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SUBJECT INFORMATION TECHNOLOGY IN MILITARY EDUCATION

Miroslav Hrubý*

*Faculty of Military Technology, University of Defence, Brno, Czech Republic

Abstract: *The paper deals with the first experience in realization of a new Master's degree program at the Faculty of Military Technology, University of Defense, Brno, Czech Republic. This Master's degree program named Military Technology was prepared according to the new requirements of the Czech Ministry of Defense. The author's attention is focused on the subject "Information Technology" (IT) which plays an important role not only from the Department of Communication and Information Systems point of view. The subject IT was for the first time realized at the Faculty of Military Technology in the winter semester of the academic year 2014/2015. The content, teaching methods and assessment of the subject IT are described. Finally a few important points for the future of the subject IT are formulated.*

Keywords: *algorithms, computer networks, engineering education, programming.*
MSC2010: 68W01,68N15, 68P05, 97Q60.

1. INTRODUCTION

In the last years the Faculty of Military Technology, University of Defense, Brno, Czech Republic offered to its military students Bachelor's degree programs and follow-up Master's degree programs. Since 2013, the Faculty of Military Technology has been preparing, according to the new requirements of the Czech Ministry of Defense, its new five-year Master's degree program named Military Technology.

This new Master's degree program has only one field of study. This field of study is also named Military Technology. Subjects and study duties in the first 5 semesters are the same for all military students but from the 6th semester this study field is internally divided into 15 modules that correspond to the names

of the required military specialties. These are: as follows:

- Automated Command and Control Systems;
- Combat and Special Vehicles;
- Communications and Information Systems – Information Technology (IT);
- Communication and Information Systems – Communication Technology (CT);
- Aircraft – Avionics and Armament;
- Aircraft – Airframes and Engines;
- Air Radio Navigation systems;
- Air Staff Officer;
- Airbase Engineering Support;
- Radar Technology and Electronic Warfare;
- Air Traffic Control;
- Military Geography and Meteorology;
- Military Pilot;

- Weapons and Ammunition;
- Military Engineering.

In the winter semester of the first year of studies the subject IT is included. The current specification of this subject is derived from [2] and [3] in the first part of its content.

The goal of the article is to introduce a study plan of the subject IT, its teaching methods and rules for granting the credit. The findings from the first semester of the subject teaching are included.

2. SUBJECT “INFORMATION TECHNOLOGY”

2.1 Goals of the subject. First of all it is necessary to keep in mind that new military university students are coming from various types of secondary schools. Their IT knowledge and digital competences can radically differ. The course especially builds on secondary school knowledge of mathematics and physics, improves skills for PC usage and forms algorithmic thinking necessary for technically educated military professionals. Gained knowledge is useful for next subjects being studied in curriculum.

Due to the obvious characteristics of new students the goals of the subject were specified in two main aims:

- Algorithms and programming (32 teaching hours);
- Computer networks (16 teaching hours).

Students should gain knowledge of problem analysis ways, basics of programming techniques, principles and practical usage of the event programming, the meaning of IT technical terms and principles of operation of various types of computer networks. They should be able to divide the problem into sub-processes, to create applications in particular development environment, to solve simple applications as a support for engineering activities, to assess the basic network components configuration for workstations, to design simple local computer network, to design methods of obtaining the status of network components in workstations. Students should be acquainted with the basics of analytical and programming work on a local computer and within a computer network. It

was planned that laboratory topics from programming should be implemented using selected higher programming language (Python, Java Script, C# or Visual Basic).

Finally, JavaScript programming language was selected as the most suitable tool for the practicing of programming skills. This programming language was evaluated at the department level as a modern and popular tool which is available free of charge as a component of contemporary web browsers. Teachers and students can access many good information sources at the Internet [1,4,5].

2.2 Content of the subject. The first part of the subject is focused on algorithms and programming. Firstly, three lectures (3 x 2 teaching hours) are provided:

- Introduction into algorithms;
- Data types and data structures;
- Statements of a high level programming language, structure of a program.

Secondly, 26 teaching hours are given in the form of laboratory practicing of the topics such as:

- User interface of the program (application);
- Programming of the input and output;
- Usage of an array;
- String processing;
- Subroutines and user defined functions.

Thirdly, the second part of the subject focused on computer networks is started by three lectures (2 + 4 + 2 teaching hours):

- Introduction to computer networks, network architecture reference model ISO/OSI, model TCP/IP;
- Ethernet, fundamental suite of TCP/IP protocols;
- Planning the address space, CIDR, VLSM, routing.

