Bringing your ideas and innovations to education
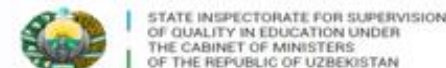
MECHAUZ

Modernization of Mechatronics and Robotics for Bachelor's degree in Uzbekistan through Innovative Ideas and Digital Technology

(MechaUz)

609564-EPP-1-2019-1-EL-EPPKA2-CBHE-JP

MechaUZ_2.2 Report of WP12: Development of BS Program

[Uzbek Partner number P12]

INTERNATIONAL HELLENIC UNIVERSITY

SOUTH-EAST EUROPEAN RESEARCH CENTRE

VILNIUS TECH

LIEPAJA UNIVERSITY

VIDZEME UNIVERSITY OF APPLIED SCIENCES

ipvc Instituto Politécnico de Viana do Castelo

Andijan machine-building institute

TURIN POLYTECHNIC UNIVERSITY IN TASHKENT

Farg'ona Politexnika Instituti

Tashkent University of Information Technologies named after Muhammad al-Khwarizmi

Karshi Engineering Economics Institute

Tashkent State Technical University

Ministry of Higher and Secondary Specialised Education System of Uzbekistan

STATE INSPECTORATE FOR SUPERVISION OF QUALITY IN EDUCATION UNDER THE CABINET OF MINISTERS OF THE REPUBLIC OF UZBEKISTAN
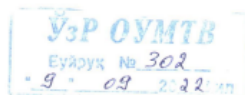
DEVELOPED AND APPROVED QUALIFICATION REQUIREMENTS FOR UNDERGRADUATE GRADUATES OF TSTU IN THE SPECIALTY "MECHATRONICS AND ROBOTICS"

Ўзбекистон Республикаси
Олий ва ўрта махсус таълим вазирлиги

60711500– Мехатроника ва робототехника
бакалавриат таълим йўналишининг малака талаблари

Тошкент-2022

ЎзР ОУМТВ
Буйруқ № 302
« 9 » 09 2022 йил

КЕЛИШУВ ВАРАҒИ

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"Unique innovation tree" MChJ

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"ATOM Smart Solution" MChJ

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CURRICULUM FOR MECHATRONIC AND ROBOTICS

Qualification requirements have been developed and officially approved within the framework of the documents "State Educational Standard of Higher Education. Basic rules" and "Classifier of areas of study and specialties of higher education".

The purpose of the qualification requirements

Characteristics of the direction of preparation of bachelors

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

General qualification

Professional Qualifications

Courses of the direction

The educational program

STANDARD TEMPLATES FOR MECHATRONICS AND ROBOTICS
Program details

Duration:	4 year
Duration:	166 weeks
Number of weeks per semester:	18 (15 for teaching and 3 for examinations)
Total number of credit hours:	240
Number of credit hours per semester:	30

SUBJECTS AND COURSES

Subject	Percentage of the total course modules	Title of courses	Credits Hours	% Subject	% Total
Mechanical Engineering	16,8	1. Electromechanical systems (with term paper)	6	2,5	100
		1. Solid mechanics	4	1,7	
		1. Design of robot control systems 1,2 (with term paper)	8	3,3	
		1. Robotic technologies	4	1,7	
		1. Design of mechatronic modules 1,2 (with term paper)	8	3,3	
		1. Elective Course 1,2	10	4,3	
Electrical/ Electronic Engineering	12,6	1. Electrical Engineering and Electronics 1,2	8	3,3	
		1. Circuitry and microprocessor systems 1,2 (with course project)	10	4,3	
		1. Microcontrollers and industrial controllers 1,2	8	3,3	
		1. Power electronics	4	1,7	
Computer Science/ ICT	13,6	1. Engineering and computer graphics	4	1,7	
		2. Algorithmization and information processing	4	1,7	
		3. Programming language (C)	4	1,7	
		4. C++ programming language	4	1,7	
		5. Fundamentals of Robot Programming	6	2,5	
		6. Automatic design systems (CAD/CAM/CAE systems) 1,2	10	4,3	
Mechatronics	33,7	**1. Introduction to the specialty**	**4**	**1,7**	
		2. Mechatronic system drives 1,2 (with term paper)	10	4,3	
		3. Robotics	4	1,7	
		4. Automatic control systems 1,2 (with term paper)	10	4,2	
		5. Modeling mechatronic modules and robots	4	1,7	
		6. Information devices of mechatronic modules and robots 1,2	8	3,3	
		7. Artificial intelligence systems	4	1,7	
		8. Open Elective Course 1,2	8	3,3	
		9. Elective Course 1,2	10	4,3	
		10. Graduation Thesis (Thesis project)	18	7,5	
Fundamental subjects	23,3	1. Modern history of Uzbekistan	4	1,7	
		1. 2. Physics 1.2	8	3,3	
		1. 3. Higher Mathematics 1,2,3	14	5,8	
		1. 4. Uzbek (Russian) language 1,2	6	2,5	
		1. 5. Ecology	4	1,7	
		1. 6. Academic writing	2	0,8	
		7. Foreign language	8	3,3	
		1. 8. Metrology and standar-dization	4	1,4	
		1. 9. Philosophy	4	1,4	
		1. 10. Economy and management of the industry	4	1,4	

