Assessment of Current Engineering Education in Greece. Universities and Technological Institutes.

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***Abstract* – Engineering education is offered in Greece by Engineering Faculties of both, Universities (A.E.I.) and Technological Educational Institutes (T.E.I.). The paper presents first an assessment of current such education in connection with the professional praxis in Greece. Next, the specific case of the educational programme of the Civil Engineering Department, Xanthi, of Democritus University of Thrace is investigated concerning the possibilities of teaching and research activities as well as international collaboration for its postgraduates. Further, the case of the School of Technological Applications of the Technological Educational Institute, Kavala, is investigated in the same format. Finally, general concluding remarks, concerning the Engineering Education System in Greece in connection to current trends, are presented.**

Index Terms – Enginering Education, Higher Education System, the role of Technical Universities and Technological Educational Institutes.

INTRODUCTION

Greece (Hellas), member of the European Union, in the South-East Europe region, covers a total area of 131.957 sq. km and has a population of 10.964.020 (2001 - census). More than 4 millions Greeks are estimated to live abroad, including over 2 millions in America.

Education, according to the Greek Constitution, is one of the main missions of the State, aiming at the promotion of the moral, intellectual, vocational and physical education of the Hellenes (Greeks), to develop their national and religious consciousness and to shape them as free and responsible citizens. All Hellenes (Greeks) have the right to free public education at all levels. All citizens are entitled to equal opportunities in education, regardless of family background, origin or gender.

The Hellenic (Greek) educational system is governed by national laws that have passed parliament and legislative acts (decrees, ministerial decisions) The general responsibility for education falls under the Ministry of National Education and Religious Affairs (YPEPTH). For details see the link www.ypepth.gr.

Education in Greece is compulsory for all children 6-15 years old; namely, it includes Primary (Dimotiko, age 6-12 years) and Lower Secondary (Gymnasio, age 12-15 years) Education.

Post-compulsory Secondary Education, (age 15-18 years), according to the reform of 1997, consists of two school types: Eniaia Lykeia (Unified Upper Secondary Schools) and the Technical Vocational Educational Schools (TEE). The duration of studies in Eniaia Lykeia (EL) is three years and two years (a' level) or three years (b' level) in the Technical Vocational Educational Schools (TEE). The holders of a leaving certificate from the Eniaio Lykeio can claim admission to higher education institutions by means of national entrance examinations.

Public higher education (age over 18 years old) is divided into Universities (AEI) and Technological Education Institutes (TEI). Students are admitted to these Institutes according to their performance at national level entrance examinations taking place at the second and third grade of Lykeio.

Formal education is characterized by the fixed length of study, the possibility of repetition and the award of a formal school-leaving certificate which is the official authorization.

As a consequence of the classification of the education institutions, a title (school-leaving certificate, degree, diploma for Engineers etc.) is compulsory for students at each education level in order to continue to the next.

In Higher Education, the Universities (AEI) and Technological Education Institutes (TEI) are selfadministrated legal entities of public law (NPDD) and the Minister exercises supervision and monitors the legality of their actions and decisions through the Services of the Ministry's Central Service.

The aim of the present paper is to give details and assessment of the Engineering Education in Greece, considered as a part of the above briefly described educational system.

HIGHER ENGINEERING EDUCATION IN GREECE

According to the previous description of the Greek Educational System, Higher Engineering Education in Greece comprises of engineering departmens and schools of two sectors: the University sector (AEI), including Universities, Technical Universities and the Higher School of Fine Arts, and the Technological sector (TEI), including the Technological Education Institutes.

I. Universities (AEI)

These are fully self-administered legal entities of public law. The general objective of the courses in University

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departments is to provide a high level of theoretical and all-round training to the country's future professionals, scholars, scientists and academics. University courses place emphasis on the documentation, production, development and transmission of knowledge, science and technology, on pure and applied research and on the development of modern postgraduate studies. The ultimate aim of University education is to equip graduates with the ability to adapt to the ever changing and constantly growing demands of financial and community life.

