**Name of the course:** Simulation of Construction and Technological Processes of Device Production

**Department responsible for the course or** **equivalent:** Dpt. Electronic Apparatus Design, Institute of Nanotechnologies, Electronics and Electronic Equipment Engineering

**Lecturer (name, academic title, e-mail): Ass. Prof., PhD Yulia Klunnikova, yvklunnikova@sfedu.ru**

**Semester when the course unit is delivered**: 1

**Teaching hours per week**: 3

**Level of course unit**: Master level

**ECTS credits: 5**

**Admission requirements**: The course ”Simulation of Construction and Technological Processes of Device Production“ requires the basic knowledge of higher mathematics (differential and integral calculus with several variables, probability calculation), digital and analogue circuit technology, electric and magnetic fields, design layout and functioning of electronic circuits, general and solid state physics, chemistry and material science.

**Course aims**: To obtain theoretical and practical knowledge and insight in simulation methods for the study of materials and nanodevices construction and technological processes.

To make the students familiar with the basics of the research organization for development of new constructions and technological processes of device in micro- and nanoelectronics; taught in the course and to illustrate some practical aspects of these techniques.

The ”Simulation of Construction and Technological Processes of Device Production“ course is taught in the 1st semester of the Master’s program.

**Course contents**:

The course is comprised of 3 units (and UNIT 0). Each unit ends with a creative project worked by the students individually with guidance from the lecturer.

Unit 0: Simulation in science and technology.

Introduction to simulation methods. Classification of simulation methods. CAD/CAE/CAM.

Unit 1: Mathematical models of the element base.

Physical and topological models. Technological models. Circuit models. Functional-logical models. Automation of scientific and technical calculations.

Unit 2: Universal simulation tools.

Application of Matlab/Simulink for physical-topological, technological modeling, circuit design and functional logic modeling. LTSpice for circuit simulation of the element base.

Unit 3: Specialized simulation tools.

Application of ANSYS for physical processes simulation by finite element method. Thermal analysis. Application of CATIA for technological processes of device production.

**Learning outcomes**: Students will give an oral presentation on a current topic in area of simulation methods in micro- and nanoelectronics.

**Planned learning activities and teaching methods:** Lectures and Practical Sessions.

**Assessment methods and criteria**

Assignments for this course consists of: 4 projects, a midterm and final exams, and an end of term presentation.

1. Simulation in science and technology **Project**  one week from end of unit 10%

2. Mathematical models of element base **Project** one week from end of unit 10%

3. Universal simulation tools **Project**  one week from end of unit 10%

4. In Class Mid term Exam 20%

5. Specialized simulation tools **Project** one week from end of unit 10%

6. Presentation in class 10 min pres. and 5 min Q&A 10%

7. Final Exam 30%

**Course literature (recommended or required):**

1. Fitzgibbon W., Kuznetsov Yu.A., Neittaanmäki P., Pironneau O. Modeling, Simulation and Optimization for Science and Technology. Amsterdam: Springer, 2014. - 248p.
2. Polderman W., Willems C. Introduction to Mathematical Systems Theory. A Behavioral Approach. Springer, 2013. - 458 p.
3. Higueras I., Roldan T., Torrens J.J. Numerical Simulation in Physics and Engineering, Springer, 2016. - 264 p.
4. Fujimoto, R., Bock, C., Chen, W., Page, E., Panchal, J.H. Research Challenges in Modeling and Simulation for Engineering Complex Systems, Springer, 2017. - 140 p.