

### Aims of the Programme

1. To deliver knowledge of mathematics and nature sciences, necessary for specialist of industrial engineering, able to design, produce and exploit mechatronic and robotic systems
2. To bring fundamentals of theoretical knowledge in area of special technological sciences and build practical skills, necessary for collecting, analysing and understand information of industrial engineering area. To learn operate with production systems, understand and be able to evaluate main quantity and quality parameters of such systems; identify problems, perform practical research.
3. To deliver special knowledge and develop ability to analyse and solve problems of industrial engineering, be interested in advances of mechatronics and robotics; independently implement it in practical activity.
4. To develop ability to improve professional competence due to life-long learning. To develop ability understand influence of engineering solutions and its importance to society development.

### Curriculum

Main field of study for the qualification: **Mechatronics and Robotics**

Name of qualification: **Bachelor of Engineering Sciences**

Level of qualification: **University first cycle (undergraduate, Bachelor's) studies**

Official length of programme: *Four years studies, 240 credits*

Mode of studies: **Continual studies**

1 semester					
15 weeks (teaching course) + 4 weeks (session) + 1 weeks (Independent Work) = 20 weeks					
Course title	Hours				Credits/area
	Lectures	Practical	Lab. works	Consultation	
Chemistry	30	15	00	04	6 A
Physics 1	30	15	15	04	6A
Programming C	30	15	00	02	3 B
Mathematics 1	30	15	15	04	6 A
Introduction to Mechatronics and Robotics	30	00	00	02	3 C
Human's Safety and Environmental Protection	30	15	00	02	3 B
Law	30	00	00	02	3 A
<b>Total:</b>	<b>315</b>				<b>30</b>

<b>2 semester</b>					
<b>15 weeks (teaching course) + 4 weeks (session) + 1 weeks (Independent Work) = 20 weeks</b>					
<b>Course title</b>	<b>Hours</b>				<b>Credits</b>
	<b>Lectures</b>	<b>Practical</b>	<b>Lab. works</b>	<b>Consultation</b>	
Physics 2	15	15	30	04	3 A
General Engineering Graphics	15	15	30	04	6 B
Mathematics 2	30	15	15	04	6 A
Materials Science 1	30	15	00	02	3 B
Engineering Mechanics	30	00	30	04	6 B
Management	30	00	15	02	3 B
Cognitive Practice	00	00	15	02	3 D
<b>Total:</b>	<b>330</b>				<b>30</b>
<b>3 semester</b>					
<b>15 weeks (teaching course) + 4 weeks (session) + 1 weeks (Independent Work) = 20 weeks</b>					
<b>Course title</b>	<b>Hours</b>				<b>Credits</b>
	<b>Lectures</b>	<b>Practical</b>	<b>Lab. works</b>	<b>Consultation</b>	
Fluid Mechanics and Thermodynamics	15	15	15	02	3 B
Applied Engineering Graphics	15	15	15	02	3 B
Mathematics 3	30	15	15	04	6 A
Materials Science 2	30	15	00	02	3 B
Theory of Mechanisms and Machines (with course project)	45	15	30	06	9 B
<i>Option (one of the following)</i>					
English Language	00	00	30	02	3 A
German Language	00	00	30	02	3 A
French Language	00	00	30	02	3 A
<i>Option (one of the following)</i>					
Ethics	30	00	00	02	3 A
Formal Writing	15	00	15	03	3 A
<b>Total:</b>	<b>345</b>				<b>30</b>

