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The First Year Curriculums of Electrical-Electronics Engineering Departments in Turkey

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Abstract—In this study, we consider evaluation of the first year undergraduate curriculums of electrical-electronics engineering departments at the state universities in Turkey (TR). The first year education is very significant, in view of the student's vocational information. Therefore, the first year curriculums are explained at thirty state universities. Analyzing the curriculums, the situation of electrical-electronics engineering departments is represented. According to analyze, we propose lessons of the first year curriculum.

Key words—electrical and electronics engineering education, the first year curriculum.

I. INTRODUCTION

A lot of industrial technology institutions have been founded, with developing technology in the world. Their number has permanently increased. Recently this increase has accelerated. In Turkey, technology institutions have increased according to these. The institutions which have particularly the electrical electronics and computer areas has constituted an increase rather speed. According to this speed increase, a need for electrical and electronics engineer has increased in Turkey. As a result of this need the number of electrical and electronics engineering departments has been increased at the universities.

For accomplishment of the technology institutions, the information of engineers is vital significant. The most of institutions which are large scale have the at least one. Because the institutions need electrical and electronics engineer in order to develop their technological systems. The engineers of the 21st century are expected not only to be technical experts but also to integrate science and technology into society as a whole. Thus, the electrical and electronics engineering education is very important. It is commonly discussed in the literature [1–6]. In the USA, THE American Society for engineering education, the National Science Foundation, and the Accreditation board for Engineering and Technology are the major driving forces for new engineering education reform [7].

In view of undergraduate student's achievement at the departments of electrical and electronics engineering, the first year is crucial. The student who has finished the high school education, the first time has started the undergraduate education. Therefore, basic training in the first year is quite important for basic engineering education. And the first impressions which have been acquired by the students are rather crucial in view of their future education. Thus, in this study, the first year undergraduate curriculums of the state universities which have electrical and electronics engineering departments in Turkey are analyzed (electrical engineering departments,

and electronics engineering departments are not considered).

II. A BRIEF HISTORY OF ELECTRICAL AND ELECTRONICS ENGINEERING EDUCATION IN TURKEY

The source of information about the engineering education is based on empire naval engineering school (Muhendishane-i Bahr-i Humayun), which was founded in 1773. It was composed the substructure of Istanbul Technical University.

In July 1944 with 4619 law, high engineering school was founded as "Istanbul Technical University". It had three faculties; and the electrical faculty was the first to be found.

During the period 1971-1981, ten universities were founded so electrical engineering education increased in Turkey. In 1982 combining academies, various universities were founded and so they started electrical electronics engineering education [8].

III. THE VIEW OF ELECTRICAL AND ELECTRONICS ENGINEERING EDUCATION IN TURKEY

The number of electrical and electronics engineering departments is 37 among the 84 state universities including 32 universities, which were founded between 2006 and 2007. 7 of these were founded but they have not just started undergraduate education. In 2006 year, one department was closed to undergraduate education and it has been started undergraduate education in 2007. In addition, some departments which have undergraduate education were closed in their evening education (EV) section and some departments opened the evening education section. Fig. 1 shows the total student quota by date.

