been developing rapidly in recent decades. It includes a set of quantitative methods and techniques for the investigation, modeling and mapping of spatial phenomena and processes, aimed at their interpretation and support of the relevant decision-making process. As a result it provides the possibility for:
• accurate description and mapping of spatial standards,

• exploring spatial relationships and understanding the spatial processes that produce the above standards,
• forecast and evolution over time of the phenomena under study
In this course, the most important methods, techniques and technologies that are currently used during the analysis and solution of spatial problems are examined, grouped in the following sections:
• QUANTITATIVE GEOGRAPHICAL ANALYSIS - GEOSTATISTICS
• LOCATION - ALLOCATION
• SPATIAL INTERACTION
The lectures of the course are combined with respective individual and / or group laboratory exercises and applications on which a significant part of the assessment is based. At the same time, a complete semester topic is prepared, with a specific example in which emphasis is placed on the utilization of the analysis methods and techniques presented.

- **6044-Fluid Mechanics**

Introduction and basic properties of fluids, pressure, viscosity, elasticity. Hydrostatics, Pascal's principle, differential manometers, hydrostatic forces in submerged surfaces and tank walls. Kinematics and dynamics of fluids, flow lines, velocity, acceleration, continuity equation in differential control volumes, boundary conditions, parallel flow, equations of fluid flow in the direction of flow lines, Bernoulli equation. Macroscopic flow analysis in finite control volumes, Reynolds transport theorem. Fundamental equations of fluid mechanics, equations for conservation of mass, momentum, and energy. Real and ideal fluids. One-dimensional equations of conservation of mass, momentum and energy in pipes. Energy and piezometric lines..

- **6188- Transportation Infrastructure Design-Economic aspects**

Railways: Introduction. Elements of train motion. Study elements of horizontal and vertical alignment. Super-elevation of railroads. Rail changes. Airports: Introduction. Types, forms and parts of airport settlement. Elements of aircraft flight. Categories of airports. Calculation of the length of the landing/taking off corridor. Taxiways. Vertical alignment and elevation set of corridors and taxi-ways. Earthworks. Financial-technical issues (General elaborating principles of financial-technical studies): Introduction. Developing design / planning. Basic principles. Investments, introductory concepts. Investment categories. Financial-technical studies and elaboration methodology. Financial and economical evaluation. Conclusions.

- **6217- Geodesy V (Satellite Geodesy)**

Introduction to Satellite Geodesy. Satellite Positioning Systems (GPS, Galileo). General principles. Conventional and satellite reference systems, time, clocks. GPS. Broadcast signal. Broadcast message, satellite orbits, satellite ephemerides. Code and phase measurements, measurement errors. Single, double and triple phase differences. Error sources. Instruments. Data processing, quality criteria, accuracy. Special measurement techniques, accuracies. Geodetic (satellite) networks, adjustments. Applications.

- **6122- Photogrammetry II (Analytical Photogrammetry)**

Revision of basic notions - Recap of Photogrammetry I. Special subjects of interior and exterior orientation. Planning a photo-flight. Systems and software for the navigation of a photoflight - Specifications. Notions of digital photogrammetry. Aerial triangulation and phototriangulation: Basic principles, methods and procedures. Accuracies. Combined triangulation adjustments. Photogrammetric surveys and products. Photogrammetric production of Digital Terrain Models. Extraction of DTM's from LiDAR and other systems. Accuracy of stereo-restitution - Specifications. Orthophotography: Basic principles, procedure, instruments and software. Photogrammetric processing of satellite imagery. High resolution satellite images. Geometric models for scene orientation. Accuracies and products.

