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MECHAUZ

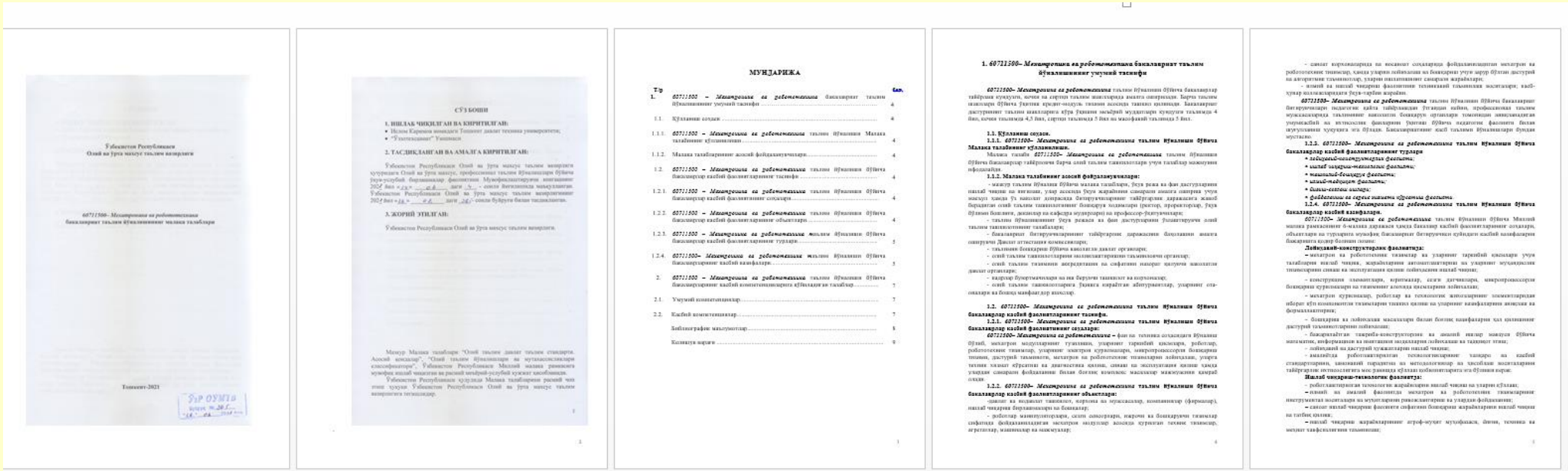
ИСЛОМ КАРИМОВ номидаги
ТОШКЕНТ ДАВЛАТ ТЕХНИКА УНИВЕРСИТЕТИ

“ЭЛЕКТРОНИКА ВА АВТОМАТИКА” факультети

“МЕХАТРОНИКА ВА РОБОТОТЕХНИКА”
КАФЕДРАСИНИНГ
ФАОЛИЯТИНИНГ НАТИЖАЛАРИ БЎЙИЧА
Ҳ И С О Б О Т И

ТОШКЕНТ 2022

Developed and approved qualification requirements for undergraduate graduates of TSTU in the specialty "Mechatronics and Robotics"