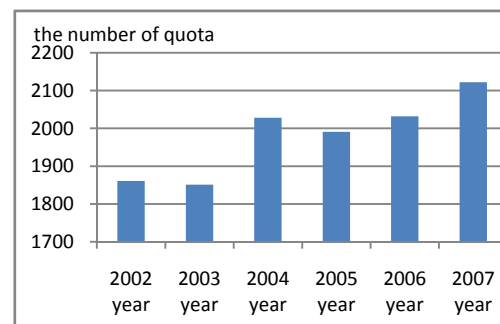


Figure 1. Changes of quotas

TABLE I.
ELECTRICAL AND ELECTRONICS ENGINEERING THE NUMBER OF QUOTA AND PLACEMENT STUDENTS

The State Universities		2007		2006		2005		2004		2003		2002	
		Quo.	Plac.	Quo.	Plac.	Quo.	Plac.	Quo.	Plac.	Quo.	Plac.	Quo.	Plac.
1	Anadolu University	62	62	62	62	62	62	63	63	53	53	53	53
2	Ataturk University	31	31	31	31	31	31	0	0	0	0	0	0
3	Balikesir University	21	21	21	21	0	0	0	0	0	0	0	0
4	Bogazici University	52	52	62	62	52	52	53	53	53	53	53	53
5	Cumhuriyet University	31	31	0	0	31	31	32	32	32	32	32	32
6	Cukurova University	41	41	41	41	41	41	42	42	42	42	42	42
	Cukurova University (EV)	31	31	31	31	31	31	32	32	32	32	32	32
7	Dicle University	31	31	31	31	31	31	32	32	32	32	32	32
8	Dokuz Eylul University	62	62	62	62	62	62	63	63	63	63	63	63
9	Dumlupinar University	52	52	52	52	41	41	42	42	42	42	42	42
	Dumlupinar University (EV)	0	0	0	0	41	41	42	42	42	42	42	42
10	Ege University	41	41	41	41	31	31	32	32	32	32	32	32
11	Erciyes University	62	62	62	62	62	62	63	63	0	0	0	0
	Erciyes University (EV)	52	52	52	52	52	52	53	53	0	0	0	0
12	Eskisehir Osman Gazi University	62	62	62	62	62	62	63	63	63	63	63	63
	Eskisehir Osman Gazi University (EV)	31	31	31	31	31	31	63	63	0	0	0	0
13	Firat University	62	62	62	62	52	52	53	53	53	53	53	53
	Firat University (EV)	52	52	41	41	52	52	53	53	53	53	53	53
14	Gazi University	62	62	62	62	62	62	63	63	63	63	53	53
15	Gaziantep University	62	62	62	62	62	62	63	63	63	63	63	63
	Gaziantep University (EV)	52	52	0	0	0	0	0	0	0	0	0	0
16	Hacettepe University	72	72	72	72	72	72	73	73	73	73	73	73
17	Inonu University	31	31	31	31	31	31	32	32	32	32	32	32
	Inonu University (EV)	31	31	31	31	31	31	32	32	32	32	32	32
18	Istanbul University	82	82	82	82	82	82	83	83	83	83	104	104
19	Kahramanmaraş Sutcu İmam University	41	41	41	41	41	41	42	42	32	32	32	32
	Kahramanmaraş Sutcu İmam University (EV)	41	41	31	31	41	41	42	42	32	32	32	32
20	Karadeniz Teknik University	93	93	93	93	93	93	94	94	94	94	94	94
21	Kirikkale University	52	52	52	52	52	52	53	53	53	53	53	53
	Kirikkale University (EV)	41	41	41	41	41	41	42	42	42	42	42	42
22	Mersin University	41	41	41	41	41	41	41	41	41	41	41	41
23	Mustafa Kemal University	41	41	41	41	41	41	42	42	42	42	42	42
	Mustafa Kemal University (EV)	41	41	41	41	0	0	0	0	0	0	0	0
24	Nigde University	41	41	41	41	41	41	32	32	32	32	32	32
	Nigde University (EV)	0	0	0	0	0	0	0	0	32	32	32	32
25	Ondokuz Mayıs University	41	41	41	41	41	41	42	42	42	42	42	42
26	Orta Dogu Teknik University	175	175	195	195	175	175	196	196	206	206	206	206
27	Pamukkale University	52	52	52	52	41	41	42	42	32	32	32	32
	Pamukkale University (EV)	47	47	31	31	41	41	32	32	32	32	32	32
28	Sakarya University	62	62	62	62	62	62	63	63	63	63	63	63
	Sakarya University (EV)	41	41	52	52	52	52	53	53	53	53	53	53
29	Selcuk University	52	52	52	52	52	52	53	53	53	53	53	53
30	Zonguldak Karaelmas University	52	52	41	41	31	31	32	32	32	32	31	31
	TOTAL	2122	2122	2032	2032	1991	1991	2028	2028	1851	1851	1861	1861

As shown in Fig. 1, during the period 2002–2003 and 2004–2005 the decreases were observed in the number of quotas, although new electrical and electronics engineering department was started the education as shown in Fig. 2. Because the quotas of some departments were decreased.