- **6099- Applied Hydraulics**

Introduction, real and ideal fluids. Steady vs unsteady flow. Laminar vs turbulent flow in pipes. Reynolds number. Velocity distribution near pipe boundaries. Boundary layer theory. Coefficient of friction. Flow in pipes, Darcy-Weisbach equation and Moody diagram. Basic principles and applications in steady flow in closed conduits under pressure. Water distribution systems under pressure. Local energy loses, flow of water between reservoirs, pumps and water turbines. Pipe networks, Hardy-Cross method, flow distribution in open channel cross sections. Manning equation, St. Venant equations. Uniform and non-uniform flow in open channels. Specific energy. Critical and non-critical flow. Froude number. Hydraulic jump.

- **6076- Engineering Hydrology**

Introduction to Hydrological Processes. Elements of Geomorphology. Statistical Analysis of Hydrological Information. Measurement and Analysis of rainfall and snow data. Hygrometry: Networks and Data analysis. Floods. Routing through reservoirs of stream sections. Meteorological and Hydrological analysis..

- **6049- Cadastre**

The importance of Land and the concept of real estate property. Ownership, use, acquisition and ownership restrictions, special rights. Elements of technical legislation, title implementation. Urban, forest and rural Land-parcel topology. Cadastral issues from transforming rural grounds to urban. Cadastral concept and evolution through the years. Cadastral systems. Cadastral Books – Cadastral Maps – Cadastral Identification Numbers. Implementation, keeping and updating procedures of the Hellenic Cadastre. Digital Cadastral Map. Analog diagrams, digital and analytical data. Digital transformation and orthophotography. Hardware. Software. Hellenic Cadastre. Users, recoverability. Implementation procedure. Cadastral information collection methods. Legislation, technical specifications and operational cost. Administrative structure, setting-up, management and maintenance-updating of the system.

- **6153- Digital Image Analysis for Remote Sensing**

Computational Image Interpretation. Image Histogram. Contrast enhancement, linear histogram stretching, histogram equalization, histogram saturation. Display alternatives, color processing. Filters, edge enhancement, high pass filtering, smoothing, low pass filtering, gradient, Laplacian. Spatial registration, geometric manipulation, coordinate transformation, interpolation. Radiometric Errors and corrections. Feature extraction: spectral rationing, principal component analysis, vegetation indices. Mathematical concepts for image classification, discriminant functions, Bayes theory. Density slicing. Supervised training and classification: parallelepiped, table look-up, decision tree, minimum distance, maximum likelihood. Unsupervised clustering, Algorithms: K_means, ISODATA. Post classification processing. Object oriented classification: Segmentation nearest neighbour classification. Classification accuracy. Data merging. Geographic information systems. Change detection. Applications.

- **6120- Urban Planning**

Introduction to urban planning: Aim, objectives, laws. Urban standards and functions. Types of plans, land uses. Systematic planning and post-modern trends. Urban mechanisms and motives. Ways of interference. Control plan of Athens – general Urban Plan. Implementation Deed. Centres. Industrial areas. Habitation. Fundamental meanings.

- **6166- Hydraulic Works**

Analysis of flow in closed conduits. Municipal water supply: Demand prediction – Water quality. Reservoir design. Water supply network design and technology. Urban drainage networks design and management. Principles of operation and maintenance. Elements of other hydraulic works..

- **6130- Regional Planning**

The scope of the course is to provide the theoretical and methodological background that would enable a student to participate in the design and implementation of regional and development plans. The course consists of both theory and applications. More specifically the theoretical part includes: Introductory Concepts in Planning; Theory in Planning; Planning Process; Goal and Objectives Setting; Delineation of Regions; Regional Data Base Development; Scenario Analysis; Scenario Evaluation; Development of Policy Packages; Regional Planning in Greece; Institutional Framework for the Implementation of Regional Plans; Regional Planning in Europe. The applied part on the other hand elaborates on the implementation of a Regional Plan for one of the administrative units of the country following the methodological steps presented during the theoretical part of the course.