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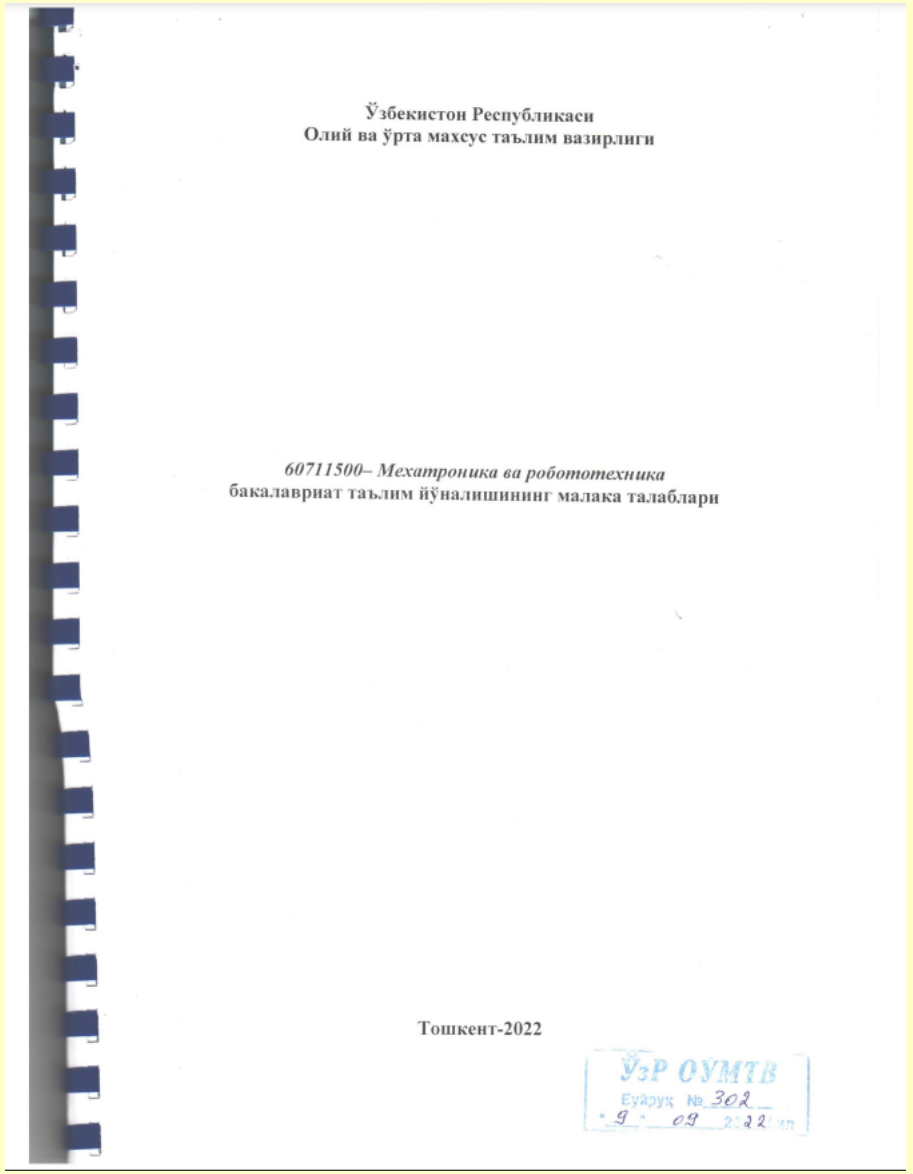

Ўзбекистон Республикаси
Олий ва ўрта махсус таълим вазирлиги

60711500– Мехатроника ва робототехника
бакалавриат таълим йўналишининг малака талаблари

Тошкент-2022

ЎзР ОЎМТВ
Буйруқ №302
9 09 2022 йил

КЕЛИШУВ ВАРАҒИ

ИШЛАБ ЧИҚИЛДИ:

Ислом Каримов номидаги
Тошкент давлат техника университети

Ректор _____ проф. С.М. Турабджанов

2022 йил «2» 08

М.Ў.

«ЎЗЭЛТЕХСАНОАТ» Уюшмаси

Раиси _____ М.М. Юнусов

2022 йил «2» 08

М.Ў.

КЕЛИШИЛДИ:

Ўзбекистон Республикаси
Олий ва ўрта махсус таълим вазирлиги
ҳузуридаги Олий таълимини
ривожлантириш тадқиқотлари ва
илғор технологияларни татбиқ этиш
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Директор _____ Ш. Якубов

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Тошкент шахридаги Турин
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Ректор _____ Ж. Иноятходжаев

2022 йил «3» 08

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"Unique innovation tree" МЧЖ

Директор _____ Д. Хожамухаммедов

2022 йил «4» 08

М.Ў.

"ATOM Smart Solution" МЧЖ

Директор _____ О. Халикулов

2022 йил «4» 08

М.Ў.

9

60711500 - Types of professional activities of bachelors in the field of mechatronics and robotics

- design and construction activities;
- installation and adjustment works;
- organizational and managerial activity;
- research activities;
- operation and maintenance activities;
- production and technological activities.

General qualification:

- understand the nature of documents and work related to their professional activities in one of the foreign languages, have special knowledge in the field of scientific sciences and be able to use them in their professional activities on a modern basis;

- be able to use information technology in their professional activities, master the methods of collecting, storing, processing and using information, be able to make informed decisions in their activities;

- has an idea about a healthy lifestyle and the need to compliance it.