According to the Constitution of Hellas (article 16, paragraph 5), University education is provided exclusively by the State in institutions, which are fully self-administered legal entities of public law.

In Hellas there are twenty (20) Universities. Engineering education is offered in the National Technical University of Arthens, the Technical University of Crete (Chania) and in the Schools of Engineering of other four Universities: the Aristotle University of Thessaloniki, the Democritus University of Thrace (Xanthi), the University of Thessaly (Volos) and the University of Patras.

The Universities consist of faculties. The faculties comprise a group of related disciplines to ensure the interaction necessary for the development of knowledge and for the coordination of research and teaching. Faculties are divided into departments. The department is the main operating academic unit, which covers a discipline's field of knowledge. The department course leads to a single degree. Each department can grant more than one specialisation of this single degree.

Departments are divided into sections (or divisions). The section co-ordinates the teaching of that part of the department's field of knowledge, which corresponds to its special field.

The programme of studies of every University department contains the titles of the courses (compulsory, compulsory elective and optional), their subject matter, the number of hours of classes per week and other useful information about the courses. The programme of studies is adapted to the number of semesters required to receive a degree -minimum of ten (10) for Engineering Departments and Technical Universities-eight (8) for non Engineering ones.

University teachers are members of so-called Teaching and Research Personel (DEP), of which there are four ranks: Lecturers, Assistant Professors, Associate Professors, Professors. The qualifications required for the University teaching ranks from Lecturer to Professor increase to reflect the total scientific, teaching and professional work of each one.

At Hellenic Universities there are postgraduate study programmes (PMS) that lead to the granting of a postgraduate specialisation degree (MDE) and/or Doctorate.

II. Technological Education Institutes (TEI)

Higher technological education is mainly provided by the Technological Education Institutes (TEI), which are self-governing legal entities under public law, supervised and subsidised by the state through the Ministry of National Education and Religious Affairs (YPEPTH).

TEIs differentiate from Universities, regarding their role, their orientation and courses and the diplomas they lead to. More specifically, their objective is to: - provide theoretic and practical education adequate for the application of scientific, technical, artistic and other knowledge and professional skills; - contribute to the shaping of responsible citizens capable of actually contributing, in the context of democratic planning, to the economic, social and cultural development of the country; - implement the right of all Greek citizens to free education depending on their abilities, and in line with competent laws.

The curriculum consisting of seven (7) or eight (8) semesters adapts to the defined number of semesters required to lead to the diploma of each Department.

A student completes studies and is granted a diploma when succeeding in the defined courses and gathering the necessary academic credits (a.d.m.). The holder of a TEI Department Diploma is entitled to work in the corresponding professional field.

TEI teachers that perform the main educational and research work – the Teaching Personel (EP) as they are called, fall under 4 ranks:- Laboratory Instructors;- Assistant Professors;- Associate Professors;- Professors. Classification in the four ranks is made on the grounds of a scale of qualifications increasing bottom-up (academic –scientific qualifications are considered more important requirements, but also professional experience is taken into account).

There are today 14 Technological Education Institutes in various cities and towns in Hellas; many institutes also have branches, i.e. independent departments in another town.

In both, AEIs and TEIs, the academic year begins on the 1st September of each year and ends on August 31 of the following year. The educational task for each academic year is structured chronologically into two semesters. Each semester includes at least thirteen (13) full weeks of classes and three (3) weeks of examinations. The first semester begins in the second fortnight of September and the second semester ends during the second fortnight of June. During the final semester of study every student is required to undertake and publicly defend a diploma thesis in his/her field of study.

Finally, it must be emphasized that the basic organisational features of TEIs, along with those of Universities, are their democratic structure and operation, with the participation of representatives of all components of the academic community in decision taking, university asylum, academic liberties; or freedom in scientific research and the exchange of ideas.

