Syllabus of the educational discipline
«THEORETICAL FUNDAMENTALS OF DIGITAL SIGNAL PROCESSING»

Cycle of Higher Education	*First cycle of higher education (Bachelor's degree)*
Field of Study	*12 Information Technologies*
Specialty	*123 Computer engineering*
Educational program	*Computer systems and networks*
Discipline status	*Normative*
Teaching language	*English*
Year of studies, semester	*3 year (5 semester)*
Number of credits ECTS	*3,5 credits*
Distribution by types of trainings and hours of study	*Lectures, Laboratory studies, Independent training*
Form of final assessment	*Test*
Teacher	*Horvat P. P., Associate Professor of the Department of Computer systems and networks, PhD* *Syniavska O. O., Associate professor of Department of Probability Theory and Mathematical Analysis, PhD*
Teacher's contacts	*petro.horvat@uzhnu.edu.ua, olga.synyavska@uzhnu.edu.ua*
Course Schedule	*According to the timetable*

The purpose of the discipline " Theoretical Fundamentals of Digital Signal Processing " is to provide background and fundamental material for the analysis and processing of digital signals, applications.

At the end of this course, students should:

know:

- basic properties of signals and related methods, including Fourier series, Fourier transforms, Laplace transforms, and convolution;
- the different types of signals and systems;
- introduction to Filtering;
- Image Processing, real-time processing.

be able to

- analyse and explain behaviour of basic digital signal processing systems;
- apply the knowledge of multi-rate signal processing in the real time applications;
- design a digital filter using various techniques.

Prerequisites for learning

Mathematical Analysis, Algorithms and Methods of Calculations

Content of the educational discipline

Module 1

Topic 1. Introduction to signal processing.
Topic 2. Frequency domain representation of discrete time signals and systems.
Topic 3. Elements of signal theory.
Topic 4. Mathematical methods for signal processing.
Topic 5. Discrete-Time Signals in the Frequency Domain.
Topic 6. The Fourier transform.
Topic 7. The fast Fourier transform.
Modular control work

Module 2

Topic 8. Image as a Signal.
Topic 9. Image Processing.
Topic 10. Audio Signal processing.
Topic 11. Digital signal processing for video.
Modular control work
Test

Material and technical support (software) of the discipline

Mathcad (MATLAB)	
Course page on the Moodle platform (personal training system)	*Syllabus of the educational discipline, hyperlinks to electronic publications of the discipline, recommended literature, students' attendance, lecture materials, presentations, questions for self-control, tests, tasks for checking students' knowledge.* https://moodle.uzhnu.edu.ua

Recommended literature

1. *Proakis, John G., and Dmitris K. Manolakis. Digital Signal Processing. 4th ed. Upper Saddle River, NJ: Prentice Hall, 2006.*
2. *Oppenheim, Alan V., Ronald W. Schafer, and John R. Buck. Discrete-Time Signal Processing. 2nd ed. Upper Saddle River, NJ: Prentice Hall, 1999.*
3. *Antoniou A., Digital Signal Processing, Tata McGraw Hill, New Delhi, 2006.*
4. *Stearns, Samuel D., and Don R. Hush. Digital Signal Analysis. 2nd ed. Englewood Cliffs, NJ: Prentice Hall, 1990.*

Assessment system of learning outcomes

Current control carried out the semester and evaluated by the amount of points (max is 100 points). A minimum amount, that allows a student to get credit is 35 (max is 100 points).

The student's rating (R_s) in the course consists of points that he/she receives for defended project assignments (R_1) and the modular control work(R_2):

$$R_s=R_1+R_2=100 \text{ points.}$$

As a result, the maximum average weight score in each module is equal to: 3 project assignments x 15 points = 45 points, modular control work = 55 points

Each module is rated at a maximum of 100 points. At the end of the discipline displayed rating score, which is defined as the arithmetic mean of two modules.

The students whose overall points at the end of the semester are more or equal to 60 points can:

- *get their final grade according to the rating system;*
- *pass an final test in order to increase the grade.*

Final (semester) control is carried out in the form of test and evaluated in points (max is 100 points, min is 35 points).

ECTS and national grading scale

Mark scale	ECTS	Exam	Test
90 - 100	A	Excellent	Satisfied
82 - 89	B	Good	
74 - 81	C		
64 - 73	D	Satisfactory	
60 - 63	E		
35 - 59	FX	"Unsatisfactory" with possibility to pass the exam again	"Not satisfied" with possibility to pass the exam again
1 - 34	F	"Unsatisfactory" with obligatory repeated study of the discipline	"Not satisfied" with obligatory repeated study of the discipline