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|  | **Course Syllabus** |

**1.** **Course Title:**

Advanced Nanotechnologies. MEMS

**2. Academic Level:**

Master

**3. ECTS Credits:**

5 ECTS

**4. Semester:**

1, autumn semester; 2, spring semester; 3, autumn semester

**5. School/Department:**

Institute of Nanotechnologies, Electronics and Equipment Engineering / Department of Nanotechnology and Microsystems Technology

**6. Location:**

Taganrog Campus, 2 Shevchenko St., Taganrog

**7. Instructor:**

English

Prof. Evgeny Gusev, PhD, email: [eyugusev@sfedu.ru](mailto:eyugusev@sfedu.ru)

**8. Language of Instruction:**

**9. Course Description:**

The course is designed to study technologies for manufacturing modern products of micro- and nanosystem technology, as well as the basics of technological development of promising components for creating next-generation systems.

**10. Course Aims:**

- to form general professional and professional competencies in the field of technology for manufacturing products of micro- and nanosystems (components, sensors and (bio)microelectromechanical systems).

- to develop communicative competence in English.

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

English B1. Bachelor's degree in Engineering or Science, preferably in the field of micro- or nanofabrication. Knowledge: fundamentals/basics of higher mathematics (differential and integral calculus with several variables), chemistry and materials science, general and solid state physics (crystallography); digital and analogue circuit technology, layout design for electronic circuits; nanomaterials technology, integrated circuit, micro and nanofabrication, microsystem technologies. Skills: analytical calculations, computer-aided design basics, algorithm and flowchart basics.

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**12. Course Content:**

1, autumn semester. Modern trends in the development of technology of microelectromechanical systems (micro- and nanomachining). Beam and membrane structures.

2, spring semester. Implantable probes. Invasive neural interfaces.

3, autumn semester. Non-invasive neurointerfaces. Nanoparticles for non-invasive neural interfaces.

**13. Intended Learning Outcomes:**

Knowledge: specialized operations of micro- and nanomachining, features of their use in the technology of micromechanical systems, specialized technological processes for the manufacture of micromechanical components, sensors and (bio)microelectromechanical systems, principles of their organization.

Abilities: to analyze, make a reasonable choice of technological methods of manufacture, technological routes for the manufacture of components, sensors and MEMS; plan research and analyze research results; develop technological routes for the manufacture of micromechanical components, sensors and systems.

Skills: assessment and calculation of the main parameters of specialized structures and technological operations, work with technological documentation, technological and analytical equipment, skills of independent work with educational, methodological, scientific and technical literature.

**14. Learning and Teaching Methods:**

**Passive:** lecture-visualization using presentation material, oral questioning.

**Active:** independent work with literature, scientific, educational and reference digital resources.

**Interactive:** lab sessions and project work. The course can be carried out partly or as a whole using electronic and distant educational system of University.

**15. Methods of Assessment/Final assessment information:**

Assignments: project assignments (60%), lab work (30 %), presentation (10%). 1,2 semesters – credit. 3 semester – exam.

**16. Reading List:**

1. Franssila S. Introduction to Microfabrication, Wiley, 2010, 536 p., ISBN 9781119991892, 1119991897.

2. Senturia S.D. Microsystem Design, Springer US, 2005, 689 p., ISBN 0792372468, 9780792372462.

3. Luttge R. Nano- and Microfabrication for Industrial and Biomedical Applications (Micro and Nano Technologies), William Andrew, 2016, 278 p., ISBN-10 0323378285, ISBN-13 ‎978-0323378284.

4. Guo L. Neural Interface Engineering. Linking the Physical World and the Nervous System, Springer International Publishing, 2021, 438 p., ISBN 9783030418564, 3030418561.