

Engineering Education in Greece

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Abstract

This paper provides an overview of the current status of Engineering Education in Greece. Topics include: an overview of the overall educational system in Greece, a description of the characteristics of engineering institutions offering undergraduate and graduate engineering education (including traditional and more recently, newly introduced fields of study and degrees offered), the problematic employment situation for engineering graduates (including the impact of European Union policies fostering mobility of engineers in its constituent countries as well as the legal requirements for employment as a Professional Engineer in Greece) and the status of women engineers in Greece.

1. Introduction

Engineering Education in Greece is in a transition period due to a variety of reasons. New major areas have been added within the last few years and for each major, in addition to the curriculum requirements, the rights and privileges of the graduates must be defined. As a whole, there are a larger number of engineering graduates than available engineering jobs. The policies of the European Union allowing mobility of engineers within the countries of the European Union [1] also affect the job market in Greece. Historically, Science and Engineering were very important in Ancient Greece. Running water and sewage systems, beautiful architectural structures (temples, baths, etc.) were made possible by application of geometry and mechanics. Famous mathematicians such as Thales, Euclid, Pythagoras, and Archimedes made significant contributions. Levers were used to move large stones and catapults were constructed to throw stones at the enemy. Theoretical science was very important to the Ancient Greeks, too, since they were inquiring information and knowledge about the surrounding world. The process of asking questions and getting answers, regardless of the correctness of answers, laid the foundations of Western science.

Only boys were generally educated in ancient Athens and their education consisted of both physical and mental training. In the better and larger schools reading, writing, and mathematics were taught by special teachers, called the "grammatistes", lessons in music and poetry were given by teachers called the "kitharistes", whereas physical training was directed by the trainers, or "paidotribes".

This paper is organized in seven sections including this introduction section. Section 2 Discusses the Educational system in Greece and section 3 discusses Engineering education in

particular. In addition to general information, an example program is discussed and information on accreditation is provided. Section 4 deals with employment of engineers in Greece, section 5 with women engineers, section 6 with graduate studies and section 7 is the paper's summary.

2. Educational System

In Greece the educational system is as follows: Kindergarten, elementary school consisting of six grades, Gymnasium (equivalent to Junior High school consisting of three grades), and Lyceum (equivalent to High School consisting of three grades). Lyceum graduates can then take national entrance exams to enter institutions of higher learning. These include Universities, Technical Educational Institutes (TEI), and Military Colleges, all of which are public. In addition, there are private Colleges and Institutes that operate under their own rules and regulations pertaining to their scope of training, as well as other public post high school institutes.

Required classes for all college bound students in the 1st year of the lyceum are [2]: Modern Greek Literature, Ancient Greek, History, Mathematics, Physics, Chemistry, Religion, Foreign language, Economics, Technology, Physical Education and Profession guidance. In addition students must choose, as electives, at least one (at most two) of the following: 2nd Foreign Language, Roots of European Civilization, Application of Informatics, Psychology and Art.

During the 2nd year of the lyceum students must choose either a science direction or a theoretical direction. Required courses for the science concentration are Religion, Modern Greek Literature, Ancient Greek, History, Mathematics (Algebra and Geometry), Physics, Chemistry, Biology, Foreign Language, Physical Education, Introduction to Law and Civics. They also take at least one or at most two of the following electives: Introduction to Environmental Sciences, Modern European Literature - History and Texts, 2nd Foreign Language, Introduction to Astronomy and Space Science, Drawing, History Topics, Applications of Computers and Biology.

During the final year of the lyceum students following a science direction take: Religion, Modern Greek Literature, Modern Greek History, Mathematics with Introductory Statistics, Physics, Chemistry, Biology, Foreign Language, Physical Education, History of Science and Technology. They also take at least one of the following electives: Philosophy Problems, 2nd foreign language, Economics, Modern Greek Literature, Statistics, Logic, Computer Applications, Art History.

