Національний технічний університет України
«КИЇВСЬКИЙ ПОЛІТЕХНІЧНИЙ ІНСТИТУТ
імені ІГОРЯ СІКОРСЬКОГО»

Department of Radio Engineering Systems

[RE-18] DIGITAL SIGNAL PROCESSORS

Curriculum of the academic discipline (Syllabus)

Course details	
Level of higher education	First (bachelor's)
Field of knowledge	G - Engineering, manufacturing, and construction
Specia	G5 - Electronics, electronic communications, instrument engineering, and radio engineering
Educational program	All
Discipline status	Elective (F-catalog)
Form of higher education	Full-time
Year of training, semester	Available for selection starting from the 3rd year, spring semester
Scope of the discipline	4 credits (Lectures 16 hours, Practical 0 hours, Lab 30 hours, Independent work 74 hours)
Semester Control/control measures	Credit
Class schedule	https://schedule.kpi.ua
Language of instruction	Ukrainian / English
Information about the course coordinator / lecturers	Lecturer: Myronchuk O. Yu., Lab: Myronchuk O. Yu., Independent work: Myronchuk O. Yu.

Course location https://do.ipo.kpi.ua/course/view.php?id=6413

Curriculum

1. Description of the course, its purpose, subject matter, and learning outcomes

Studying this discipline provides an understanding of what a digital signal processor is, its structure, functionality, and place in computing technology. The discipline provides an opportunity to acquire skills in programming digital signal processors and practical implementation of digital signal processing algorithms in hardware. As a result of the course, students will know what a digital signal processor is and how to work with it. On debugging boards

, digital signals are modeled and further processed using digital filters. The knowledge gained is important in the development and operation of digital communication systems.

2. Prerequisites and post-requisites of the discipline (place in the structural-logical scheme of training under the relevant educational program)

To study the discipline, it is necessary to have a personal computer, be able to work with English- language technical literature, have knowledge of the C programming language, and know the basics of digital signal processing.

3. Content of the discipline

List of topics

1. The place of the digital signal processor in computing technology
2. Digital Signal Processor Specifications
3. Overview of the digital signal processor market
4. Classification of digital signal processors
5. Features of digital signal processor architecture
6. Instruction set architecture
7. Static SRAM memory
8. DRAM dynamic memory
9. SDRAM, DDR SDRAM dynamic memory
10. ROM reprogrammable memory
11. MRAM memory
12. Digital signal processor peripherals
13. Input/output ports
14. Timers
15. Interrupts
16. Direct memory access (DMA) controller
17. UART communication interface
18. SPI communication interface
19. I2C communication interface
20. Implementation of digital filters on a digital signal processor

4. Training materials and resources

1. Methodological guidelines for performing laboratory work in the discipline "Digital Signal Processors"
2. Documentation from Texas Instruments for the debugging board and TMS320C6678 digital signal processor

Educational content

5. Methodology for mastering the academic discipline (educational component)

Lectures

Lecture 1: The place of digital signal processors in computing technology

Lecture 2: Characteristics of digital signal processors. Overview of the digital signal processor market

Lecture 3: Classification of digital signal processors

Lecture 4: Features of digital signal processor architecture

Lecture 5: Instruction set architecture

Lecture 6: SRAM static memory. DRAM dynamic memory

Lecture 7: Dynamic SDRAM and DDR SDRAM memory. Reprogrammable ROM memory. MRAM memory

Lecture 8: Peripheral devices of a digital signal processor. UART communication interface

Lecture 9: I2C and SPI communication interfaces

Laboratory classes

Type of work	Number of classroom hours
Laboratory work 1: Introduction to the debugging board	4
Laboratory work 2: Introduction to the development environment	4
Lab work 3: Controlling LEDs and transferring data via UART	4
Lab work 4: Working with timers	4
Lab work 5: Working with an enhanced direct memory access controller memory access controller	4
Laboratory Work 6: Processing Audio Frequency Range Signals	4
Defense of laboratory work	4
Writing a modular test	2

6. Independent work by students

Independent work includes familiarization with theoretical information for each laboratory work on the eve of its implementation, performing calculation and graphic work, preparing to write a modular test, consolidating knowledge of the material studied in lectures and laboratory classes by studying the provided basic and additional literature.

Policy and control

7. Policy of the academic discipline (educational component)

Lectures: attendance at classes according to the schedule. It is permissible to study the topics covered in the lectures independently by working through the materials provided.

Laboratory work: attendance at classes according to the schedule. During laboratory work, there may be situations when a student does not have time to complete the work during the class. In this case, it must be completed independently at home or during additional time assigned by the teacher.

8. Types of assessment and the learning outcomes assessment rating system (LOAS)

Ongoing assessment: completion of laboratory work, calculation and graphic work, writing a modular test.

Calendar control: conducted twice per semester as monitoring of the current status of syllabus requirements fulfillment.

Semester assessment: test.

The student's semester grade is determined by the results of completing assignments for laboratory work 2, 3, 4, 5, 6 (laboratory work 1 is introductory in nature and does not include assignments), computational and graphical work, and writing a modular test. Grades for laboratory work and computational-graphical work are given based on the results of their defense. The maximum grade for each laboratory work is 15. Thus, during the semester, a student can receive 75 points for completing laboratory work. The maximum score for the modular test is 5. The maximum score for the calculation and graphic work is 20. Admission to the test is conditional on the defense of all laboratory work and calculation and graphic work and the completion of the modular test. For applicants who have fulfilled all the conditions for admission to the exam and have a rating of less than 60 points, as well as for those applicants who wish to improve their rating, the teacher conducts a semester test in the form of a credit test during the last scheduled class of the semester. The test contains questions on the theoretical part and tasks on the practical application of the acquired knowledge. In this case, the previous rating is canceled and the result of the test determines the final test score.

Table of correspondence between rating points and university scale grades

Number of points	Grade
100-95	Excellent
94	Very good
84	Good
74-65	Satisfactory
64-60	Sufficient
Less than 60	Unsatisfactory
Admission requirements not met	Not admitted

9. Additional information on the discipline (educational component)

...

Description of material, technical, and informational support for the discipline

Classes are held in the digital signal processing devices laboratory at the Department of Radio Engineering Systems. The laboratory is equipped with working models based on TMS320C6678L debugging boards from Texas Instruments. The board is based on the TMS320C6678 eight-core digital signal processor. There are 8 models, which allows groups of up to 25 students to work. Software development and debugging is performed in the Code Composer Studio environment.

The working program of the academic discipline (syllabus):

Compiled by O. Yu. Myronchuk;

Approved by the RTS Department (Minutes No. 06/2025 dated 06/24/2025)

Approved by the methodological commission of the faculty/research institute (protocol No. 06/2025 dated 26.06.2025)