Automation and Mechatronics (Master)

Saint Petersburg Electrotechnical University "LETI"

Degree or qualification is awarded: **Master**

Language of study: **English**
Mode of study: **full-time**
Duration: **2 years**
Availability of free education: **yes**
Price: **200 000 rubles per year**

Programme webpage at the university website: https://etu.ru/en/study/masters-degree/automation-and-mechatronics/

Programme curator: **Daria Uverskaia**
Tel.: **+7 812 234-35-53**
E-mail: master@etu.ru

Students learn the principles of robotics and mechatronics, mechatronic and robotic actuators, modern technologies of microcontroller application. The program gives students a deep theoretical knowledge of modern methods of automatic control theory, in particular, the methods of analysis and design of nonlinear, adaptive and intelligent control systems. About the program
The program provides students with a broad knowledge and skills in the field of automation of production processes and equipment, as well as in the field of mechatronic devices and control systems. Study of network technologies, issues of SCADA-systems construction, practical use of real-time systems are important parts of the program.

Academic mobility

Students of the program have the opportunity to participate in short-term (2–4 weeks) and long-term (6–10 month) internship programs, including double degree programs. The main international partners, where students of the program often have internships, are:

Germany

- Technische Universität Ilmenau
- Leibniz Universität Hannover
- Fachhochschule Stralsund - University of Applied Science

Finland

- Lappeenranta University of Technology
- Aalto University

France

- University Of Technology Of Compiegne

South Korea

- KOREATECH

Japan

- Research Institute of Electrical Communication Tohoku University

China

- Beijing Institute of Technology BIT

Taiwan

- National Taichung University of Education

Invited lecturers

- Bismark Singh, Ph.D., University of Texas at Austin (QS World University Rankings – 63, Times Higer Education World University Rankings – 39);
- Jani Heikkinen, D.Sc., Aalto University (QS World University Rankings – 201-250, Times Higher Education World University Rankings – 181);
- Tatiana Minav, D.Sc., Aalto University (QS World University Rankings – 201-250, Times Higher Education World University Rankings – 181).

Specializations within this programme

1. Course: Russian Language

Teacher: N.D. Strelnikova, Ph.D.

This course is pointed on providing training courses for foreign citizens who had not studied the Russian language before. It includes language and speech models based on the requirements for the Elementary certification level. Achieving this level in Russian will satisfy the foreign students' basic communicative demands in social and cultural as well as in educational spheres of communication.

The content of the program involves implementation of flexible training models, depending on the communicative purposes, native language and students' individual features.

2. Course: Modern methods of control theory

Teacher: N.D.Polyakhov, Professor

Materials of this course has the external and internal approaches to research and synthesis of linear and nonlinear systems. In addition, modern interpretation methods of investigation of nonlinear systems based on an external approach are considered. As well as the universal criterion of stability of nonlinear systems.

3. Course: Nonlinear, adaptive and intelligent control systems

Teacher: N.D.Polyakhov, Professor

Studying the basics of the theory of nonlinear, adaptive and intelligent (fuzzy and neural network) control systems.

The material of the course set out: the method of Lyapunov functions, including elements of its design; square and circle criteria for absolute stability; the study of periodic solutions, Poincare type methods and Galerkin harmonic balance; research methods of nonlinear dynamics, linear stability analysis, stability of periodic, quasi-periodic and chaotic solutions, local and nonlocal bifurcation; searchless algorithms and adaptive control systems, basic structure, synthesis methods, speed-gradient method; variable structure system. Fuzzy and neural systems - intelligent control systems.

4. Course: Adaptive control in mechatronics and robotics

Teacher: V.B. Vtorov, Ph.D.

The greatest attention in this course is paid to the questions of the following areas: mechanics systems, mechatronics, dynamic systems, automatic systems with adaptive control, automatic systems with modal control, theory of stability, theory of state recovery.

5. Course: Interpersonal interactions in business environment

Teacher: N.V. Kazarinova, Ph.D.

