Course Syllabus

1. Course Title:

Methods and Algorithms for the Synthesis of Digital Signal Processing Devices

2. Academic Level:

Master

3. ECTS Credits:

5 ECTS

4. Semester:

1, autumn semester

5. School/Department:

Institute of Radio Engineering Systems and Control, Department of Fundamentals of Radio Engineering

6. Location:

44 Nekrasovsky St., building "D", Taganrog, Russian Federation

7. Instructor:

Prof. Alexander Maryev, email: aamarev@sfedu.ru

8. Language of Instruction:

English

9. Course Description:

This course provides the base of knowledge that the following courses subsequently build upon: modern methods and tools for measurements in radio engineering and communications; methods and algorithms for complex signal processing in transmitters and receivers; digital television.

10. Course Aims:

- obtaining theoretical and practical education necessary for the construction of devices that implement the basic linear and nonlinear methods of digital signal processing;
- formation of a system of concepts, ideas and methods in the field of digital signal processing, consolidating physical views and mathematical models of common classes of digital deterministic and stochastic signals, as well as relevant devices;
- studying of the engineering methods for designing the digital signal processing devices of different use.

11. Specific entry requirements (if any):

Pre-requisites for this course are knowledge, abilities and skills, learned from bachelor's programs in following areas: signal theory, stochastic process theory, methods for transmission and processing of information; methods and devices for digital signal processing; applied mathematical methods of radio engineering and communications, informatics and basics of programming.

12. Course Content:

Module 1. Analysis and simulation of digital signals
Estimation of signal characteristics in time domain
Spectral characteristics estimation
Correlation characteristics estimation
Estimation of signal characteristics based of spectrogram representation
Digital signal simulation with given characteristics

Module 2. Methods and algorithms for designing the digital filters
Digital filters and their characteristics
Methods for synthesis of digital filters of standard types
Digital matched filters
Sampling frequency conversion. Modulation and demodulation

13. Intended Learning Outcomes:

The process of studying the discipline focused to form following knowledge, abilities and skills:
Knowledge: modern software for simulation and development of digital signals and devices.
Abilities: to collect and to analyze the original data for calculations and design parts, blocks and devices for radioengineering and communication systems.
Skills: to work with modern local and foreign software for design in radioengineering and communications.

14. Learning and Teaching Methods:

During the classes, a student will be able to obtain the following skills: problem solving, interpersonal communications skills as well as experience teamwork with the use of interactive lectures, group discussions, and imitational models analysis. Teaching involves results of scientific research, provided at SFedU.

The discipline can be realized using e-learning and distance educational technologies: contact work between students and a teacher can be conducted using the Microsoft Teams platform, including online lectures and online seminars.

15. Methods of Assessment/Final assessment information:

Formative and interim assessment include performing and defense of laboratory works, performing and defense of individual tasks. Summative Assessment method: pass.

16. Reading List:

1. R. Lyons, Understanding Digital Signal Processing, Addison Wesley Longman, Reading, Massachusetts, 1997.
2. A. Oppenheim, et al, Discrete-Time Signal Processing, Prentice Hall, Upper Saddle River, New Jersey, 1999.
3. J. Proakis and D. Manolakis, Digital Signal Processing-Principles, Algorithms, and Application, Prentice Hall, Upper Saddle River, New Jersey, 1996.
4. Rabiner L.R., Gold B. Theory and application of digital signal processing. Prentice Hall, New Jersey, 1975.