- **6129- Design and Construction with Armed Concrete**

Basis of design: fundamental requirements, limit states, actions, characteristic and representative values of actions, design values of action, combination of actions, mechanical properties of reinforcing steel and concrete. Structural elements and structural systems of concrete reinforced structures: idealization of the element and the structure, analysis methods for ultimate and serviceability limit states. Section and member design for bending, longitudinal force, shear, torsion, punching and buckling. Applications to slabs, beams, column and foundation elements. Control of cracking and deformation. Details of reinforcement, spacing of bars, concrete covers, minimum and maximum reinforcement percentage, minimum requirements in dimensions of structural members.

- **6177- Business Administration**

Introduction to Business Administration. The Nature of the Firm. Types of Firms. The Business Environment (internal and external environment). Aims and Objectives of the Firm. The Organization of the Firm. Organization Theories. Structure of Organizations. Principles of Organization. Firm's Operation. Engineering Works and Firms. Introduction to Total Quality. Business Administration. The Notion of Administration. Total Quality Management. Special Topics: The Functioning of the Market. Profit & Loss Analysis. Break-Even Point Analysis. The Production Function. Introduction to Balance Sheets and Financial Statement Analysis. Financial Ratios. The Flow Chart.

- **6125- Introduction to the Legal System and Elements of Technical Legislation**

The course includes two teaching units:
A) Elements of Law: General Overview of Law, the basic legal concepts and the main legal relations of the following branches of Law are explained: Public Law, European Law, Civil Law (General Principles, Property, Obligation), Commercial Law (Commercial Law) , Companies, Securities), Labor Law (Occupational Accidents, liability of the engineer).
B) Technical Legislation: Legislation for the construction of Public Works (National, European), Town Planning Law, Spatial Planning, town planning, environmental protection, sources of Town Planning Law, protection of architectural heritage.

- **6188- Transportation Infrastructure Design-Economic aspects**

Railways: Introduction. Elements of train motion. Study elements of horizontal and vertical alignment. Super-elevation of railroads. Rail changes. Airports: Introduction. Types, forms and parts of airport settlement. Elements of aircraft flight. Categories of airports. Calculation of the length of the landing/taking off corridor. Taxiways. Vertical alignment and elevation set of corridors and taxi-ways. Earthworks. Financial-technical issues (General elaborating principles of financial-technical studies): Introduction. Developing design / planning. Basic principles. Investments,

introductory concepts. Investment categories. Financial-technical studies and elaboration methodology. Financial and economical evaluation. Conclusions.

- **6227- Environment and Development**

Development and Environment (legal, social, economic, political and cultural components. Development of sustainable development, development of worth-living integrated development, confrontation of two opinions. Environmental and developmental policies. Preventive principle, precautionary principle, models of production, distribution, consumption. Environmental economy, Strategy, Methods and techniques of monitoring, recording and estimation of impacts, Environmental danger and uncertainty, Decision-making systems, Multi-criteria methods, Life cycle assessment. Analysis of specific areas of - cases of development and environment practices of confrontation. Projects of interdisciplinary teams of students on the practices that will be presented in the class, likely with the method of debate. Technological and ethical obligations of engineer: the engineer can and considers his obligation to offer alternative solutions.

DIPLOMA THESIS

Diploma Thesis - Assignment procedure

i. The Diploma Thesis (D.T.) lasts one (1) academic semester and is completed during the 10th semester of studies at SRSE.

ii. The assignment of the D.T. to a student is possible only when up to eight (8) courses are required prior to obtain the diploma. The student has the opportunity to complete the D.T. in one semester in cases where up to 3 courses prior the diploma are required.

iii. The D.T. is prepared individually by the student in the Department or in collaboration with the Department where the student has chosen the speciliasation, according to the Undergraduate Studies Program.

iv. The estimated duration for the preparation of the D.T. is about 500 hours.

v. The process of assigning the topic of a D.T. requires an application submitted by the student to the Secretariat of the School, in the periods mentioned in the Academic Calendar. The application identifies the Department, the scientific area of the D.T. and the suggested supervisor. The topic is either selected by the student from a list of suggested topics, announced by each faculty member. at the beginning of each academic semester or by a nominated topic by the supervisor to the student. The proposed topics should describe roughly the objectives, expected results, background knowledge, basic literature and other information that is useful for informing the interested students.