The increases have been observed to the present time from 2002 except for the period 2004-2005, 2002-2003 by changes of the quota and new founded department. Most of the increases were between 2003 and 2004.

During the period 2002-2003 and 2006-2007 the numbers of electrical and electronics engineering departments was the same as shown in Fig. 2. During the period 2004-2006 the number of electrical- electronics engineering departments increased. The increase is expected to continue.

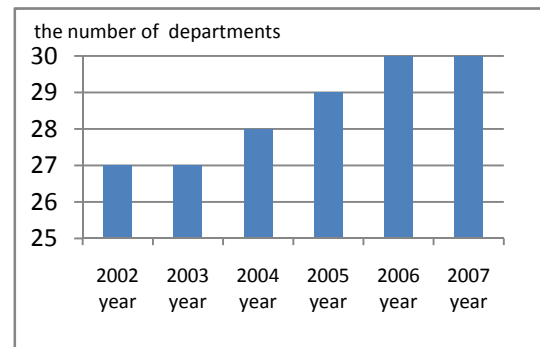


Figure 2. The changes of the number of the electrical and electronics engineering departments



Figure 3. The distribution of electrical and electronics engineering departments in regions of Turkey

The electrical and electronics engineering has been increased quite speed at the universities in Fig. 2. According to this increase, the number of students has also increased. During the period 2002-2007 electrical and electronics engineering student quotas at the state universities are shown in table I [9-11]. Table I shows that Turkey have thirty electrical and electronics engineering departments. The accepted students are shown in table I. Between 2002 and 2007, determined all quotas were preferred by the students as in table I. This state shows that the electrical and electronics engineering is demanded a lot by the students.

Fig. 3 shows regions of Turkey. Turkey Republic has seven regions. Turkey has a lot of universities in these regions. Fig. 3 also shows the distribution of electrical electronics engineering departments in regions of Turkey. There are the most number of electrical and electronics engineering departments in the Central Anatolia region. Since it is the central of Turkey, in this region, the number of electrical and electronics engineering departments is more than other regions. There is approximately same number of electrical and electronics engineering departments in the other regions of Turkey except for Central Anatolia region. The Central Anatolia has 10; Marmara, Aegean and Mediterranean have 4; Black Sea and Eastern Anatolia have 3; Southeast Anatolia has 2 electrical and electronics engineering departments as shown in Fig. 3.

IV. THE FIRST YEAR CURRICULUMS OF ELECTRICAL AND ELECTRONICS ENGINEERING DEPARTMENTS

The first year curriculum of electrical- electronics engineering can be separated two part, which are engineering lessons and basic science lessons. In this study either part is researched (apart from history, language, physical education etc.). So the distribution of lessons is considered particularly engineering and basic science lessons. Since these lessons have more various names, some names of the lessons, of which contents are very similar, are considered as same lesson. The engineering lessons are very important for the students. Because engineering lessons are concern direct the

engineering information. Basic science lessons are base of engineering; therefore basic science lessons are also important for understanding engineering lessons.

Basic science lessons are shown for thirty universities in table II [10]. As shown in table II the first year curriculums of all electrical and electronics engineering departments have “mathematics”, “physics” and “chemistry” lessons. Other lessons: “linear algebra” is 14, “physics laboratory” is 5, “materials information” is 4, “engineering mechanics” is 3, “probability” is 3, “numerical analysis” is 2, “differential equations” is 2, “engineering mathematics” is 1, “research and report preparation” is 1 and “seminar of introduction to electrical engineering” is 1. Fig. 4 shows distribution of the basic science lessons in departments. This state shows that the universities have various curriculums. The universities consider lessons for undergraduate student education. Therefore, it is observed that the universities a lot of names of lesson except for mathematics, physics and chemistry.

