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ELECTRONICS ENGINEERING EDUCATION IN TURKISH AIRFORCE ACADEMY

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Abstract: *Turkish Air Force, to carry out air defense and attack mission undertaken by the Turkish Armed Forces effectively and as quick as possible, have to be well equipped with all kinds of technological possibilities and capabilities. It is only by well-trained manpower to use of electronic systems with infrastructure of the complex architectures in an effective way. Generally speaking electronic systems lay mainly on the control and communication engineering that are areas interacting each other and the basic disciplines to be trained for pilots considering that they are in the center of all flight operations. Turkish Air Force Academy Electronics Engineering department trains future aviators in communication and control engineering to meet the needs of the best graduate education. In this paper Electronics Engineering Education in Turkish Air Force Academy is described by its program definition, projects, learning technics, laboratories and other facilities in detail.*

Keywords: *electronics engineering, education, air force*

1. INTRODUCTION

In twenty first century both the individuals and organizations are exposed to rapid change. The change in needs also changes the expectations. In this context, mission of educational institutions taking responsibility for educating people in accordance with the needs of their communities is being questioned. Growing and changing demands of the outside world are pushing educational institutions to graduate students who are learning constantly instead of memorizing academic or encyclopedic information. In such a constantly changing world, the most fundamental responsibility of universities is to provide students with appropriate education for real life situations. Graduates of higher education institutions are expected to be skilled in problem solving, compatible with team work and well informed about time management and communication technologies (Harvey, Moon, Geal, 1997).

The traditional view of education is far from meeting the needs of the new century. Behaviorism is the traditional approach to education and it shaped educational practices for nearly 50 years from 1920s until 1970s. The behaviorists tried to explain human behavior with the data obtained from experiments on animals and they have neglected affective and cognitive domain by only focusing on observable and measurable human behavior. The behaviorists, who consider human-beings as machines, claimed that learning will take place with the regulation of environmental conditions and explained the term of learning as the reaction of the

organism to the effect from the environment. Throughout the behaviorist reign, mental processes are all ignored and process of teaching is regarded as a black box that cannot be explored. So, behaviorists focused on the process-product paradigm (Romizowski, 1981).

Contemporary approach to learning points out the importance of deep learning and rejects the idea of memorizing the information presented by the instructor. Learning to learn and versatile mental development are also emphasized in educational understanding adopted by the contemporary approach. In learning processes dominated by behaviorist approach relationships between the particles of information are ignored and failures are encountered with in the process of making sense of the new information and perceiving the whole. Today, behaviorist reign has lost its dominance in educational settings and constructivist learning theories came to the fore. In learning environments, meaningful learning, experiential learning, contextual learning, learning to think, research and discovery, problem solving and project-based learning concepts have come to the stage and replaces traditional tools like reinforcement and meaningless repetition (Akbaş, 2007).

Life is different in 21st century than it is in previous eras because of technology. To well aware of all technological innovations is main purpose for all nations. Electronics with quick improvements is the impact or dominant factor that changes world. Since electronics engineering is essential departments for all education institutes and military schools. Turkish Air Force Electronics Engineering education is main scope of this paper.

2. PROGRAM DEFINITION

Electronics Engineering Department aims to provide cadets with essential engineering skills in order to cultivate their academic background and know-how they acquire under electronics discipline, thus incorporate this knowledge to put forward future plans and insightful ideas for Turkish Air Force, manage high order technical and organizational processes, cope with ambiguous problems and difficult situations of our times and future. Besides academic education every cadet is firmly adherent to Principles of Atatürk, Turkish Republic founder, hence believes in thrust, faith, honor, morals and health as building blocks of a prospective officer.

Air Force, abiding to its operative mission, is equipped with latest technology systems. These systems can only be successfully managed, maintained and improved by well-trained personnel. Turkish Air Force Academy merges PhD and MSc degree officers from Turkish Air Force and selected academicians from universities in Istanbul to accomplish this mission.

Electronics Engineering Department possesses two options; Control and Communication Systems. In a closer look, control and communication are two main disciplines which are vital for flight related activities and pilots at the center of all.

