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# NEW CONCEPT OF ELECTRICAL ENGINEERING EDUCATION

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**Abstract:** This paper describes new concept of Electrical Engineering high – school education at the Department of Theoretical and Experimental Electrical Engineering, Technical University Brno. The methodology, some problems, didactical aspects and experience by performance of lectures, numerical practises and laboratory education process are here very briefly presented.

**Keywords:** Electrical engineering, bachelor course, study, education, teaching, lecture, numerical and laboratory exercises.

## 1 Introduction

Since academic year 2002/2003 the three – years bachelor course of study was generally opened at the Faculty of Electrical Engineering and Communication Technology – BUT Brno. The bachelor education program represent the first stage of high – school education and provides basic education in many declared branches of our faculty as applied electronics and communication techniques, teleinformations, power electrical and electronic engineering, microelectronics and technology, control and measurement.

The bachelor system of study prepares the students as specialists in area of electrical and electronic engineering with good knowledge in design, construction, service and applications of electrical and electronic devices and systems, which are required in technical practice. The above mentioned bachelor programme also enable to obtain knowledge of the wider scientific basis needed

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to further study in second stage of high – school education ( two – years magisterial study) , that can the most successful students to absolve.

## **2 The Electrical Engineering courses of the bachelor study conception**

The students of the all study branches obtain the fundamental electrical engineering knowledge in courses named Electrical Engineering 1 (ET1) during first (winter) semester of first year of study and Electrical 2 (ET2) in second (summer) of first year of their study. The lists of survey matter of the courses are ordered to the Tab.1 and Tab.2.

Table 1.

<b>ET 1</b>	
<b>1</b>	Safety in electrical engineering.
<b>2</b>	Safety in electrical engineering.
<b>3</b>	Basic electrical quantities, laws, methods of network solution.
<b>4</b>	Basic network elements and models.
<b>5</b>	Principle of superposition ,applying of Kirchhoff's laws.
<b>6</b>	Method of current loops.
<b>7</b>	Method of nodal voltage.
<b>8</b>	Thevenin's and Norton's theorem.
<b>9</b>	Time variable quantities – their parameters.
<b>10</b>	Power in electrical network, impedance matching.
<b>11</b>	Magnetic networks, basic parameters, basic laws.
<b>12</b>	Solutions of magnetic networks- graphic, analytic and numeric methods.
<b>13</b>	Magnetic networks , transformers.

Table 2.

<b>ET 2</b>	
<b>1</b>	Harmonic quantities in electrical network, phasors.
<b>2</b>	Symbolic method for simulation of linear network in harmonic steady state.
<b>3</b>	Properties of basic linear passive RC, RL network
<b>4</b>	Characteristics of resonant circuits LCR (serial and parallel) – using in practice.
<b>5</b>	Three – phase systems- delta, star connections- properties.
<b>6</b>	Power in three – phase systems.
<b>7</b>	Transients in simple linear RC and RL networks.
<b>8</b>	Transients in 2nd – order networks.
<b>9</b>	Operator method for solution of transients in linear network.
<b>10</b>	Step and impulse responses of a linear network.
<b>11</b>	Transmission lines, primary and secondary parameters.
<b>12</b>	Harmonic steady state, waves on transmission lines, impedance.
<b>13</b>	Transient phenomena in transmission lines.

To fulfilling of required innovations in study programmes many organizing and teaching problems were solved during transformation of the teaching programmes into bachelor study systems.

In comparison to previously used education system generally the teaching space area was on the one side essentially diminish (lectures- from 39 to 26 teaching units per semester), on the other side the required part Safety in Electrical Engineering with evaluation of the student's knowledge according the Notice No.50/1978 was in course ET1 inserted. Consequently two – ports and non – linear networks as parts of circuit theory was according decision of the Subject committee cancelled. Now very shortly some problems in teaching and learning activities in the new bachelor study:

- **Lectures** – to eliminate shortened teaching space the new wider lecture texts for both parts of subject (ET1 and ET2) were prepared [1], [2] and as electronic free text on Internet page was given. The new multimedia lecture system to teaching of required part Safety In Electrical Engineering , First aid and Basic types and properties of electrical measurements was created [3] .
- **PC numerical practises** – the new texts for the numerical exercises with PC counter experiments were prepared [4], [5] and new special educational software which takes into account the low student's knowledge level was created - one example of main screen of BCC1 program (solution of simply AC circuit – see in Fig.1.). In first part of subject (ET1) the PC counters are used mainly as a motivation tool to further self study, in the second part (ET2) the PC counters will be wider used to reach namely higher effectiveness in learning process.
- **Laboratory practises** – are essential parts of education process. The content and didactical goals of first semester (in ET1 ) and second semester (in ET2) are different. In first semester there are very easy laboratory experiments with easy measuring equipment to enhance productivity of lectures and numerical practices. In second semester there are used more complicated measuring experiments [6] , some new laboratory exercises were performed to explain more difficult parts of subject. One interesting example - the measurement of properties of homogenous lines, where as measuring generator was used very cheap CB receiver, is shown in Fig.2.
- **Virtual laboratory** – were created namely as helping tool to explain some difficult parts of subject and better prepare to real laboratory experiments [7] and are free to disposal in Internet page of our department. In future we plan this learning form essentially forced.

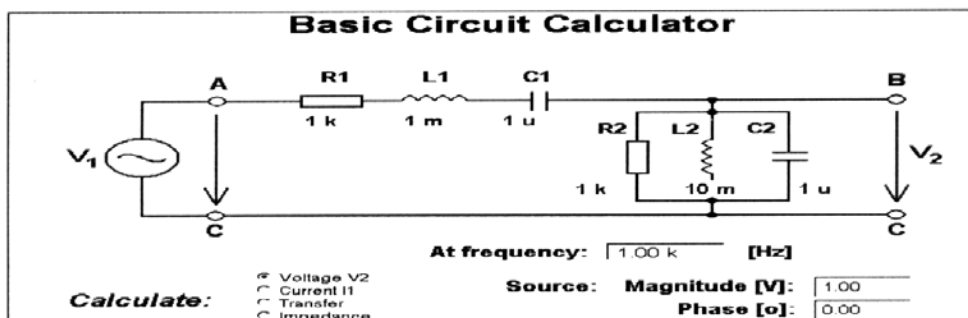


Fig.1 The example of main screen from new program BCC1

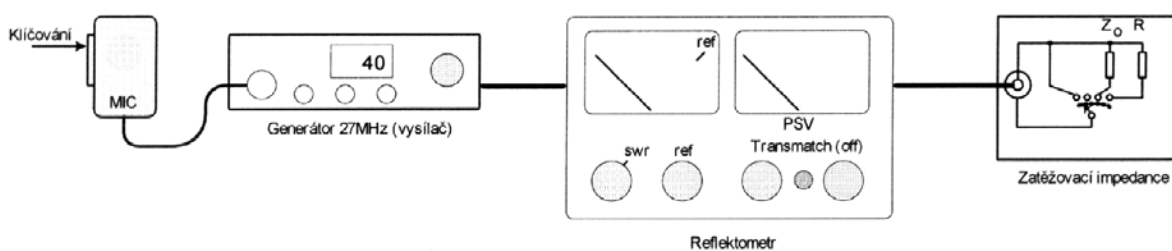


Fig.2 The example of arrangement of new laboratory experiment

## Conclusion

The new concept of Electrical Engineering education in bachelor system study and some problems has been reviewed very shortly in some details. Our experience shows, that in present time the student's input level knowledge is relatively low and therefore during education process is very important to force namely this forms of teaching process which are motivating to higher study activity and consequently to higher education effectivity.

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