



Syllabus Course Program

Microprocessor Technology in Mechatronics

Specialty

141 – Electric power engineering, electrical engineering and electromechanics

Institute

Institute of Education and Science in Power Engineering, Electronics and Electromechanics

Educational program

Electromechanics

Department

Department of Automated Electromechanics Systems (129)

Level of education

Bachelor's level

Course type

Mandatory

Semester

6

Language of instruction

English

Lecturers and course developers



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Senior lecturer at Department of Automated Electromechanics Systems of NTU "KhPI"

Work experience - 14 years. Author of 15 scientific papers, author and co-author of 3 patents. Specialist in software development for embedded systems.

Links: [LinkedIn](#)

General information

Summary

The course has been designed to provide students basic theory and practical skills in software development for mechatronic systems.

Course objectives and goals

The course objective is to make students familiar with microprocessor technology and devices which can be applied for mechatronic systems.

Format of classes

Lectures, laboratory classes, self-study. Final control in the form of test.

Competencies

GC 3. The ability to apply knowledge in practical situations.

GC 7. Skills of using information and communication technologies.

GC 8. The ability to learn and master modern knowledge.

GC 9. Ability to search, process and analyze information from various sources

GC 10. Ability to work in a team.

PC 3. Ability to use basic knowledge of general physics, higher mathematics, theoretical foundations of electrical engineering and electrical materials for solving practical problems in the field of electric power engineering, electrical engineering and electromechanics.

PC 12. Ability to study and analyze scientific and technical information in the field of electric power engineering, electrical engineering and electromechanics.

PC 14. Ability to develop simple designs of electrical and electrical objects and to assess the mechanical strength of designed structures.

Learning outcomes

PRT 1. To find the necessary information in the information space.

PRT 2. Discuss professional topic.

PRT 12. Know and use the methods of fundamental sciences to solve the general engineering and professional tasks

PRT 19. Solving professional tasks in the design, installation and operation of electric power, electrical engineering, electromechanical complexes and systems

PRT 20. To analyze processes in electric power, electrotechnical and electromechanical equipment and corresponding complexes and systems.

Student workload

The total volume of the course is 90 hours (3 ECTS credits): lectures - 24 hours, laboratory classes - 12 hours, self-study - 54 hours.

Course prerequisites

To successfully complete the course, a student must have some basic background in electronics and informatics.

Features of the course, teaching and learning methods, and technologies

Lectures are conducted interactively using multimedia technologies. Laboratory work is performed using online tools and desktop software.

Program of the course

Topics of the lectures

Topic 1. Overview of microprocessors.

Topic 2. Overview of peripheral modules of microcontrollers. CPU Core, Memory map, Ports.

Topic 3. Overview of peripheral modules of microcontrollers. Timers.

Topic 4. Overview of peripheral modules of microcontrollers. Analog to digital converters.

Topic 5. Overview of peripheral modules of microcontrollers. Universal Synchronous and Asynchronous Serial Receiver and Transmitter (USART).

Topic 6. Overview of peripheral modules of microcontrollers. Serial Peripheral Interface.

Topic 7. Overview of peripheral modules of microcontrollers. Watchdog Timer.

Topic 8. Overview of peripheral modules of microcontrollers. I2C Bus.

Topic 9. Overview of Bootloaders.

Topic 10. 1-Wire interface.

Topics of the workshops

No workshop classes in this course

Topics of the laboratory classes

Topic 1. Programming of GPIO, LEDs.

Topic 2. Programming of GPIO, Buttons.

Topic 3. Programming of Timer, PWM mode.

Topic 4. Programming of Analog to digital converter.

Topic 5. Programming of USART.

Self-study

Information on self-study and individual assignments (reports, course projects, etc.), if it is necessary according to the plan. Also, methods of control and assessment of self-study.

Course materials and recommended reading

1. Daniele Lacamera. Embedded Systems Architecture: Explore architectural concepts, pragmatic design patterns, and best practices to produce robust systems. Packt Publishing (May 30, 2018). 324 pages
2. ATmega16 datasheet. [Online]. Available: <http://ww1.microchip.com/downloads/en/devicedoc/doc2466.pdf>
3. Understanding Pipelined ADCs . [Online]. Available: <https://www.analog.com/en/resources/technical-articles/understanding-pipelined-adcs.html>
4. Basics of SPI communication. [Online]. Available: <https://m.youtube.com/watch?v=xogsRnnhK44>
5. Understanding the I2C Bus. [Online]. Available: <https://www.ti.com/lit/pdf/slva704>

Assessment and grading

Criteria for assessment of student performance, and the final score structure

The final grade consists of the results of the evaluation of laboratory reports (60%) and passed test (40%)

Grading scale

Total points	National	ECTS
90–100	Excellent	A
82–89	Good	B
75–81	Good	C
64–74	Satisfactory	D
60–63	Satisfactory	E
35–59	Unsatisfactory (requires additional learning)	FX
1–34	Unsatisfactory (requires repetition of the course)	F

Norms of academic integrity and course policy

The student must adhere to the Code of Ethics of Academic Relations and Integrity of NTU "KhPI": to demonstrate discipline, good manners, kindness, honesty, and responsibility. Conflict situations should be openly discussed in academic groups with a lecturer, and if it is impossible to resolve the conflict, they should be brought to the attention of the Institute's management.

Regulatory and legal documents related to the implementation of the principles of academic integrity at NTU "KhPI" are available on the website: <http://blogs.kpi.kharkov.ua/v2/nv/akademichna-dobrochesnist/>

Approval

Approved by

Date, signature
03.02.2024

Head of the department
Bohdan VOROBYOV

Date, signature
03.02.2024

Guarantor of the educational program
Mykola ANISHCHENKO