NO	CODE	COURSE	H	CR
1	ELK 424	CONTROL SYSTEMS THEORY	(3 0 0)	3,0
2	ELK 431	DIGITAL CONTROL	(3 0 0)	3,0
3	ELK 441	MEASUREMENT ANDDETECTION TECHNIQUE	(3 0 0)	3,0
4	ELK 443	POWER ELECTRONICS	(3 0 0)	3,0
5	ELK 471	CONTROL SYSTEMS DESIGN	(3 0 0)	3,0
6	ELK 472	CONTROL SYSTEMS LABORATORY	(0 0 2)	1,0
7	ELK 488	MICROPROCESSORS BASED SYSTEM DESIGN	(3 0 0)	3,0
8	ELK 491	INTRO TO AVIONICS SYSTEMS	(3 0 0)	3,0
9	ELK 492	FLIGHT CONTROL SYSTEMS	(3 0 0)	3,0
10	ELK 493	INTRO TO ROBOT CONTROL SYS.	(3 0 0)	3,0

Table1.Control System Option Elective Courses

Control Systems Option

Control Systems are devices, machines and systems which incorporate hardware and software, collect sensor data from environment, make decisions based on the fused data and operator support. All aircrafts, weapons and support systems in Turkish Air Force inventory are examples of control systems. These systems together with pilotage

and operator abilities directly effect the power factor of the Turkish Air Force. The table of elective courses of the option is given in Table1.

Communication Systems Option

*C*ommunication Systems are composite structures which are in charge of transmission and receiving of signals regardless of environmental situations. Air traffic control. airfield management, aircraft and satellite systems are examples of complicated communication systems. In addition, new generation UAVs designed for reconnaissance and surveillance missions are high technology systems forming the basis of future defense scenario. The table of elective courses is given in Table2.

3. FACILITIES

Electronics Engineering Department located in Engineering Faculty with its classrooms and laboratory sections.

Since application in electronics engineering education is crucial, industrial projects, science festivals and laboratory courses are supplementary training actions.

Signal Processing and Microprocessors Laboratory

Signal Processing and Microprocessors Laboratory holds Intel based one server and 20 workstations, microprocessor and microcontroller experimentation sets. This laboratory is equipped for demo presentations and in-class activities regarding Fundamentals of Electrical Engineering, Analog/Digital Signal Processing and Microprocessor courses. Graduate studies are also carried out in this laboratory.

Communication Systems Laboratory

Housing eight advanced communication systems experimentation sets and multipurpose setups with interchangeable circuit cards, communication systems laboratory provides a well-equipped environment for both graduate and undergraduate studies.

Supporting theoretical courses with comprehensive experiments and presenting the practical side of knowledge, communication systems laboratory proves to be an interactive classroom.

Fig.1.Signal Processing and Microprocessors Laboratory

NO	CODE	COURSE	H	CR
1	ELK 421	ANTENNAS AND PROPAGATION	(3 0 0)	3,0
2	ELK 422	MICROWAVE CIRCUITS	(3 0 0)	3,0
3	ELK 423	REMOTE SENSING	(3 0 0)	3,0
4	ELK 461	RADAR TECH. AND ELECTRONIC WARFARE	(3 0 0)	3,0
5	ELK 464	ANALOG COMMUNICATIONS	(3 0 0)	3,0
6	ELK 466	DIGITAL COMMUNICATIONS	(3 0 0)	3,0
7	ELK 467	COMMUNICATION SYS. LAB.	(0 0 2)	1,0
8	ELK 481	ELECTRONIC CIRCUITS IN COMM. SYS.	(3 0 0)	3,0
9	ELK 491	INT. TO AVIONIC SYSTEMS	(3 0 0)	3,0

Table2. Communication System Option Elective Courses

Fig.2. Communication Systems Laboratory

Control Systems Laboratory

Real-time control systems development equipment, multipurpose experimentation sets and interactive classroom activities promote the motivation of the cadets and courage learning. Besides serving as a classroom and a demonstration area for senior class students, control systems laboratory houses an intermediate level shop to carry out graduate and undergraduate theses and projects. Rich assortment of materials and projects in the

laboratory provides an insightful laboratory atmosphere.

Fig.3. Control (left) and Electronics (right) Laboratory

Electronics Laboratory

Electronics Laboratory has 10 multipurpose experimentation sets which enable performing analog and digital electronics laboratory courses. In addition, rich amounts of different measurement equipment are available for general use.

4. TEACHING TECHNIQUES

Active Learning

Active learning improves the quality of students' learning and through active learning applications students can achieve deep learning desired in higher education (Haack, 2008). In order to use active learning model, use of student-centered teaching strategies is a necessity. Case based scenarios and cooperative learning are mostly used to actively involve students with course content. In case-based education scenarios based on real events and stories are used to help the students to improve decision making and critical thinking skills. Case-based education is student-centered and it entails students to engage in real life situations by interacting with each other. Case-based education is widely used in the fields of law, medicine and business as an alternative of traditional education (Artan, 2007).