SCHEME OF STUDIES FOR BS IN MECHATRONICS AND ROBOTICS

Schedule of the learning process

Grade	Weeks (1–52)	Sub Total	Theoretical and practical education	Examination	Introduction of ECTS	Internship	Final Project/Thesis	Number of holiday weeks	Total
I	K (wk1); E H H E E H H H K (wks 18–25); E E I I I I I H H H H H H (wks 41–52)	41	30	5	2	4		11	52
II	K (wk1); E H H E E H H H K (wks 18–25); E E I I I I I I I H H H H (wks 41–52)	43	30	5	2	6		9	52
III	K (wk1); E H H E H H H K (wks 18–24); E E I I I I I I I I I H H H H (wks 40–52)	43	30	4	2	7		9	52
IV	K (wk1); E E K H H (wks 17–21); E E I I H H H P P P P P P H H H H (wks 40–52)	39	26	4	2	2	5	9	48
Total		**166**	**116**	**18**	**8**	**19**	**5**	**38**	**204**

Note: **K**-Introduction of ECTS; **E**-Examination; **H**-holiday; **I**-Internship; **P**-Final Project/Thesis

1, 2 Semesters / Contact hours

Qualification code	Title of the course	Credits	Total Hours	Contact hours					Students' workload
				Sub total	Lecture	Practice	Laboratory	Seminars	
1-semester									
MHUZ1104	Modern history of Uzbekistan	4	120	60	30			30	60
PHIZ1104	Physics 1	4	120	60	30	15	15		60
PRLN114	Programming language (C)	4	120	60	30	30			60
HMAT1106	Higher Mathematics 1	6	180	90	45	45			90
INTS1104	Introduction to the specialty	4	120	60	30	15	15		60
UZLN1104	Uzbek (Russian) language 1	4	120	60		60			60
ECOL1104	Ecology	4	120	60	30	15	15		60
Total for semester:		30	900	450	195	180	45	30	450
2-semester									
ECGR1204	Engineering and computer graphics	4	120	60	30	30			60
PHIZ1204	Physics 2	4	120	60	30	15	15		60
ACTS1204	Automatic control systems 1	4	120	60	30	15	15		60
HMAT1204	Higher Mathematics 2	4	120	60	30	30			60
ELST1206	Electromechanical systems (with term paper)	6	180	90	30	30	30		90
UZLN1204	Uzbek (Russian) language 2	2	60	30		30			30
ALIP1204	Algorithmization and information processing	4	120	60	30	30			60
ACWR1202	Academic writing	2	60	30		30			30
Total for semester:		30	900	450	180	210	60	0	450
Total for year:		60	1800	900	375	390	105	30	900

3, 4 Semesters / Contact hours

3-semester									
EENE2304	Electrical Engineering and Electronics 1	4	120	60	30	15	15		60
CMPS2304	Circuitry and microprocessor systems 1	4	120	60	30	15	15		60
ACTS2306	Automatic control systems 2 (with term paper)	6	180	90	30	30	30		90
HMAT2304	Higher Mathematics 3	4	120	60	30	30			60
VCIC2304	Microcontrollers and industrial controllers 1	4	120	60	30	15	15		60
SLME2304	Solid mechanics	4	120	60	30	15	15		60
FGLN2304	Foreign language	4	120	60		60			60
Total for semester:		30	900	450	180	360	90	0	450
4-semester									
EENE2404	Electrical Engineering and Electronics 2	4	120	60	30	15	15		60
CMPS2404	Circuitry and microprocessor systems 2 (with course project)	6	180	90	30	30	30		90
CPRL2404	C++ programming language	4	120	60	30		30		60
PWEL2404	Power electronics	4	120	60	30	15	15		60
VCIC2404	Microcontrollers and industrial controllers 2	4	120	60	30	15	15		60
MTST2404	Metrology and standardization	4	120	60	30	15	15		60
SFLN2404	Special foreign language	4	120	60		60			60
Total for semester:		30	900	450	180	150	0	0	450
Total for year:		60	1800	900	360	510	90	0	900