Professional Qualifications:

- Has the search, analysis and use of regulatory documents in their professional activities;

- Has the skills to develop methods for monitoring and assessing the quality of production processes, includes the creation and application of modern mechatronic and robotic systems;

- be able to produce and calculate mathematical, informational simulation models on the topic of experimental design and practical work;

- Has the skills to develop project and program documentation;

- use of modern communication, information and computer technologies;

Professional Qualifications:

- develop design and program documentation;

- carrying out tests on the collection of operating parameters of the actuators of mechatronic and robotic systems;

- be able to apply the formulas and professional standards of robotic technologies, tools and computing facilities in accordance with the specialty being trained;

- Has the ability to manage processes in mechatronic and robotic systems;

- the ability to control compliance with the technological operation of mechatronic and robotic systems;

Professional Qualifications:

- be able to use and implement measures for the natural use of energy resources in mechatronic and robotic systems;

- know the rules and dimensions of dimensions, testing and adjustment of mechatronic and robotic systems;

- Has the skills to check the technical condition of mechatronic and robotic systems, structures and equipment and assess the residual life;

- be able to lead a team;

- Has the skills to recognize the code of professional ethics;

- Has the skills to work in design institutes, participation in scientific research, fairs and innovative exhibitions.

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- **Undergraduate study programs in the specialty "Mechatronics and Robotics" of leading universities in Europe and the USA were studied**

- **TSTU analyzed the curricula of the bachelor's specialty "Mechatronics and Robotics" and developed a new curriculum, which has been introduced into the educational process since the 2022/2023 academic year at TSTU.**

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Finalisation of the curricula

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Analysis of curricula developed by Uzbek universities: TSTU, TUIT, AndMI and TTPU

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Higher education institution	Name of bachelor's degree	Percentage of the subject of the course - fundamental subjects	Percentage of the subject of the course - general technical	Percentage of the subject of the course – subjects in the specialty	Percentage of the subject of the course – elective course	Total	Percentage of the subject of the course – including IT
TSTU since 2016 to 2021	Mechatronics and Robotics	34	37	15	14	100	20
TSTU from 2022/23 academic year	Mechatronics and Robotics	30	28	23	19	100	22
TUIT	Computer engineering	26	30	30	14	100	57
TTPU	-	20	31	33	16	100	23
AndMI	Automation of technological processes and production	26	37	23	14	100	20

CURRICULUM
60711500- Mechatronics and Robotics

Course type	Course code	Course name	Credit	Hours	Classes					Self-study	Course type	Course code	Course name	Credit	Hours	Classes					Self-study
					Total	Lecture	Practice	Labs	Seminar							Total	Lecture	Practice	Labs	Seminar	
1 semester (15 weeks)											2 semester (15 weeks)										
1		Modern history of Uzbekistan	4	120	60	30			30	60	1		Engineering and computer graphics	4	120	60	30	30			60
1		Physics 1	4	120	60	30	15	15		60	1		Physics 2	4	120	60	30	15	15		60
2		Programming language (C)	4	120	60	30	30			60	3		Automatic control systems 1	4	120	60	30	15	15		60
1		Higher Mathematics 1	6	180	90	45	45			90	1		Higher Mathematics 2	4	120	60	30	30			60
3		Introduction to the specialty	4	120	60	30	15	15		60	2		Electromechanical systems (with term paper)	6	180	90	30	30	30		90
1		Uzbek (Russian) language 1	4	120	60		60			60	2		Uzbek (Russian) language 2	2	60	30		30			30
2		Ecology	4	120	60	30	15	15		60	2		Algorithmization and information processing	4	120	60	30	30			60
											6		Academic writing	2	60	30		30			30
		Total for semester:	30	900	450	195	180	45	30	450			Total for semester:	30	900	450	180	210	60	0	450
													Qualification practice	0							
													Total for year:	60	1800	900	375	390	105	30	900