3. Engineering Education and Licensing

Only engineering graduates of the public Universities in Greece may work as licensed (professional) engineers in Greece. The Universities in Greece that offer engineering degrees are the following: National Technical University of Athens, University of Thessaloniki, University of Patras, University of Thrace, University of Crete, and University of the Thessali. It should be noted that not all Universities offer all the engineering majors. Representative

types of engineering majors available are: architectural engineering, chemical engineering, civil engineering, computer engineering and informatics, electrical and computer engineering, environmental engineering, industrial engineering, mechanical engineering, metallurgical and mining engineering, naval architecture engineering, production engineering, and surveying engineering.

The Technological Educational Institutes offer degrees in Engineering Technology. Their graduates may take exams to enter the second year of the corresponding engineering specialty area in the Universities. This current policy and the educational programs of the Technological Educational Institutes is being reviewed including various options for graduate studies for Engineering technology majors [3].

As in most western European countries, the years of study for all University engineering majors is five, leading to a Diploma in the specific area of Engineering which is considered equivalent to a Masters Degree in Engineering. The last year of the study consists of graduate level courses and includes a mandatory thesis. Starting in the fourth year of studies each student chooses an area of concentration where he or she will eventually work on their thesis in the fifth year. Courses from different concentration areas may also be taken as electives.

One particular problem that is presented is that there is not sufficient guidance counseling pre-entering college in order for students to be exposed to what engineering is. After the entrance exams, students may find themselves in majors that are wrong for them and this is a real problem since there is no chance for changing majors other than re-taking the exams.

Also, students cannot transfer from one University in Greece to another, even if their homes are nearer to a different University from the one they were initially accepted in. Special circumstances exist for siblings accepted to different Universities or for students with serious illnesses etc. Similarly, students from overseas are allowed to transfer only at the beginning of the sophomore year and after passing a series of written examinations on key courses of the first year. Foreign language is a requirement for all. These courses are advanced technical terminology classes related to their field. However, this is usually not a problem since most students reaching the University are fluent in one or two of the foreign languages. The most common foreign languages are English, French, German, and Italian.

Since Universities are public, their budget primarily comes from the state and it is limited. However, in most cases the laboratories are well-equipped with state of the art equipment due to a large percentage of research grants from the European Union and private industry. Considerable opportunity is given to students to work on research projects both as undergraduates and as graduate students.

3.1 Example Program

Since it is difficult to show in this paper different programs and different majors, we show the curriculum of the Electrical and Computer Engineering Dept. of the University of Patras, as an example of a program [4]. This program, as all the others, consists of 10 semesters.

The first three years consist of general math and science classes, general engineering classes and major classes. In addition 2 courses of humanities/social sciences electives and two semesters of Foreign Language and terminology are offered. During the final two years of study the students must concentrate on one of the following concentration areas: telecommunication and information technology, electrical energy systems, electronics and computers, systems and automatic control. They take a minimum of 6 courses each semester in their fourth year and 5 courses each semester if their fifth year in their area of concentration and up to 2 courses each semester in other concentration areas. They are also allowed to start working on their Diploma thesis that is 12 credit hours. Each student must have an advisor and the Diploma thesis is then presented to a committee.

Students take 6-7 courses per semester, which are equivalent to about 30 credit hours. The minimum number of credit hours for graduation is 260. Final exams are held at the end of each semester and for many courses the only grade that the student receives in a class is the grade in the final. There may be homework assignments, term papers or midterm exams, but in many cases they do not constitute a requirement. Lab courses, however, require mandatory attendance and lab reports in addition to participation in the laboratory exercise.