Cooperative Learning

Active learning is a model based on constructivist approach. Understanding of the models depends on understanding of the methods developed under the models and techniques presented by these methods. In this section we will focus on cooperative learning techniques shaping classroom practices of active learning model. Cooperative learning which is an applicative form of active learning is a method of teaching that allows students to learn in small groups by helping each other (Tan, Sharan, Lee, 2006). In cooperative learning activities are evaluated by students' learning levels and contributions to collaborative work. Additionally, students are offered opportunity to learn and to teach team-mates by working in a team (Slavin, 2000).

Cooperative learning can be considered as students' learning process by working in small groups and helping each other. Students' effort to develop both themselves and their friends to the end of their capacity is what makes group works cooperative learning. This is quite different from students' learning alone. During group works, by interacting with each other, students have the opportunity of living important learning experiences-such as asking questions, giving examples, making explanations, making critics-which they cannot experience alone. Working in small groups is not enough for students to realize cooperative learning and all group works are not cooperative learning. Some group works cannot be regarded as cooperative learning for the following reasons:

- ***Social loafing:*** Some group members share the success of others providing no contribution to group work.
- ***Exploitation:*** Some group members feel that they are doing others' work and so they feel unhappy.
- ***The enrichment of the rich:*** Group members who have a high level of success are always doing much of the work and they benefit from group work more than the others. Group members who have a low level of success namely slow learners cannot do this, and they become weaker and weaker day by day.
- ***Lack of Respect:*** Group members who have a high level of success pay no attention to others' statements and recommendations (Açıkgöz, 2007).

Cooperative learning is a method by which students work in small groups to solve a problem or to accomplish a task. It is only

under the following conditions that a group work can be cooperative learning;

Group Award: To be successful it is a must for members to have a group with success. In other words groups must be successful in order to be members of the group to be successful.
Positive Interdependence: Creates a situation that individuals combine their efforts for reward and common purpose. Each group member has a unique contribution to make to the joint effort because of his or her resources and/or role and task responsibilities.
Individual Accountability: Group success depends on each individual's learning. Each student should have the responsibility of learning all the material and doing what is s/he is expected to do.
Face-to-Face Interaction: Group members encourage each other and facilitate each other's effort.
Social skills: Students should be taught how interpersonal relations should be and they should be encouraged to use them.

Turkish Air Force Academy is a military academy training future pilot candidate air force officers and providing the cadets with an undergraduate education in the fields of Electronics, Aerospace, Computer and Industrial Engineering.

The purpose of engineering undergraduate education of the academy is to train students capable of coping with the prospective challenges by the help of leadership skills acquired in the academy. Air Force Academy cadets by completing the academy program, get the rank of lieutenant with a bachelor's degree in engineering. In this respect, these students are quite different from other university students. So these engineer officers should develop problem-solving and teamwork skills as future team leaders. So, the academy witnessed a great instructional paradigm shift from traditional to active in the year 2008. The senate also decided to apply active learning in engineering courses at all levels of instruction i.e. freshman, sophomore, junior and senior classes. On the basis of this decision active learning practices would cover at least 50% of the engineering courses and 100% of the social science courses.

In an educational institution teachers play a major role in starting up a new program and the success of this program. In the Air Force Academy, in order to be apply active learning techniques successfully, it was a must to teach the academic staff. So, an active learning expert i.e. a professor invited to the academy and all the teaching staff attended a seven week active learning in-service training program. Active learning training program comprised the theoretical background, discussion of theory and practice teaching sessions followed by discussions. This program totally lasted three months with 21 hours face to face training.

Other Active Learning Techniques:

All of the following activities are carried out in the laboratories used as a classroom for student centered activities.

- Preparing multiple choice and open ended questions with short answers,
- Designing projects and realizing those projects,
- Producing different solutions to the problems given on Control Projects carried out in the laboratory,
- Making a demonstration using a modular experiment system as a group work,
- Writing a poem related to the subject matter studied in class.

5. CONCLUSIONS & ACKNOWLEDGMENT

Turkish Air Force Academy seeks better education opportunities in many ways such as facilities and laboratory improvement, conductance of detailed researches both in control and communication engineering or new teaching techniques such as active learning and cooperative learning..

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