TABLE II.
BASIC SCIENCE LESSONS

LESSONS	THE NUMBER OF DEPARTMENT
Mathematics	30
Physics	30
Chemistry	30
Linear Algebra	14
Physics laboratory	5
Material information	4
Engineering mechanics	3
Probability	3
Numeric analysis	2
Differential equation	2
Engineering mathematics	1
Research and report preparation	1
Seminar of introduction to electrical engineering	1

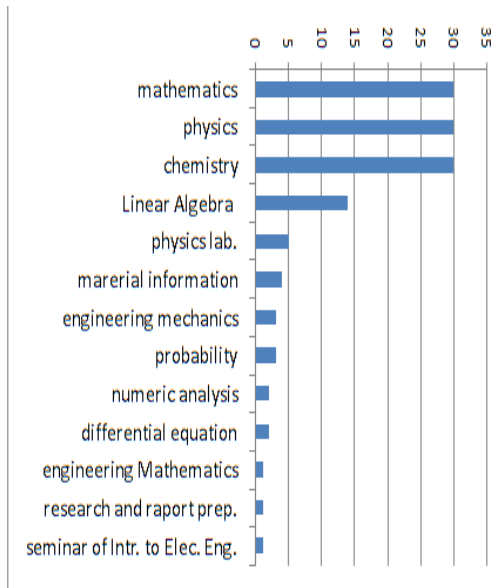


Figure 4. The distribution of basic science lessons

The engineering lessons are as shown in table III [10]. As shown in table III, most of the engineering lessons in curriculum are (computer aided) technical drawing, introduction to electrical (and electronics) engineering, basic information technology and computer programming. Fig. 5 shows distribution of the engineering lessons in departments.

Most of the lessons have various names at the universities. Some names of lessons are different, but they have similar contents. For example: computer, basics of computer, computer programming etc. In general, these lessons are called as basic information technology. Their contents are the same, a few contents consist differences. The contents of lessons are the same at the most of departments, and their names are different. One department has lessons as logic circuits, digital systems, electronic etc. The other departments have these lessons (as the same or different name) in second or third year curriculum.

Though the some engineering lessons have the same contents, they are called various names. This state shows that the name standard is not determined by Turkish Council of Higher Education.

The universities have various engineering lessons, which are kinder than basic science lessons. This state, which must be considered are very important. They affect on learning for the students. They also affect engineering careers. The students will start to engineering career with acquired education at the universities. Therefore, engineering lessons are determined by the universities. All engineering lessons must be gradated. The most necessary lessons must be determined. Others can be determined as elective.

We consider alternative lesson program for the first year curriculum. In table IV, the time of basic science lessons are proposed that it is can be applied by all universities.

Discussing the contents of these lessons can be determined by universities. We suggest that probability, numeric analysis, differential equation and engineering

TABLE III.
ENGINEERING LESSONS

LESSONS	THE NUMBER OF DEPARTMENT
Technical drawing	21
Introduction to electrical (and electronics engineering)	17
Basic information technology	16
Computer programming	15
Basics of computer sciences	7
Basics of computer	6
Basics of electrical circuits	3
Basics of electrical and electronics engineering	3
Computer	3
Information of electrical engineering material	3
Electrotechnics	2
Electrical and electronics measurement	2
Laboratory	2
Electrical measurement laboratory	2
Computer and programming	1
Alternating current circuits	1
Physical electronics	1
Logic systems	1
Introduction to logic design	1
Electrotechnics laboratory	1
Electronics	1
Direct current circuits	1
Basic electric laboratory	1
Workshop training	1

mathematics must not be in the first year. They must be in the other years. Research and report preparation, physics laboratory, Material information and seminar of introduction to electrical engineering must not be in the first year curriculum. They may be elective lesson in the other years.