<b>4 semester</b>					
<b>15 weeks (teaching course) + 4 weeks (session) + 1 weeks (Independent Work) = 20 weeks</b>					
Course title	Hours				Credits
	Lectures	Practical	Lab. works	Consultation	
Electrical Engineering	30	15	00	02	3 B
C++ Programming Language	30	30	00	04	6 B
Machine Elements (with course project)	30	15	15	04	6 B
Elements of Mechatronics	30	15	00	02	3 C
Mechanics of Materials	30	15	15	04	6 B
<i>Option (one of the following)</i>					
Speciality English Language	00	00	30	02	3 A
Speciality German Language	00	00	30	02	3 A
Speciality French Language	00	00	30	02	3 A
<i>Free choice obligatory course</i>	–	–	–	–	3 A/B/C
<b>Total:</b>	<b>300</b>				<b>30</b>
<b>5 Semester</b>					
<b>15 weeks (teaching course) + 4 weeks (session) + 1 weeks (Independent Work) = 20 weeks</b>					
Course title	Hours				Credits
	Lectures	Practical	Lab. works	Consultation	
Electronics	30	15	00	02	3 B
Automatic Control Systems (with course project)	30	15	15	04	6 B
Electric Drives	30	15	00	02	3 C
Theory and Practice of Measurements (with course project)	30	15	15	04	6 B
Robotics	30	15	15	04	6 C
Mechatronic Systems 1	30	00	15	02	3 C

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<i>Option (one of the following)</i>					
Philosophy of Technology	30	00	00	02	3 A
Politics and Technology	30	00	00	02	3 A
<b>Total:</b>	<b>345</b>				<b>30</b>
<b>6 semester</b>					
<b>15 weeks (teaching course) + 4 weeks (session) + 1 weeks (Independent Work) = 20 weeks</b>					
Course title	Hours				Credits
	Lectures	Practical	Lab. works	Consultation	
Materials in Mechatronics	30	15	00	02	3 C
CAD/CAM/CAE	30	00	30	04	6 B
Mechatronic Systems 2	30	00	30	04	6 C
Robotical Technology	30	15	15	04	6 C
Fundamentals of Economics (with course work)	30	00	15	04	6 B
<i>Free choice obligatory course</i>	–	–	–	–	3 A/B/C
<b>Total:</b>	<b>270</b>				<b>30</b>
<b>7 Semester</b>					
<b>10 weeks (teaching course) + 2 weeks (session) + 8 weeks (practice) = 20 weeks</b>					
Course title	Hours				Credits
	Lectures	Practical	Lab. works	Consultation	
Digital Automatics (with course project)	20	10	20	04	6 C
Specific Purpose Language Culture	20	00	10	02	3 A
Career Intership	00	00	00	00	12 D
Bachelor Graduation Thesis 1	00	00	10	02	3 D
Design of Mechatronic and CAD/CAM Systems. Integrated Project	00	00	30	04	6 C
<b>Total:</b>	<b>120</b>				<b>30</b>

<b>8 Semester</b>					
<b>12 weeks (teaching course) + 2 weeks (session) + 6 weeks (final thesis) = 20 weeks</b>					
<b>Course title</b>	<b>Hours</b>				<b>Credits</b>
	<b>Lectures</b>	<b>Practical</b>	<b>Lab. works</b>	<b>Consultation</b>	
Industrial Logical Controllers	24	12	00	02	3 C
Design of Mechatronic and Robotic Systems (with course project)	24	00	24	04	6 C
Quality and Certification in the Automated Industry	24	12	12	04	6 B
Bachelor Graduation Thesis 2	00	00	12	04	6 D
Bachelor Graduation Thesis 3	00	00	00	00	9 D
<b>Total:</b>	<b>144</b>				<b>30</b>

Explanations:

Area of disciplines:

A – General studies

B – Common technical/administrative studies

C – Specialisation studies

D – Practical placement and final thesis preparation.

There are few cycles of discipline chains, connected into logical sequence; this is related to areas B and C.

Possible options for this curriculum for localization. Initially it takes place in the area C, but keeping workload the same and keeping essential skills. For localization possible to add: Food technology, Cotton technology, Machines of special technology. Disciplines like Mechatronic systems 1 and 2 there are space for adding some local processes.

I would recommend do not touch Electronics, Digital automatics, Robotic technology. There in fundament and laboratory works are very general and fits to the all program localisation cases.

Programming C and C++ looks good for engineers, but you can replace by another programming language, but object-oriented programming basics should stay for the purpose. Management, Work safety, Economics can be spreaded between another disciplines together with quality control.