Fourthly, 8 teaching hours in laboratory are focused on:

- Addressing in a simple network, (configuring user devices and basic network devices);
- Realization of simple network and their diagnostics (configuration of simple networks in practice, their diagnostics and troubleshooting).

2.3 Teaching methods. Lectures are provided in a high capacity lecture hall for all



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students at the same time. Lectures focused on algorithms and programming and lectures focused on computer networks are realized by two vocational specialist. Laboratory exercises are provided for the groups of 25 students. In the academic year 2014-2015 five members of CIS Department academic staff took part in laboratory exercises. The teaching process was coordinated by the guarantor of the subject.

For clarification, the three examples of tasks from programming are as follows:

- One-dimensional array (vector) named Charles has 13 elements. Give each element random whole number from the interval $\langle 10; 99 \rangle$. Find out how many numbers which are stored in the array Charles meet the interval which limits are set by the user. Display all used data in the form which you find as the most suitable.
- Two-dimensional array (matrix) contains the results of written work from the subject Math. The work was done by a group of 24 students. According to the position of a teacher's desk and each student's place in the classroom, the results of students are characterized as:

Teacher

1 2 2 3 3 1
1 3 2 1 2 2
3 4 2 2 4 1
2 3 2 3 1 4

Find occurrence of each classification levels. Display all used data in the form which you find as the most suitable.

- Declare and check a user defined function which has to make a calculation of the monthly cost of water for swimming pool cuboids with dimensions l (length) / w (width) / d (depth), which will be filled to $p\%$. The pool water is completely changed n -times per month. The price of water is x CZK per m^3 . Realize displaying

the pool parameters and calculated costs on a web page. Suggest this listing in the form which you find as the most suitable.

From the three examples above it is evident that programming tasks are especially focused on the array data structure and statements of branching, switch and cycles.

The students should be familiarized with three basic control structures (sequence, branching and cycle) and their use in writing algorithms by a high level programming language (in its integrated development environment).

2.4 Subject assessment. The students' knowledge and skills assessment is realized independently in two phases. Firstly, in the first part of the subject the students have to accomplish the tasks from algorithms and programming. Secondly, later in the second part of the subject they have to accomplish the tasks from computer networks. The tasks are set by the teaching academic staff and each group of students has to fulfil the goals during their laboratory exercises.

Finally, the students, who fulfil the stated goals in both two parts of the subject, receive the course credit.

3. CONCLUSIONS & ACKNOWLEDGMENT

The subject "Information Technology" is a mandatory subject for all military students at the Faculty of Military Technology, University of Defense, Brno Czech Republic in the first semester of their Master's degree program since 2014. It is a subject of so-called core knowledge. In previous study programs realized at the Faculty of Military Technology was no subject of such content which was mandatory for all students.

The students are warned that it requires significantly different demands due to the previous knowledge and skills of students in the ICT field, especially focused on algorithms and programming. Both students and teachers have to keep in mind this fact.

The first experience from the teaching process is the follows:

- Inclusion of the subject “Information Technology” in the education of all Faculty of Military Technology students is very important for their future studies.
- Teaching of the subject in the 1st semester of military students’ studies is the optimal time.
- The content of the subject, focused on algorithms and programming and computer networks, seems to be well done but it will be suitable to be prepared to slightly modify the subject content appropriate to the experience gained.
- The current number of 25 students in the laboratory exercises would be reduced to the number of 10 to 15 students in the interest of better communication and individual approach which is sometimes needed.
- If possible, it is necessary to encourage students to use their own notebooks because of these students can make better progress thanks to the usage of devices they are familiarized with.
- It is suitable to install and use the same web browser by all students. It makes better conditions for discussions among students and their teacher about various solutions of programming tasks.
- The topics of programming tasks should be selected carefully according to the contemporary knowledge of students in the laboratory groups and their interests.
- The teachers should creatively use connections to the problem areas of other subjects, e.g. work with vectors and matrices in mathematics.
- The author assumes that evaluation of different high level programming languages usage according to the teachers’ offer and students’ selection could bring interesting results for the subject guarantor.

Acquiring of the algorithmic thinking skill is sometimes a long distance run but this type of thinking is a necessary prerequisite for successful studies at the military technical faculty and the important element of a contemporary military professional profile.

The author assumes that students’ assessment should always consist of a written part and a practical part of assessment. From the algorithms and programming point of view the written part should be focused on understanding of key concepts and connections among key terms used in this vocational field, including understanding of simple parts of the code. On the other hand, in practical part of assessment the students should demonstrate their current programming skill. They should be capable to create required code and explain their thinking process which led to this code.

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