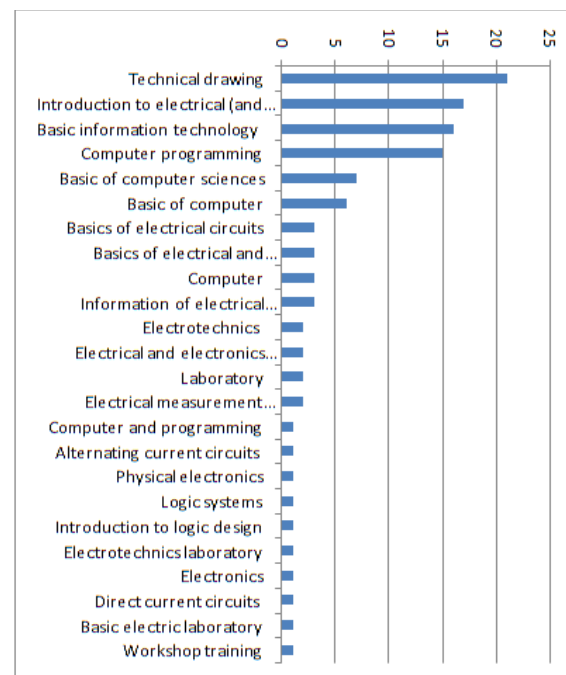


Figure 5. The distribution of engineering lessons

TABLE IV.
THE PROPOSED TIME OF BASIC SCIENCE LESSONS

LESSONS	PROPOSED TIME
Mathematics	first year
Physics	
Chemistry	
Linear Algebra	
Probability	in other years
Numeric analysis	
Differential equation	
Engineering mathematics	
Research and report preparation	
Physics laboratory	in other years or elective
Seminar of introduction to electrical engineering	
Material information	
Engineering mechanics	

TABLE V.
THE PROPOSED TIME OF ENGINEERING LESSONS

LESSONS	PROPOSED TIME	
Alternating current circuits	first year	
Direct current circuits		
Basics of electrical circuits		
Basics of electrical and electronics engineering		
Introduction to electrical (and electronics engineering)		
Basic information technology		
Basics of computer sciences		
Computer		
Computer and programming		
Computer programming		
Information of electrical engineering material		
(Computer aided) technical drawing		
Laboratory		in other years
Electrotechnics laboratory		
Basic electric laboratory		
Electrical measurement laboratory		
Electronics		
Logic systems	in other years as elective	
Introduction to logic design		
Physical electronics		
Workshop training		

Similarly table V shows we propose time of the engineering lessons. Table VI shows we propose names of the engineering lessons. There are a lot of names of lessons at the electrical and electronics engineering departments about computer. We propose that computer lessons can separate two parts: basics of computer and computer programming. Introduction to electrical and electronics engineering must be in the first year curriculum. Because the students learn the basics of electrical and electronics engineering and what electrical electronics engineering is. Laboratory, electrotechnics laboratory, basic electric laboratory, electrical measurement laboratory, electronics, logic systems, introduction to logic design are not in the first year curriculum. These lessons must be in other years. Because priority levels of these lessons are low.

According to we propose the time of lessons which must be in the first year curriculum as shown in table IV and V, we propose first and second semester lessons in the first year curriculum as shown in table VII.

According to we propose curriculum in table VII, We can prepare example contents. Let see these contents.

TABLE VI.
THE PROPOSED NAMES OF ENGINEERING LESSONS

LESSONS	PROPOSED NAME
Alternating current circuits	Introduction to electrical and electronics engineering
Direct current circuits	
Basics of electrical circuits	
Basics of electrical and electronics engineering	
Introduction to electrical (and electronics engineering)	
Basic information technology	Basics of computer
Basics of computer sciences	
Computer	
Computer and programming	Computer programming
Computer programming	
Information of electrical engineering material	Information of electrical engineering material
(Computer aided) technical drawing	Computer based technical drawing

TABLE VII.
THE PROPOSED THE FIRST YEAR CURRICULUM

FIRST SEMESTER	SECOND SEMESTER
Basics of computer	Computer programming
Mathematics I	Mathematics II
Physics I	Physics II
Chemistry	Introduction to electrical and electronics engineering
(Computer aided) technical drawing	Linear Algebra

A. Basics of computer

History of computing and computers, introduction to informatics systems, general information software and hardware in computer, basic structure of a network system, telecommunication, introduction to operating system, DOS, Windows, Linux, Microsoft word, excel, power point and paint applications, using the internet.

