# Course Syllabus

### 1. Course Title:

Methods for Modeling and Simulation of Radio Electronic Components and 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. Alexandr Pilipenko, email: ampilipenko@sfedu.ru

### 8. Language of Instruction:

English

### 9. Course Description:

The elective course "Methods for modeling and simulation of radio electronic components and devices" provides the base of: modern methods and tools for measurements in radio engineering and communications; methods and algorithms for complex signal processing in transmitters and receivers.

### 10. Course Aims:

- study of numerical methods for analysis of various classes of radio electronic circuits;
- development of numerical methods for parametric optimization of radio electronic components models;
- acquisition of skills in working with programs for computer simulation of radio electronic devices and their elements.

**11. Specific entry requirements (if any):**

Pre-requisites for this course are knowledge, abilities and skills, learned from bachelor program in following areas: mathematics, circuit theory, basics of computer science, programming and information technologies; applied mathematical methods of radio engineering and communications.

**12. Course Content:**

Module 1. Models of radio electronic components and parameter optimization
Mathematical models of elements of radio electronic circuits
Methods for diagnostics of elements of radio electronic circuits
Numerical approximation methods
Convex optimization techniques
Analytical, numerical and numerical-analytical descent methods

Module 2. Methods for modeling radio electronic devices
Numerical methods for ordinary differential equations solving
Foundations of the theory of errors
Numerical analysis of high-dimensional circuits
Numerical analysis of impulse circuits
Numerical analysis of narrowband circuits and oscillators

**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 radio engineering and communication systems.
Skills: to work with modern local and foreign software for design in radio engineering and communications.

**14. Learning and Teaching Methods:**

During the classes, a student will be able to obtain the following skills: solving computational problems, interpersonal communications skills as well as experience team work with the use of interactive lectures, group discussions, and imitational models analysis. Teaching involves results of scientific researches, 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:**

For current and boundary control of students' progress laboratory work defense is being performed as well as tests and examinations during seminars. Summative Assessment method: pass.

**16. Reading List:**

1. Hairer E., Wanner G. Solving Ordinary Differential Equations II: Stiff and Differential-Algebraic Problems. 2nd rev. ed. Springer-Verlag, Heidelberg, 1996.
2. Leon O. Chua and Pen-Min Lin, Computer aided analysis of electronic circuits: algorithms and computational techniques, Prentice-Hall, Englewood Cliffs, N.J., 1975, 737 p.
3. Modern Numerical Methods for Ordinary Differential Equations / edited by G. Hall, J. M. Watt, Clarendon Press, Oxford, 1976.