Control Systems

Bachelor’s Educational Programme | 240 credits | Field: instrument engineering, automation and control systems engineering | Georgian Technical University

Programme admission prerequisite

The right to study at bachelor’s level is granted only to a holder of a state certificate confirming complete general education, or of a document equivalent to it, who is enrolled in accordance with the procedure established by the legislation of Georgia.

Programme objectives

- To provide broad knowledge of modern technologies of control systems, automation and test engineering, which includes the design, operation and monitoring of automatic control and measuring-diagnostic systems and of the elements and nodes contained in them, as well as the practical application of control principles and analysis methods.
- To provide engineering skills for solving the tasks and problems existing in the field of control systems, automation and test engineering, by means of modern computer and information technologies;
- To provide the opportunity to achieve professional success in the free labour market, both individually and in a team environment.

Learning outcomes / competences (general and professional)

1. Possesses broad knowledge of the general and fundamental theories and methods characteristic of the field of instrument engineering, automation and control systems engineering;
2. Analyses data and situations characteristic of control, automation and measurement-control systems, using standard methods and some of the latest methods;
3. Applies multifaceted theoretical and practical knowledge to modern control systems and automation processes, and to the operation, testing and monitoring of electronic and digital equipment, measurement-control equipment, microprocessors and microcontrollers;
4. Identifies, formulates and analyses the problems characteristic of automatic control and measurement-control systems;
5. Possesses the knowledge and practical skills to solve problems arising in control and automation, in measurement-control systems and in the quality monitoring process, in accordance with predetermined instructions;
6. Uses computer and information technologies to solve practical tasks in control, automation and measurement-control systems;
7. Prepares various types of projects and reports on the modelling of control systems, automation and measurement-control systems, in accordance with predetermined instructions;
8. On the basis of analysis, formulates a substantiated conclusion about the devices and/or systems characteristic of control systems, automation and test engineering;
9. Prepares a detailed written report or presentation about ideas, existing problems and ways of solving them, and conveys the information orally and/or in writing to specialists and non-specialists of the engineering community, using modern communication technologies.

Concentration 1

1. Describes the principles of construction and modelling of non-linear automatic control systems, their specific features and the technological processes, using the theories and methods of control systems;
2. Analyses the processes taking place in control and automation systems, as well as the data and characteristics of the relevant digital and sensor equipment, using standard methods and some of the

latest methods;

3. Identifies and analyses the problems of control systems and automation during their planning;
4. Applies theoretical and practical knowledge and modern computer technologies to the modelling of non-linear control systems, the planning of automatic regulation systems, and the operation and testing of the electronic and digital equipment, microprocessors and microcontrollers required for automation processes;
5. On the basis of reporting and analysis, develops a substantiated conclusion about the condition of non-linear control systems, automatic regulation systems and the hardware part;
6. In accordance with instructions, prepares a written project/report/presentation on the modelling of control systems, the design of automatic regulation systems and digital systems, and presents it before a wide audience using modern communication technologies.

Concentration 2

1. Describes the main theories, methods and principles of metrology, standardisation, certification and quality management;
2. Analyses the methods and means of measurement, of metrological assurance and of quality control of technological processes, using modern approaches;
3. Identifies and analyses clearly manifested problems in the process of measurement and quality monitoring;
4. Uses modern technologies of measurement, metrological expertise, standardisation, certification and testing in order to establish the conformity of product quality parameters;
5. Formulates a substantiated conclusion on the basis of metrological assurance and measurement results;
6. In accordance with instructions, prepares a written project/report for quality control, for the automation of technological processes and for the organisation of inter-laboratory tests, and delivers a presentation before a wide audience using modern communication technologies.

Concentration 3

1. Describes modern technologies of measurement automation and the principles of operation, use and construction of measuring-control equipment, using theoretical and practical methods;
2. Analyses the possibilities of using the digital, analogue and power electrical devices and the wireless measurement technologies required for the automation of measurements;
3. Identifies problems arising during the operation of measuring-control equipment and analyses the ways of eliminating them;
4. Applies in practice the possibilities of measurement-control systems, devices and instruments for measurement automation processes, relying on modern expertise and computer technologies;
5. Draws up a substantiated conclusion about measuring-control equipment on the basis of analysis and experiments;
6. Prepares a written report/project on measurement automation and on expert measuring equipment in accordance with preliminary instructions, and delivers a presentation before a wide audience using modern communication technologies.