B. Mathematics I

Numbers, infinite series, functions, limit, derivative, applications of derivative, theorem of Taylor and Taylor series, indefinite integral, definite integral.

C. Physics I

Physical quantities, standards, vectors, Newton's laws of motion and applications, static and dynamic, energy and power, rotation of rigid bodies, equilibrium of bodies, gravitation, simple harmonic motion, linear momentum and its conservation, torque.

D. Chemistry

Matter and its properties, atom and atomic theory, electrons in atoms, stoichiometry, electronic structure, periodic table and some atomic properties, chemical bonding, liquids, solids and intermolecular forces, molecular orbital properties of solutions, equilibrium chemical kinetics, thermodynamics and electrochemistry.

E. Computer aided technical drawing

Introduction to computer aided technical drawing, definition of tools and standards, basic geometrical drawings, application of drawing to mechanical parts, three dimensional drawing techniques, projection,

measurement and scaling, perspective drawings, electrical and electronics schematic drawing, drawing printed circuit board design.

F. Computer programming

Introduction to programming, programming concept, algorithms, Introduction to C and C++, strings, data, expressions, assignments and simple input/output, decision and reception, structure types, graphics in defining the macros with parameters, procedures and functions, arrays and records, files, dynamic structures.

G. Physics II

Electrostatic fields, coulomb law for limited symmetry, gauss law, electric potential, capacitance and dielectrics, direct current, ohm law, faraday law, electromotive force and circuits, magnetic fields.

H. Introduction to electrical and electronics engineering

An orientation course aiming at introducing the student to the profession of engineering, an introduction to various fields of electrical and electronics engineering, historical development and contributing scientists of Electrical and Electronics Engineering (EEE), Tools and methods used in the field, interaction between EEE and other sciences and engineerings, the role of the engineering profession in the modern world, Kirchhoff Laws, ohm's law, resistors, diodes, half-wave rectifier, non-linear resistive elements, semiconductor elements, capacitors, inductors, transformers.

I. Mathematics II

Coordinate systems. functions of multiple variables, power series sequences, series, partial derivative, partial derivative in higher degree, the chain rule functions, partial derivatives of closed functions and Jacobean, multiple integrals, Vectors, curves, lines, planes, vector-valued functions, integration in vector fields.

J. Linear Algebra

Matrices, determinants and Systems of linear algebraic equations, vector spaces, the euclidian space, linear transformations, eigenvalues, diagonalization, lines and planes in 3-space, basic surfaces in space, cylinders, surface of revolutions, quadratic surfaces.

V. CONCLUSIONS AND SUGGESTIONS

In this study, the first year undergraduate curriculums of electrical and electronics engineering departments are researched at the state universities in Turkey. There are a lot of differences in the first year curriculums. It is observed that the names of lessons are different but most of the contents of the lessons are the same. These differences can make a problem for passing another university and accreditation.

Engineering lessons have various names for the first year curriculum. Engineering lessons and their contents must be determined by Turkish Council of Higher Education. Engineering lessons must be also called same name. As for elective lessons, they are determined by the universities. In addition, founding the universities committee, the name of lessons in the curriculums must be called the same and the contents of lessons must be increased substantially

According to we research about the electrical and electronics departments in Turkey, we consider time and names of the lessons for the first year curriculum. Thus, we propose first semester and second semester for the first year curriculum. In addition, we prepare example contents of lesson for proposed first year curriculum.

It is expected that this study helps the new departments in future, and that universities with high competitive potential will have more shares in this proposed curriculum.

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