Becoming a Professional Engineer is a requirement for all engineers wanting to work in Greece. Because of this, the title of Engineer and the rights and privileges are protected by law. All engineers become members of the Technical Chamber of Greece (TEE) once they obtain a license to practice engineering. An accreditation body (called DIKATSA) decides about the equivalency of degrees obtained in a foreign country and in this way allows engineering graduates of foreign Universities with a Masters Degree or European 5 year Engineering degree to sit for the licensing exams offered by TEE. The present number of regular membership of the Technical Chamber of Greece totals to about 62.500 engineers divided according to professional specialization's as follows [5]:

Civil Engineers	17.885
Architects	13.268
Mechanical and Electrical Engineers	3.328
Mechanical Engineers	7.338
Electrical Engineers	7.738
Rural and Surveying Engineers	4.144
Chemical Engineers	5.880
Mining and Metallurgical Engineers	1.850
Naval Architects	107
Marine Engineers	901
Electronic Engineers	1.246
TOTAL	62.495

3.2 Accreditation

Currently, there is no accreditation body in Greece for Engineering Education. All Engineering Programs in the country are considered equivalent. However, an accreditation procedure is being designed by the Ministry of Education. In anticipation of the upcoming accreditation procedure, a number of Engineering Programs are bringing in their own accreditation team comprised of faculty in Engineering Programs in the US and Europe that serve on accreditation Boards.

4. Employment

As a whole, the job market for engineers in Greece is problematic due to overproduction of engineers by the universities in addition to repatriated engineers having studied abroad. Four groups facing unemployment or underemployment (limited hours of employment) are: young engineers, women engineers, repatriated engineers from Eastern European countries, and older engineers who were laid-off from companies primarily due to downsizing.

Underemployment is particularly a problem for architectural engineers, civil engineers and surveying engineers. Due to the continuously changing job market, the engineer in Greece must be constantly able to adapt to new situations and new technologies. Also a constantly upgrading engineer should be able to determine the dynamics of the job market. As a result, engineers having studied in Greece are considered the most able to adapt and to find other types of employment (non-engineering) than any other group of scientists in Greece. This is due to the type and high quality of education they have acquired.

13% of all licensed engineers in Greece are employers, 36% are self-employed, 36% are salaried employees, 8% are employed in other (non-engineering) professions, 3% are unemployed and 4% are unemployed by choice [6].

The mobility of engineers between European countries is foreseen by the rules and regulations of the European Union (EU) [1]. As a result, a good number of European engineers are working in Greece.

5. Women Engineers

Women engineers in Greece are about 14% as a whole in the engineering profession. Women are noticeably underrepresented in electrical and mechanical engineering (less than 10%). Women civil engineers are about 15%. Architectural, surveying and chemical engineers have the largest percentage of women engineers, over 30% [6].

A large number of women engineers work in building construction (19%) and in services (22%), but only 8% of women engineers work in industry [6].

There is considerable effort to retrain women engineers in the marketplace in new technology areas and in areas where telecommuting is possible so that they can work out of their home and be close to their children [7].

6. Graduate Studies

Until a few years ago, graduate studies were not systematically organized. Ph.D. Degrees were awarded according to an existing old law to those graduates who worked on an innovative engineering subject, presented and defended an original dissertation to a committee in the appropriate department. Original publications were required and the average time for completing the dissertation was about five years. Now systematic graduate studies have started, requiring an entrance examination, completion of graduate courses, work on a research program, publication of original journal papers, as well as writing, presentation, and defense of an original dissertation. There is a push from the Ministry of Education to allow graduates of Technological Educational Institutes to pursue M.S. graduate degrees in Engineering Departments at the Universities. However, the Technical Chamber of Greece is strongly opposing this due to the risk of equating Engineering Technology Degrees with a 5-year Engineering.

7. Summary

This paper presented the current status Engineering Education in Greece. The present situation is a transitory one due to both secondary and post-secondary education reforms. An example of an Engineering Program was discussed. Employment opportunities are not sufficient for the graduates produced each year because the supply is much higher than the demand. However, many choose and succeed in careers that are alternatives to strict engineering. The number of women engineers is increasing in Greece and ways to gainfully employ them while they have a family are being explored. Systematic graduate studies are currently in place leading primarily to the Ph.D. degree.

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