THE CASE OF THE CIVIL ENGINEERING DEPARTMENT IN DEMOCRITUS UNIVERSITY OF THRACE

Democritus University of Thrace (D.U.Th, see the link www.duth.gr) was established in July 1973. It was named after the ancient Greek philosopher Demokritos who was born in Avdira, Thrace, an administrative district of Northern-East Greece. The administration of the University is located in Komotini, which is the seat of the administrative district of East Macedonia and Thrace.

The University is organised in two Faculties and eighteen Departments located in four cities of Thrace - seven in Komotini, five in Xanthi, four in Alexandroupolis and two in Orestiada. A total of about 18.000 (2007-census) undergraduate students are enrolled.

The University plays an important and effective role in establishing the national and cultural significance of Thrace and is contributing to the high level of education of the Higher Education in Greece. Through the quality of teaching and the level of research, the University has achieved a place among the leading Universities in Greece.

As an Institution of Higher Education, Demokritos University of Thrace is a Public Institution with full administrative autonomy. It is subject to state supervision via the Greek Ministry of Education and Religious Affairs (YPEPTH), which also provides its funding.

The School of Engineering is located in Xanthi and has the following five (5) Departments:

1. Department of Civil Enguineering
2. Department of Electrical and Computer Enguineering
3. Department of Environmental Enguineering
4. Department of Architectural Enguineering
5. Department of Production and Management Enguineering

The duration of the undergraduate studies is five (5) years, covering ten(10) academic semesters.

The students of the School of Engineering have the opportunity to obtain real-world experience, before their graduation, by practical training programs/residencies in National and European Industries and Research Institutes.

Often, these industries are also partners in large research programs of the various Departments of the School.

According to the current legislation regarding the higher education in Greece, the Department of Civil Engineering is divided into the following seven (7) divisions (or sections):

1. Division of Structural Engineering.
2. Division of Mechanics
3. Division of Mathematics and Project Management
4. Division of Hydraulics and Environmental Engineering.
5. Division of Geotechnical Engineering.
6. Division of Transport, Infrastructure and Regional Planning.
7. Division of Architectural Engineering and Building materials.

Following the link www.civil.duth.gr one can find details about the scientific field of each division as well as its research orientations. E.g.:

Division of Geotechnical Engineering

The division covers the scientific fields of engineering geology and behavior of geomaterials, general behavior of soils, soil element description and determination of natural characteristics and properties.

Divisions of Structural Engineering and Materials

The division covers the scientific fields of theoretical & applied mechanics, strength of materials, structural analysis & design, structural dynamics and earthquake engineering, behavior & design of reinforced concrete structures, design of steel structures, experimental methods in structural engineering, nanomechanics, fracture mechanics, building materials, concrete technology, construction engineering.

Division of Highway Design and Transportation Engineering

The division covers the scientific fields of traffic control and transportation systems, transportation planning, transportation engineering, road planning, design, construction, management of public transport, airports and harbor design, application of business research in the field of transportation.

Division of Hydraulics and Environmental Engineering

The division covers the scientific fields of fluid mechanics, hydrodynamics, experimental & applied hydraulics, environmental fluid mechanics, hydrology, water resources management, coastal & harbor engineering, hydraulic works, municipal & industrial wastewater treatment & disposal, environmental planning and management, and environmental impact assessment.

As it is obvious from the above description, the department aims to equip students with techniques for solving various civil engineering problems and the problems on infrastructure constructions. The course focuses on the design, construction and management skills required by the all-round professional civil engineer. So core objects studied include: Civil Engineering Design, Construction and Management, Structural Mechanics, Hydraulics and Environmental Engineering, Geotechnics, Engineering Surveying, Highways, Traffic and Transportation, Computing, Mathematics, Foreign Languages, Soil Mechanics. Visits of industrial and construction sites are an important component of the course.

THE CASE OF TEI OF KAVALA

The main campus of the Technological Educational Institute (T.E.I.) is in Kavala, the second biggest city in Northern Greece after Thessaloniki. A satellite campus of the Institute is in Drama, a nearby city about 35 km away.

The mission of the Institute is to offer education at the highest level of applied scientific knowledge, while promoting modern technological skills.