The aim of the course is to discuss some important problems of theory and practice interpersonal communication in business environment. The following issues are discussed in the course: situate and psychological factors interpersonal communication, verbal and nonverbal practices of communication, active listening, specific ways of

interpersonal pressure, influence and manipulation, emotional management, types of corporate culture and teambuilding.

6. Course: Computer-based Technologies of Control in Technical System

Teacher: A.D. Stotskaya, Ph.D

The material of this course is based on universal provisions applicable to the control of any complex system. In general terms, the questions concerning the control of technical systems and industrial automation systems in various fields.

An important role is given to the study of issues related to network technologies as the foundation for designing modern industrial systems - Intranet- and Internet-technologies.

7. Course: History of Science and Technology in the Field of Control and Technical Systems

Teacher: A.V. Weinmeister, Ph.D.

The main aims of the course are as follows: study of a new physical phenomena discoveries new scientific theories and laws forming, basic ideas and technical solutions appearance in the field of electrical engineering, electromechanics and control, that formed the automatic control science.

8. Course: Modeling and Synthesis of Robotic System Nonlinear Elements

Teacher: E.B. Solovyova, Professor

The course deals with the construction of various forms of nonlinear dynamic systems` mathematical models such as Volterra functional series, neural networks, wavelet neural networks, spline neural networks, polynomial perceptron networks, fuzzy inference adaptive networks and other.

Practical issues of synthesis of polynomial and neutral filters and postcompensators of signal nonlinear distortion are considered.

9. Course: Safety Maintenance Systems for Control Engineering Tools

Teacher: V.N. Pavlov, Ph.D.

The discipline considers general engineering issues in complex security. Also, principles of design and construction such systems are discussed. The focus is on the safety requirements in the test instrument. The discipline covers problems related to the features of technical equipment in terms of electromagnetic compatibility, ergonomic engineering and other.

10. Course: Electromechatronic Complexes and Systems

Teacher: D.V. Samohvalov, Ph.D.

In this course students will study the process of electromagnetic and electromechanical energy conversion processes associated with functional and design combining in EMTC electromechanical converter with electronic components. We consider the structure and operation of EMTC of an example with synchronous machines and information type EMT systems. The technique of calculating the parameters and characteristics of EMTC are considered. Practical and laboratory classes are conducted with the development of methods for the preparation and analysis of EMTC performance.

11. Course: Mechatronics and Basics of Robotics

Teacher: D.M. Filatov, Ph.D.

The discipline covers principles of mechatronic and robot-based technological complexes design. Robotic systems drives, questions of mathematical description and simulation of robots and mechatronic machines are discussed.

The discipline is supported by a large number of practical and laboratory classes and students' self studies on the

basic sections of the programme. Testing and current control of students' knowledge are provided in order to ensure the quality control of mastering the discipline by students.

12. Course: Electric and Hydraulic Drives of Mechatronic and Robotic Systems

Teacher: L.P. Kozlova, Ph.D.

In this course students study the principles of operation of electric and hydraulic drives of various types used in modern mechatronic and robotic devices and control methods of actuators and methods for their calculation and modeling. As well as the examples of different types of actuators are presented in this material.

13. Course: Methodology and Logic of Scientific Research

Teacher: E. E. Elkina

Knowledge of tools and methods of modern science is indispensable for independent creative research to distinguish the genuinely scientific work of pseudoscientific builds. The students should acquire knowledge and skills necessary for successful analysis and solutions to epistemological and logical-methodological issues that need to be in their professional work. The same logic-methodological training could become a base for continued education on postgraduate training program.

14. Course: Microcontrollers in Control Technology

Teacher: S.E. Golik, Ph.D.

This course will give to the future specialists skills of algorithmization and further implementation of their automation ideas using microcontrollers. The educational process covers the lecture hours and practical hours while the students have the opportunity and facilities for the microcontroller programming and automatic control systems design.