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Scientific
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Knowing Electronics

Knowing electronics means knowing to translate an idea or a project to an electronic circuit, to design, to build, to program, to trace errors and to implement.

The difference between the electronic subject and the other high school subjects is that the student who learns electronics wants to know it. He learns the other subjects because they are pre-required to his goals (matriculation certificate, academic studies).

The electronic subject has no advantage at high school. Not from the matriculation certificate point of view, nor from the admission requirements to engineering or practical engineering studies. Despite of this, the students are ready to invest more time and effort, if they feel that the reward for their efforts is practical knowledge and job skills.

The electronic profession became the most important technological profession in the modern market. All the other professions – mechanics, electricity, vehicle mechanics, medical equipment etc. are based on it. Everyone teach and learn electronics and microcontrollers.

The traditional method of teaching is the "organized" teaching – resistor, diode, transistor, operational amplifier, power supplies, gates, decoders, tracking systems, microprocessors etc. In this teaching method, the student does not see the complete picture of the system and does not get all the implementation ability. This teaching method is like pulling out rabbits from a hat, one by one, without the student knowing how many rabbits are in the hat and when will he know how to build something.

The world of electronics today enables us to teach all the subjects the student must know to pass the Board of Education exams and to know electronics.

In the past, electronic systems were built from various units – amplifier levels, digital components etc. The system's functions were an integral part of the system's hardware. Designing such a system was learned (if there was enough time) at the end of the course because it needed complete knowledge of electronics.

Today, every electronic system design begins with the questions: What kind of signals are we getting at the system's inputs (the number of inputs and their types), and what kind of components are we supposed to operate (the number of outputs and their types)? These two datums allow us to choose the microcontroller, which will be the heart of the system, and the system's functions implemented in a program.

This is the essence of electronics today – interfacing and software (if we ignore the minimization technology). If especially fast processing is required, (very fast data

gathering, fast display, fast communication) we will use programmable components – PLD such as Altera or XLINIX.

If we start teaching the students microcontrollers at the first year, simultaneously to the traditional teaching, we can connect the various circuits (drivers, amplifiers, sensors, converters, communication etc.) to the controller and to instill the student the sense of the system, every step of the way. The student will finish his studies feeling he acquired practical abilities and even find work at his profession as a college student.

The practical tools:

The microprocessor is situated in a very narrow niche in the electronic world – PC computers. No professional writes EXE programs with the 8086 Assembly, not to mention using the INT21 type DOS functions, in the Windows era. It looks ridiculous to the student who knows softwares such as: VISUAL BASIC, DELPI, C++ etc.

Using the 86 Assembly for creating programs, which are burned on the EPROM for 8088 embedded projects (the only surviving components of the X86 family) is still acceptable, even though the MASM and LINK make it harder (it is preferable to move to the A86). It is much preferable to move to the microcontroller, which have become the heart of most of the electronic systems in the world.

It is important to remember that the world of PCs and the X86 family moves away from the electronics and embedded microprocessors systems world. They are found in systems which require speed and a great processing power, and this is relatively a narrow field. Most of the electronic systems in the control, command, data collecting, avionics, autotronics, and communication fields are embedded with microcontroller.

The 8051, despite its advancing age, is one of the most popular in the world. It is renewed all the time, and every day (even today) different variations are developed. The reason for this is that it is one of the few microcontrollers, which is manufactured by many manufacturers. Most of the other microcontrollers are manufactured by an individual manufacture. The 8051 is also a microcontroller and microprocessor. 8051 modules can be integrated in programmable components such as Altera and others.

Combining projects in the curriculum is the right direction to know electronics. This combination necessitates using a developing system. A system the student can expand at will, connect support components to it such as: drivers, motors, converters, sensors etc. In this way, the exercise becomes a project. Simulation exercise or using an exercising card or a close system is not a project. The project should act independently at the end of the process.

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The programming in the electronic profession must lead to a burned program – a program that eventually is in the system's ROM. This kind of learning deals with the real world of the electronic man – writing a program, compiling, downloading, running and debugging opposite the system's hardware up to the stage where the system works independently.

A popular programming language is C. PC's applications are Windows applications and for them we use objects guided software. Using DOS software and PRINT commands are outdated. In embedded microcontroller systems, the ANSI-C (the standard software of C) language is used, and the studying must lead to it.

The Assembler as well is not a dirty word in embedded system, as happened in the PC world. In embedded microcontroller systems with a limited ROM memory, maximal efficiency can be reached only in Assembly programming.

According to these guidelines, SES developed exercising & developing systems and burners, with comprehensive study books, at very low prices.

Enter this page; **http://www.ses.co.il/downloads.htm**, to find a free developing software and compiler for C language. These are described in the Student Cards article.