vi. The applications for the assignment of a D.T. subject are examined by the relevant Departments meetings which also propose to the General Assembly of the School the supervisor and the other two members of the 3-member Examination Committee. The final approval is made by the General Assembly of the School.

vii. The Director of each Department should keep a record of the diploma theses prepared in the Department.

viii. In case the student wishes to prepare the D.P. in a scientific area of the School that is not included in the student's elective specialisation, an application to the Secretariat of the School should be submitted to request a supervisor. If the supervisor agrees with the assignment of the D.P., and the topic, the 3-member Examination Committee is appointed by the General Assembly of the School by the General Assembly of the School.

ix. In case the student wishes to prepare a D.T. in a scientific area outside the scientific areas of the School, the student should submit a reasoned request to the Secretariat of the School. In collaboration with the most releavnt Department of the SRSE, the Department proposes to the General Assembly of the School the acceptance of the application and appoints the supervisor from the SRSE. The

three-memebr examination Committee comprises the supervisor and two (2) other members, one of whom may be a member of the Faculty outside the School. The final approval is made by the General Assembly of the School.

Preparation, submission and examination of Diploma Thesis

i. The Diploma Thesis is prepared by the student with the continuous supervision and guidance of the supervisor and the other two members of the three-member Examination Committee. The Department(s) should provide the facilities for the smooth preparation of the D.T. by the student.

ii. Before the predefined examination periods, the supervisor certifies that the D.T. is completed and the student must give a draft copy of the D.T. to the other two members of the Examination Committee.

iii. The final approved copy is submitted (also in electronic form) to the Secretariat. The electronic version of the dissertation becomes available in the Digital Repository of the Central Library of the National Technical University of Athens (Dspace).

iv. The presentation and examination of D.P. is oral and public. It takes place after the successful completion of all other obligations of the student, as they arise from the Undergraduate Program.

v. The planning for the presentationand examination period of D.Ts is organised centrally by the Secretariat. A minimum of 30 minutes is available for the presentation of each D.T.

vi. The examination and grading of the D.T. is made by the appointed three-member Examination Committee. The final grade is the average of the scores of the members of the Examination Committee, rounded to the nearest average or 0.5, with a lower success grade of 5.5.

vii. A student who fails the examination of the D.T. may repeat this examination at a later date. If the student fails for a second time, the student requests a new subject in the same or another area, in order to prepare the D.T. and be examined in a next examination period.

Format specification for the Diploma Thesis

a. DTs are submitted typed and bounded in DIN A4 format. Departments may prescribe additional features, such as colour and line art for the cover, etc.

b. Figures and diagrams must be drawn (preferably with Indian ink) in presentable style and in accordance with the rules of linear and topographical drawing. In case the figures are larger than the standard page size, a separate booklet could be made to include those figures, suitably folded.

c. DT structure should include:

- Preface
- Table of contents

- Table of figures
- Table of diagrams
- Summary
- Summary in an international language (optional)
- Introduction
- Main Text (Chapters 1, 2, 3, etc.)
- Conclusions
- Proposals
- References
- Appendices (if any)

d. The **summary** should give a comprehensive description of the DT

e. The **introduction** reveals the motive which led to the specific choice of subject and describes the methods used in handling the problem. Difficulties encountered, the scientific and social expediency, etc. should also be included here.

f. The **main text** is divided into numbered chapters, and each chapter is further divided into sections and subsections. They are all decimally numbered, i.e. 3.2.1. where 3=chapter number, 2=section number and 1=subsection number.

g. **Tables**, **figures** and **pictures** are numbered separately and carry explanatory captions. They are cross-referenced in the text (i.e. table 3, fig. 12, picture 10). The same holds for references.

h. **Formulae** are cross-referenced relative to the chapter in which they appear and are numbered sequentially (i.e. formula 1.5, where 1=chapter number and 5=formula number within the chapter).

i. The **conclusions-proposals** include justification and evaluation of the results achieved, as well as the author's view for further research on the subject.