5, 6 Semesters / Contact hours

5-semester								
PHIL3504	Philosophy	4	120	60	30	30		60
MSDR3504	Mechatronic system drives 1	4	120	60	30	15	15	60
ROBT3504	Robotics	4	120	60	30	15	15	60
DSMM3504	Design of mechatronic modules 1	4	120	60	30	15	15	60
DRCS3504	Design of robot control systems 1	4	120	60	30	15	15	60
FNRP3506	Fundamentals of Robot Programming	6	180	90	30	30	30	90
OELC3504	Open Elective Course 1	4	120	60	30	15	15	60
Total for semester:		30	900	450	210	135	105	0	450
6-semester								
MMMR3604	Modeling mechatronic modules and robots	4	120	60	30	15	15	60
MSDR3606	Mechatronic system drives 2 (with term paper)	6	180	90	30	30	30	90
RBTN3604	Robotic technologies	4	120	60	30	30		60
DSMM3604	Design of mechatronic modules 2 (with coursework)	4	120	60	30	15	15	60
DRCS3604	Design of robot control systems 2 (with term paper)	4	120	60	30	15	15	60
EMIN3604	Economy and management of the industry	4	120	60	30			30	60
OELC3604	Open Elective Course 2	4	120	60	30	15	15	60
Total for semester:		30	900	450	210	120	90	30	450
Total for year:		60	1800	900	420	255	195	30	900

7, 8 Semesters / Contact hours

7-semester								
IDMM4704	Information devices of mechatronic modules and robots 1	4	120	60	30	15	15	60
ADSS4706	Automatic design systems (CAD/CAM/CAE systems) 1	6	180	90	30	30	30	90
AINS4704	Artificial intelligence systems	4	120	60	30	30		60
ELCR4704	Elective Course 1	4	120	60	30	30		60
ELCR4706	Elective Course 2	6	180	90	30	30	30	90
ELCR4706	Elective Course 2	6	180	90	30	30	30	90
Total for semester:		30	900	450	180	165	75	450
8-semester								
IDMM4804	Information devices of mechatronic modules and robots 2	4	120	60	30	15	15	60
ADSS4804	Automatic design systems (CAD/CAM/CAE systems) 2	4	120	60	30	15	15	60
ELCR4804	Elective Course 4	4	120	60	30	15	15	60
GRTH4818	Graduation Thesis (Thesis project)	18	540					540
Total for semester:		30	900	180	90	45	45	0	720
Total for year:		60	1800	630	270	210	150	0	1170
Total:		240	7200	3330	1425	1365	540	60	3870

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.**

DETAILS OF COURSES BS IN MECHATRONICS AND ROBOTICS

COURSE NAME: CIRCUITRY AND MICROPROCESSOR SYSTEMS 1,2

Course code	CMPS2304+CMPS2406
Course credit	10
Course description and objectives	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.
Topic covered	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;

DETAILS OF COURSES BS IN MECHATRONICS AND ROBOTICS

Topic covered	- 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.
Grading Policy	Full knowledge of the theoretical and methodological concepts related to the subject, the ability to correctly reflect the results of the analysis, independent observation of the processes under study and the performance of tasks issued as part of the current, intermediate and final control (test)
Recommended materials	1. Digital Design and Computer Architecture, by David Harris, Sarah Harris. 2013. P. ISBN-13: 978-0123944245 2. Circuitry and microprocessor system, by M. Abdullayev, N. Alimova. 2022. TSTU

DETAILS OF COURSES BS IN MECHATRONICS AND ROBOTICS

Course code	DRCS3504+ DRCS3604
Course credit	10
Course description and objectives	This course introduces students to fundamental and practical knowledge of robot control systems, their design and programming.
Topic covered	The course includes the following topics: - Homogeneous transformations - Forward kinematics - Denavit-Hartenberg convention - Inverse kinematics - Jacobian matrix - Dynamic modeling - Dynamic modeling using the Lagrange-Euler method - Robotic control strategies - Trajectories - Drone systems - Robotic control applications
Grading Policy	Full knowledge of the theoretical and methodological concepts related to the subject, the ability to correctly reflect the results of the analysis, independent observation of the processes under study and the performance of tasks issued as part of the current, intermediate and final control (test)
Recommended materials	1. Robot Modeling and Control, by Mark W. Spong, Seth Hutchinson,M. Vidyasagar United States, 2020. ISBN: 9781119524045. 2. Intelligent Control of Robotic Systems, by Laxmidhar Behera, Swagat Kumar, Prem Kumar Patchaikani, Ranjith Ravindranathan Nair, Samrat Dutta, 2020. ISBN: 9781138597716

Thank you for your attention!