SYNOPSIS

of the course
"Microprocessor Technics"
(Faculty of Mechanical Engineering)

1. Introduction to embedded systems.
2. Parallel interfaces and GPIO modules.
3. Asynchronous Serial Interfaces – RS232.
4. Embedded systems and analog signals.
5. Displays and indication in embedded systems.

Sofia, 2023   Signature: ………………………….
                               /Assoc. Prof. Lubomir Bogdanov, PhD/

INFORMATION

*Examples including source code and circuit diagrams of real-life devices are not included in the material and should not be studied for the exam.

***Subsections from lectures noted with † are not obligatory, but at least one of them should be written in the exam.**

*The exam takes 2 astronomical hours.

*The student must write answers to both questions. For successful completion of the course, the student must have a minimum of 3 (D) for both questions. If the marks from the first and the second question differ, the mean value of both is the final mark. The final mark is dependent on the laboratory exercises – they influence the rounding of the final mark.

*Only a part of the material taught on lectures is included in the exam. A thorough description of the questions is given on the next pages. The student can use these pages on the exam but cannot use the lecture presentations.

*Communication with other people during the exam is forbidden (including communication with fellow students).

1. Introduction to embedded systems.
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Microprocessors and their place in electronics. History of microprocessors. Microprocessor architectures – von Neumann and Harvard. RISC and CISC microprocessors. Block diagram of a typical microprocessor system.

2. Parallel interfaces and GPIO modules.
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Types of parallel interfaces – uni-directional†, bi-directional† and bi-directional† with special abilities. Input stages – circuit diagrams. Output stages – circuit diagrams. GPIO modules – internal registers.

3. Asynchronous Serial Interfaces – RS232.
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The RS232 interface. Naming conventions for the signals. Logic levels of the interface. Protocol for communication – start/stop bits, data bits and flow control. Interface baud rates. Internal registers of a UART module.

4. Embedded systems and analog signals.
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Classification of signals – analog and digital. Digital-to-analog converters. Converting a digital value to an analog one – formula. Analog-to-digital converters – principle of operation for flash†, SAR†, dual-slope† and sigma-delta† ADCs. Sample and hold amplifiers. Errors in ADC – differential and integral nonlinearity (INL, DNL).

5. Displays and indication in embedded systems.
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Connecting an LED indicator to a microcontroller. 7-segment indicators. Liquid crystal displays – internal structure. Alphanumeric LCD – basics. OLED displays – internal structure.