Within this framework, the Institute:

-maintains close contacts with key industrial and financial sectors of the economy;

-participates actively in applied research programs;

-cooperates closely with higher education institutes in Greece and abroad. So, over 20 externally funded research programs leading to journal articles and conference papers and effective technology transfer to local industry.

-Participation of the faculty in research and applied technology programs of the EU.

-Hosting and organization of scientific conferences and meetings.

-Funded technical and feasibility studies.

Details of the scientific and research activities of the Institute are provided in the link www.teikav.edu.gr.

Moreover, the T.E.I. of Kavala participates actively in the cultural life of the city, a fact that is reflected in the favorable coverage of the local media.

The Institute is managed by elected individual and collective bodies.

The Institute comprises of the School of Applied Technology, the School of Business Administration and Economics and the Department of Forestry (in Drama).

The various degree programs consist of six or seven semesters of lectures and hands-on laboratories and one further semester of paid internship in industry, so totally 7-8 semesters..

As concerns Engineering Education, the School of Applied Technology has the following Departments:

Department of Electrical Engineering

Department of Mechanical Engineering

Department of Petroleum Engineering

Department of Industrial Informatics

They are supported by the Department of Applied Sciences.

The teaching methods employed are:

- theoretical lectures;
- laboratory exercises;
- assignment of exercises on specific topics and the holding of seminars;
- overseeing of graduating projects;
- supervision of a compulsory six-month apprenticeship in the workplace.

The curriculum also includes apprenticeship in the workplace for at least six (6) months under the supervision of the Department.

Textbooks or other educational materials are provided free to the students.

During the final semester of study every student is required to undertake and publicly defend a diploma thesis in his/her field of study.

The School of Applied Technology emphasizes on educating executives of high quality standards that will be able to combine knowledge with application, and to use and promote modern Technology.

ASSESSMENT OF THE GREEK ENGINEERING EDUCATION SYSTEM

At this point, Authors wish to recall, referencing [1-2], first that the word engineer comes from the Latin ingenium, i. e. - spirit, genius, ingenious power, or sagacity. Thus, engineer should be understood to possess an outstanding intellectual potential, as the primary source of his practical disposition. As in the two previous sections, concerning the cases on the one hand of the Civil Engineering Department, Xanthi, and on the other hand the TEI of Kavala, is shown, the Greek Engineering Education System follows the above guidelines.

Moreover, as concerns the Bologna Declaration [3], investigations are currently made by both, the Engineering Faculties and the Technical Chamber of Greece (TEE). The latter is responsible for the professional praxis of engineers in Greece. These investigations seem to result at similar guidelines as those in [1]. So, the application of purely practice oriented engineering education runs the danger not to develop properly this potential, generating rather a narrow shaped personality. Simultaneously, education tuned merely on the practice of today is not able to meet, competently, the needs of future. Therefore, present education should, primarily, concentrate on the general sense of civil engineering, and less focused on its particulars - bringing up not only technical information, but teaching to utilize it, creatively, within the overall boundary conditions of the society. The student's real practical formation should be shifted to the time after his graduation. Having developed an appropriate intellectual ability, he will be able to adjust smoothly to any practical demand of the professional area met. In that respect, theory and practice form a unity and the statement: "experience can't be taught" holds.

CONCLUDING REMARKS

As has been presented, Higher – Tertiary – Engineering Education in Greece consists of two sectors: the University one (AEI), which includes the Universities, Technical Universities and the Athens School of Fine Arts, and the Technological one (TEI) that includes the Technological Educational Institutes.

The current Engineering Education System in Greece presented herein aims to apply the guidelines given in the previous section. Moreover, it emphasizes the necessity to follow a broad, creativity oriented education of Greek engineers that surpasses, evidently, the nowadays advocated narrow model - directed solely towards the satisfaction of the present needs of the industry. The manifold challenges of the coming 21st century require the engineer to be an open-minded, original individual - having, besides a high technical and economical capability, also a rational understanding of the humanistic background of his profession, thus being able to perform successfully the expectations of the actual society.

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