**COURSE DESCRIPTION**

***Methods for modeling and simulation of radioelectronic components and devices***

**Department responsible for the course** **or equivalent:** Institute of Radioengineering Systems and Control,Department of Fundamentals of Radio Engineering

**Lecturer:** Alexandr M. Pilipenko, Head of the Department of Fundamentals of Radioengineering, cand. of eng. sc., associate professorE-mail: ampilipenko@sfedu.ru

**Semester when the course unit is delivered:** Spring semester

**ECTS credits:** 5, 180 academic hours

**Level of course unit:** Master level

**Course description:** The discipline « Methods for modeling and simulation of radioelectronic components and devices» belongs to the variative part of the educational program (elective disciplines). To learn hereby discipline one must have knowledge of mathematics, circuit theory, basics of computer science and information technologies.

**Course objectives:**

- study of numerical methods for analysis of various classes of radioelectronic circuits;

- development of numerical methods for parametric optimization of radioelectronic components models;

- acquisition of skills in working with programs for computer simulation of radioelectronic devices and their elements.

**Course contents**

*Module 1. Models of radioelectronic components and parameter optimization*

Mathematical models of elements of radioelectronic circuits

Methods for diagnostics of elements of radioelectronic circuits

Numerical approximation methods

Convex optimization techniques

Analytical, numerical and numerical-analytical descent methods

*Module 2. Methods for modeling radioelectronic 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

**Learning outcomes**

The process of studying the discipline focused to form following knowledge, abilities and skills:

*Knowledge:* basic methods for solving problems of circuit analysis; numerical methods for solving systems of ordinary differential equations; numerical optimization methods; area of applicability of numerical methods; modern packages of computer aided analysis of electronic circuits.

*Abilities:* build a mathematical model of a specific element or device; choose the optimal models of electronic elements; evaluate the error of numerical methods and models.

*Skills:* setting and solving problems of mathematical modeling of radio electronic components and devices; work with libraries of standard models, electronic simulators, circuit design packages and computer mathematician programs.

**Planned learning activities 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.

**Assessment methods and criteria**

For current and boundary control of students’ progress laboratory work defense is being performed as well as tests and examinations during seminars.

**Course literature**

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.