CURRICULUM
60711500- Mechatronics and Robotics

Course type	Course code	Course name	Credit	Hours	Classes					Self-study	Course type	Course code	Course name	Credit	Hours	Classes					Self-study
					Total	Lecture	Practice	Labs	Seminar							Total	Lecture	Practice	Labs	Seminar	
3 semester (15 weeks)											4 semester (15 weeks)										
2		Electrical Engineering and Electronics 1	4	120	60	30	15	15		60	2		Electrical Engineering and Electronics 2	4	120	60	30	15	15		60
2		Circuitry and microprocessor systems 1	4	120	60	30	15	15		60	2		Circuitry and microprocessor systems 2 (with course project)	6	180	90	30	30	30		90
2		Automatic control systems 2 (with term paper)	6	180	90	30	30	30		90	2		C++ programming language	4	120	60	30		30		60
1		Higher Mathematics 3	4	120	60	30	30			60	2		Power electronics	4	120	60	30	15	15		60
3		Microcontrollers and industrial controllers 1	4	120	60	30	15	15		60	3		Microcontrollers and industrial controllers 2	4	120	60	30	15	15		60
2		Solid mechanics	4	120	60	30	15	15		60	2		Metrology and standardization	4	120	60	30	15	15		60
1		Foreign language	4	120	60		60			60	1		Special foreign language	4	120	60		60			60
		Total for semester:	30	900	450	180	360	90	0	450			Total for semester:	30	900	450	180	150	0	0	450
													Internship	0							
													Total for year:	60	1800	900	360	510	90	0	900

CURRICULUM
60711500- Mechatronics and Robotics

Course type	Course code	Course name	Credit	Hours	Classes					Self-study
					Total	Lecture	Practice	Labs	Seminar	
5 semester (15 weeks)										
1		Philosophy	4	120	60	30	30			60
3		Mechatronic system drives 1	4	120	60	30	15	15		60
2		Robotics	4	120	60	30	15	15		60
3		Design of mechatronic modules 1	4	120	60	30	15	15		60
4		Design of robot control systems 1	4	120	60	30	15	15		60
4		Fundamentals of Robot Programming	6	180	90	30	30	30		90
4		Open Elective Course 1	4	120	60	30	15	15		60
		Total for semester:	30	900	450	210	135	105	0	450

Course type	Course code	Course name	Credit	Hours	Classes					Self-study
					Total	Lecture	Practice	Labs	Seminar	
6 semester (15 weeks)										
		Modeling mechatronic modules and robots	4	120	60	30	15	15		60
		Mechatronic system drives 2 (with term paper)	6	180	90	30	30	30		90
		Robotic technologies	4	120	60	30	30			60
		Design of mechatronic modules 2 (with coursework)	4	120	60	30	15	15		60
		Design of robot control systems 2 (with term paper)	4	120	60	30	15	15		60
		Economy and management of the industry	4	120	60	30			30	60
		Open Elective Course 2	4	120	60	30	15	15		60
		Total for semester:	30	900	450	210	120	90	30	450
		Industrial Internship	0							
		Total for year:	60	1800	900	420	255	195	30	900

CURRICULUM
60711500- Mechatronics and Robotics

Course type	Course code	Course name	Credit	Hours	Classes					Self-study
					Total	Lecture	Practice	Labs	Seminar	
7 semester (15 weeks)										
4		Information devices of mechatronic modules and robots 1	4	120	60	30	15	15		60
4		Automatic design systems (CAD/CAM/CAE systems) 1	6	180	90	30	30	30		90
4		Artificial intelligence systems	4	120	60	30	30			60
5		Elective Course 1	4	120	60	30	30			60
5		Elective Course 2	6	180	90	30	30	30		90
5		Elective Course 2	6	180	90	30	30	30		90
		Total for semester:	30	900	450	180	165	105	0	450
1. Humanitarian and Social sciences Courses 2. Mathematical and Natural science Courses 3. General Professional Courses 4. Professional Courses 5. Professional Elective Courses										

Course type	Course code	Course name	Credit	Hours	Classes					Self-study
					Total	Lecture	Practice	Labs	Seminar	
8 semester (10 weeks)										
		Information devices of mechatronic modules and robots 2	4	120	60	30	15	15		60
5		Automatic design systems (CAD/CAM/CAE systems) 2	4	120	60	30	15	15		60
5		Elective Course 4	4	120	60	30	15	15		60
4		Graduation Thesis (Thesis project)	18	540						540
		Total for semester:	30	900	180	90	45	45	0	720
		Career Internship	0							
		Total for year:	60	1800	630	270	210	150	0	1170
		Total:	240	7200	3330	1425	1365	540	60	3870

Course Description
60711500- Mechatronics and Robotics

1 semester	
Introduction to the specialty	This course gives students an idea of the history, current state, prospects for the development of mechatronics and robotics, introduces the basic concepts and terms. The course includes the following topics: - application of mechatronics and robotics in production; - elements of mechatronic modules and manipulation robots; - structure, design and principle of operation of electric, pneumatic and hydraulic drives; - power electronics of control devices for mechatronic and robotic systems; - mechanical converters of rotational and linear movements; - varieties and purpose of sensors and sensing elements of robots; - principles of control and types of robot control devices; - modern mechatronic modules and robots, prospects for their development.