More possible alteration – strengthen robotic welding in the general robotic technology, enlarge PLC programming together with programming disciplines.

Also, depending on the requirements of the Ministry of Education of Uzbekistan for the preparation of bachelor's theses, bachelor's theses can be modified according to needs and preferences. All possible changes and your proposal we can discuss.

## **Results of Study Programme**

### **Knowledge:**

1. Knowledge of mathematics: terms, laws, theory, mathematical analysis, differential calculus, differential equations, linear algebra, numerical algebra, complex numbers, theory of probability, statistics.
2. Fundamental knowledge about Natural sciences and their laws.
3. Humanitarian and social knowledge in order to develop philosophy, enhance erudition and enable to reach engineering purpose.
4. Special knowledge on technological sciences and industrial engineering.
5. Knowledge about structure of mechatronic systems, their design production and control, ensuring quality of systems and their proper maintaining
6. Knowledge about structure of robotic systems, their design production and control, ensuring quality of the systems and their proper maintaining.

### **Ability of research:**

1. Implementing achievements and methods of mathematics and nature sciences to solve problems of engineering.
2. Understand newest engineering technologies, recognize and analyse implementation and utilization possibilities.

3. Interpretation results, sort data by its importance in order to perform design, control, production and technical maintenance of mechatronic and robotic systems.

**Analysis of Engineering:**

1. Adjusting theory and practical skills; performing laboratory and experimental research.  
2. Analysing problematic situations and finding alternative ways of such task solution, understanding consequences of solution to environment and society welfare.

3. Ability to perform analysis of separate, complex and parenthetic mechatronic systems and evaluation of parameters.

4. Ability to analyse, diagnose and forecast damages, compound and parenthetic robotic systems.

**Engineering design:**

1. Knowledge and skills how to design engineering objects according to the parameters of their specialization.

2. To develop skills for projects evaluation, new systems designing, modernization or upgrading existing systems.

3. Ability quickly to identify properties of mechatronic systems and to prepare projects for development modernization.

4. Ability to design the environment for the production cell and facilities needed to it; to design modernization of existing production cells.

**Engineering skills:**

1. Ability to combine theory and practice elements in solving engineering problems.

2. Ability to assess the situation and take right engineering solutions.

3. Ability to evaluate shape of mechatronic system by performing diagnostic and troubleshooting.

4. Ability to control existing robotic systems, to choose right components, to prepare them for manufacturing by programming and combining reciprocity of mechanisms.

**Personal and social skills:**

1. Communicating, delivering results of work in fluent language orally and in written in mother tongue and in at least one foreign language for various audience.

2. Ability to work independently; motivation to work will use creativity and responsibility in work activities; planning your own time and work activities.
3. Taking responsibility for quality of performance of team and its own on basis of profession skills and public spirit. Take care of their competence development.
4. Abilities that can be using not only in area of specialty of this study program, but also during further studies and life-long learning.
5. Moral responsibility for results of activities to society, economic and cultural development, welfare and environment of country

### **Objectives of the program, knowledge and skills acquired**

To prepared universal multidisciplinary professionals, who would be able to work in a technological, organizational, design, mechatronic and robotic systems operation and maintenance engineering expert-advisory work in companies. Knowledge about mechatronic and robotic systems design methods. Ability to identify and analyse the technical problems, ability to plan strategies for their solution, formulate and solve mechatronics and robotics practical problems, to design and investigate mechatronic and robotic systems, to develop technology of mechatronic and robotic production, which allow us successfully specialize and adapt not only in the manufacturing engineering sector. Aim of the programme to prepare specialists who know various mechatronic and robotic systems, able to supervise and choose existing or design new mechatronic and robotic systems used in automated manufacturing.

### **Professional opportunities:**

Graduates can work in scientific research or practical placements. In practical placements, they can get positions of industrial engineer, designer, technologist, diagnostic engineer as well as take leader position in industrial enterprises, state enterprises, municipalities, departments, administering engineering activities and estimating its development and growth prospective.