References are placed at the end, in alphabetical order.

In particular, references to books should include, in order: author's name, book title, published, year of publication, etc. *Example:* Rutherford D.E., Vector Methods, Oliver & Boyd Ltd., 1957.

References to scientific papers should include: author's name, paper title, journal's name, volume, pages, year of publication, etc. *Example:* Rutherford, D.E., Vector Methods, Phys.Rev. 8, 723 (1963).

Finally, references to presentations made in scientific conferences should include: author's name, paper title, title of proceedings, editor, publisher, place of publication, year of publication, etc. *Example:* Rutherford, D.E., Vector Methods, Proc. Of the 12th Intern. Conf. of the Physics of Semiconductors, ed. M.H.Pilkuhn, Flammarion, Paris, 1972.

Scholarships

For Undergraduate students

- **THOMAIDIS AWARD**

  It is granted to the students who obtain the highest mark in each NTUA Department.

- **KONTODIMOS PRIZE**

  It is granted to the students who read for Civil Engineering or Rural & Surveying Engineering with the highest mark in the 9th semester

- **EM. VOUYOUKLAKIS PRIZE**

  It is granted to students with the highest mark in the course *Descriptive and Higher Geometry.*

- **GANIOTIS-PAPAGEORGIOU SCHOLARSHIP**

  It is granted to the students who originate from Greek islands, who have limited financial means and achieve the highest marks in the national examinations for university entrance, provided that they haven' t got any other scholarship except those offered by the State Scholarship Institution.

- **PAPASTAVROS SCHOLARSHIP**

  For students originating from the town of Terpsithea of the Nafpaktos province. If there are no such students, the scholarship goes to students of Greek nationality who have been distinguished in the national examinations for university entrance and have limited funds.

- **DIOMIDIS KOMNINOS PRIZE**

  It is granted to the most successful student in the entrance examinations to the NTUA Departments of Civil Engineering, Architecture and Rural & Surveying Engineering.

- **NIKOS KRITIKOS SCHOLARSHIP**

  It is granted to students of each NTUA Department who achieve, over two examination periods, the highest mark on all mathematical courses given during the first year of studies at NTUA.

- **ARGYROPOULOS SCHOLARSHIP (in memory of Achilles and Penelopi Argyropoulos**)

  It is granted to senior students at the Departments of Civil Engineering or Rural & Surveying Engineering, who originate from Pontos, Asia Minor, and are among the first three students in the course of *Theoretical and Applied Hydraulics* (since the curriculum has changed, the average mark obtained in the courses *Fluid Mechanics* and *Applied Hydraulics* is taken into account instead) over the last two examination periods.

Other scholarships are available to undergraduate students from:

- The State Scholarship Institution
- The Technical Chamber of Greece

For Graduate students

- EVGENIDIS FOUNDATION SCHOLARSHIPS

  For top Greek NTUA students with inadequate financial resources for graduate studies abroad. To receive such a scholarship, students must already have been accepted by a foreign university; no financial support from other source is allowed, and applicants must accept the condition to return to Greece and work on the studied subject after the completion of studies. Scholarships last at most one year.

There are more scholarships available to students of the Department of Rural & Surveying Engineering who wish to undertake graduate studies either in Greece (mainly from the State Scholarship Institution) or abroad. Such scholarships are given by:

- The Academy of Athens (Lambadarios Scholarship – exclusively for graduates of the Department of Rural & Surveying Engineering)
- The State Scholarship Institution
- The Technical Chamber of Greece
- The Onassis Foundation

as well as by other public institutions.

Interested students should seek detailed information from the Department's Secretariat in good time (not later than the 8th semester of their studies).