Course Description
60711500- Mechatronics and Robotics

2 semester	
Electromechanical systems	This course introduces students to the purpose, structure, constituent elements and basic characteristics of electromechanical systems. The course includes the following topics: - selsyns, design and principle of operation; - elements of electromechanical systems; - varieties of electromechanical systems; - asynchronous and synchronous electric motors; - linear motion motors; - stepper motors and servo drives; - control schemes of electromechanical systems. As part of this course, course work is provided, where students master the methodology for calculating the electrical, energy and mechanical characteristics of electromechanical systems.

Course Description
60711500- Mechatronics and Robotics

3 semester	
Electrical engineering and electronics 1,2	This course introduces students to the basics of electrical and electronic engineering. The course includes the following topics: - Overview of the passive elements of the electrical circuit - Ohm's and Kirchhoff's laws for DC and AC circuits - Fundamentals of semiconductor electronics - Overview of active elements of the electrical circuit - Schemes of rectifiers, stabilizers, amplifiers on bipolar and field-effect transistors - Integrated circuits - Analog circuitry - Digital circuitry After this course, students will be able to analyze electrical circuits, implement conceived schemes to develop their own control systems and robots.

Course Description
60711500- Mechatronics and Robotics

3 semester	
Circuitry and microprocessor systems 1,2	This course introduces students to discrete elements of electronic circuits, digital circuitry, logic elements, digital nodes and devices, the structure of microprocessor devices and the basics of their programming. The course includes the following topics: - basic terms and definitions used in circuitry and microprocessor systems; - discrete elements of electronic circuits; - generalized structure of digital systems; - logical elements and algebra of logic; - combinational digital units: adders, comparison circuits, decoders, encoders, demultiplexers, multiplexers, bus shapers, rectangular pulse generators; - memory elements, sequential digital nodes: flip-flops, registers, counters and their varieties; - analog-to-digital and digital-to-analog converters; - microprocessors, microcontrollers and their classification; - internal structure and principle of operation of single-chip microprocessors; - programming language of microprocessors and microcontrollers - Assembler; - the basics of programming in assembler and debugging programs; - generalized structure of microprocessor control systems; - design of a processor block based on serial microprocessors; - design of a memory unit based on commercially available integrated circuits; - design of operator interfaces and control object; - application of timer and interrupt controller in microprocessor control systems. Within the framework of this course, a course project is provided, where students independently design a microprocessor control system with a given amount of memory and using various interface devices.

Course Description
60711500- Mechatronics and Robotics

4 semester	
Power electronics	This course introduces students to the elements and circuits of power electronics, their working principles and main characteristics. The course includes the following topics: - modern element base of power devices - power semiconductor devices; - power semiconductor converters; - rectifiers and inverters; - single-phase and three-phase direct frequency converters; - DC voltage converters and pulse-width modulators; - single-phase and three-phase frequency converters; - prospect of development of elements and circuits of power electronics.

Course Description
60711500- Mechatronics and Robotics

5 semester	
Mechatronic system drives 1,2	The study of this course allows students to master the types of drives for mechatronic modules and robots, introduces them to the design and principles of their operation. The course includes the following topics: - drives of mechatronic modules and robots; - electric drives of mechatronic modules and robots; - hydraulic and pneumatic drives of mechatronic modules and robots; - multiposition drives of linear and rotational movements; - calculation of drive parameters for mechatronic modules and robots; - comparative analysis and selection of drives for mechatronic modules and robots; - elements of mechatronic modules and manipulation robots; - prospects for the development of drives for mechatronic modules and robots. As part of this course, a course project is provided, during which students learn to design, analyze and select the necessary drives for mechatronic modules and robots for specific technological processes.

Course Description
60711500- Mechatronics and Robotics

7 semester	
Information devices of mechatronic modules and robots 1, 2	This course introduces students to vision sensors and systems used in mechatronic modules and robots. The course includes the following topics: - Information systems used in mechatronic modules and robots and their classification - Classification of information devices (sensors) - Classification of video sensors - Intelligent sensors - Automated systems for designing information devices of mechatronic modules and robots After this course, students will be able to analyze and select information devices in the design of mechatronic and robotic systems.

Thank you for your attention