Student knowledge assessment system

Assessment is carried out on a 100-point scale.

Positive grades:

- A. Excellent — 91–100 points;
- B. Very good — 81–90 points;
- C. Good — 71–80 points;
- D. Satisfactory — 61–70 points;
- E. Sufficient — 51–60 points.

Negative grades:

- (FX) Did not pass — 41–50 points, which means that the student needs to do more work in order to pass and is granted the right to sit an additional examination once on the basis of independent work;

- F. Failed — 40 points or fewer, which means that the work carried out by the student is not sufficient and he/she must study the subject anew.

In the case of an FX, an additional examination is scheduled no earlier than 5 days after the announcement of the results. The grade obtained at the additional examination is not added to the grade obtained in the final assessment.

Detailed information is provided on the GTU website: Instruction for the Management of the Learning Process at Georgian Technical University, https://www.gtu.edu.ge/students/stsavleba-da-mkhardachera/sastsavlo-protsesi/sauniversito-maregulirebeli-dokumentebi/

Curriculum

Where several subjects are listed in one row, they form an elective group sharing the same credit value.

Subject	Credits
Engineering Mathematics 1	5
Physics 1	5
Computer Application	6
Fundamentals of Algorithmisation and Programming	6
Computer Engineering Graphics	3
English Language 1 German Language 1 French Language 1 Russian Language 1	5
Engineering Mathematics 2	5
Physics 2	5
Personal Computer Architecture	6
Introduction to the Python Programming Language	6
English Language 2 German Language 2 French Language 2 Russian Language 2	5
Engineering Mathematics 3.2	5
Physics 3	5
Fundamentals of Occupational Safety in Informatics and Control Systems	3
Electrical Circuits 1	4
Object-Oriented Programming in the C++ Language 1	5
Electrical Measurements	4
Fundamentals of Computer Networks	4
Object-Oriented Programming in the C++ Language 2	6
Electrical Circuits 2	5
Fundamentals of Microprocessor Technology	5

Fundamentals of Control Engineering	5
Components of Control Systems	4
Elements and Nodes of Measuring Equipment	5
C# Algorithmic Programming Language	4
Programmable Logic Controllers	4
Sensors	4
Robotics Devices	4
Modelling of Virtual Systems (LabVIEW)	4
Fundamentals of System Identification	5
Free Component	5
Control of Linear Technical Systems	6
Fundamentals of Quality Management and Automation of Technological Processes	6
Local Control	5
Peripheral Interfaces for Information Transmission	4
Simulation Modelling Systems Computer Means of Measurement	4
Free Component	5

Elective concentrations

Concentration 1

Subject	Credits
Control of Non-Linear Technical Systems	5
Fundamentals of Digital Control Systems	6
Automatic Control Systems	4
Design of Automatic Regulation Systems	5
Application of Automatic Control Systems in Practice (educational and industrial practice)	5

Concentration 2

Subject	Credits
Metrology, Standardisation and Certification	5
Methods of Measurement and Control	5
Real-Time Operating Systems	5

Quality Control Methods and Instruments	5
Quality Control and Automation of Technological Processes — Practice	5

Concentration 3

Subject	Credits
Power Electronics and Intelligent Electric Drives	5
Digital and Analogue Circuit Engineering and Modelling — Proteus	4
Wireless Measurement Technologies	6
Design of Measuring Instruments	5
Application of Expert Measuring Equipment in Practice	5

Common final-stage components

Subject	Credits
Free Component	5
Measurement, Control and Regulation Based on Microcontrollers Technical and Technological Measurements Vibroacoustic Measurements and Vibrodiagnostics Visual Modelling of Control Systems	5
Architecture of Digital Control Systems Embedded Systems	5
Solving Optimisation Problems in the Matlab Environment Data Processing in the SPSS System	5
Signals and Digital Processing of Information in Control Digital Signal Processing in Information-Measurement Systems Mathematical Programming	5
Bachelor’s Project — Modelling of Control Systems (C1) Bachelor’s Project — Organisation of an Experiment and Modelling of Inter-Laboratory Tests (C2) Bachelor’s Project — Automation of Measurements (C3)	5
TOTAL	**240**