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MechaUZ_D.2.3_Testing and adapting_V.3



Modernization of Mechatronics and Robotics for Bachelor degree in
Uzbekistan through Innovative Ideas and Digital Technology
(MechaUZ)

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Revision History

Version	Date	Organisation	Author	Changes
1.0	14/11/2022	Polytechnic Institute of Viana do Castelo	Duarte Alves	Developed the Report of the WP2.3
2.0	25/08/2023	Andijan machine-building institute	Javlonbek Rakhmatillaev	Added student admission quota
3.0	15/10/2023	Hellenic Consulting Ltd.	Chioteris Spyridon	Added surveys regarding Development of BS program

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Approval Table

Version	Date of Approval	Deliverable Name	Approved By
1.0 2.0 3.0	15/11/2023	MechaUz_D.2.3_Testing and adapting_V.3	Project Management Board (Team members)



Abstract

This document gives a detailed description of the testing and adapting process of BS program during the lifetime of the MechaUZ project in the field of Mechatronics and robotics.

Abbreviations

Acronym	Definition
BSc	Bachelor
ECTS	European Credit Transfer and Accumulation System
EU	European Union
HEIs	Higher Education Institutions
PrCs	Partner countries
UZB	Uzbekistan
WPs	Work Packages
WP2	Work Package 2 – Curriculum development
IHU	International Hellenic University (Thessaloniki, Greece)
MHSSE	Ministry of Higher and Secondary Specialised Education System of Uzbekistan (Tashkent, Uzbekistan)
SEERC	The South-East European Research Centre (Thessaloniki, Greece)
VG TU	Vilnius Gediminas Technical University (Vilnius, Lithuania)
LiePU	Liepāja University (Liepāja, Latvia) Vidzeme University of Applied Sciences (Valmiera, Latvia)
IPVC	Polytechnic Institute of Viana do Castelo (Viana do Castelo, Portugal)
AndMI	Andijan machine-building institute (Andijan, Uzbekistan)
TTPU	Turin Polytechnic University in Tashkent (Tashkent, Uzbekistan)
FPI	Fergana Polytechnic Institute (Fergana, Uzbekistan)
TUIT	Tashkent University of Information Technology (Tashkent, Uzbekistan)
KEEI	Karshi Engineering-Economic Institute (Karshi, Uzbekistan)
TSTU	Tashkent State Technical University (Tashkent, Uzbekistan)



Table of contents

1. Overview
2. Curriculum development process
3. The process of admission quotas
4. Testing and adapting process
5. Evaluation questionnaire



1. Overview

The main aim of the MechaUZ project is to develop bachelor's degree program in the field of Mechatronics. This project comes as a solution to the need of developing the higher education capacity & offerings in Uzbekistan in the field of Mechatronics. The main objective of the program is to develop a continuous education program to train a new generation of engineers well capable of performing constructive engineering works and meeting today's technological challenges by developing a new curriculum.

Likewise, the project aims to maintain further cooperation between Higher Education Institutions (HEI) of Partner countries (PrCs) and Uzbekistan (UZB) to ensure the quality of higher education continuously. This project provides a great opportunity to involved HEIs to teach their students and train their faculty/staff internationally. Most importantly, an exemplary continuous education program in Mechatronics will be developed in Uzbekistan upon successful completion of the project.

The aims of the project will be reached through building up following objectives:

- Developing and implementing a new scheme of cooperation for university-industry links based on EU skills in Mechatronics sphere.
- Developing standards and curricula, courses, teaching methods, materials, and tools (soft skills) in the field of Mechatronics.
- Developing and implementing new courses for teachers, staff, and engineers of the enterprises.
- Training teachers from HEIs in Uzbekistan with teaching methodologies based on Mechatronics at EU partner universities.
- Developing and publishing a new generation of handbooks/manuals for the direction of Mechatronics.
- Establishing the Innovation laboratories (i-lab), Training Centre and Mechatronics Society of Uzbekistan for disseminate the results of project.
- Testing, adapting and accrediting curriculum, materials, and methods.
- Transferring the recommendations of the new model of education system to other sectors of the Uzbek economy.

The project will produce the following results (among others):

- An innovative internationally co-developed Bachelor (BSc) program in Mechatronics (as well as improved courses from other programs) that will equip graduates with the necessary skills to succeed at their future workplace.
- A cutting-edge teacher training centre & course which will become the leading facility for Mechatronics to train, enabling best practice multiplication across all universities &

[5]



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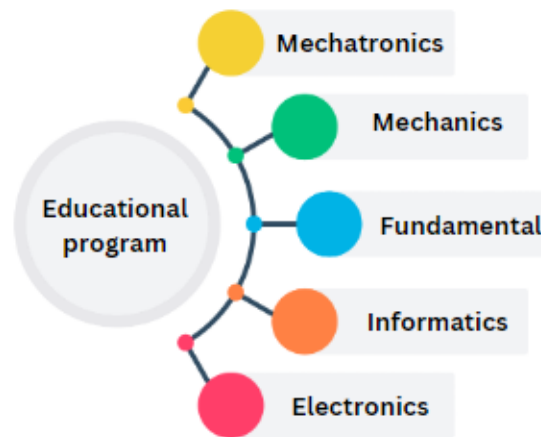
training centres from Uzbekistan - leading to internationally trained staff capable to prepare graduates for international markets.

2. Curriculum development process

The implementation of the MechaUz project included 7 work packages (WPs). All WPs of the project are coordinated by under the leader of WPs in collaboration with the International Hellenic University.

After finished the WP1: Preparation, we got the following outcomes and results:

- the project partners analyzed 52 existing mechatronics and robotics educational programs from 26 countries of the world based on the established procedure.
- It was found that there are more than 10 names of the educational program in the world, and in the end, it was recommended to name it "Mechatronics and robotics".
- Mechatronics and robotics education program will mainly consist of a set of subjects within 5 areas. The higher education institution will be able to determine the distribution of these disciplines.



- It was found that the teaching format of the educational program is based on ECTS and the 30/240 format was chosen as a recommendation.

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

- According to the studying period of the educational program, 22 (47.8%) of 56 HEIs are 3 years (one-year preparatory year is not included), 16 (34.8%) are 4 years, 4 (8.7%) was 3.5 years and 4 (8.7%) were 5 years. The 4 years form of education was chosen as a recommendation.

[6]



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Duration:	4 year
Duration:	166 weeks

The second stage of the project was the processing and development of the "Mechatronics and Robotics" educational program in WP2: Development, which was carried out under the leadership of VGTU and TSTU higher education institutions. As a result, [the qualification requirements of this educational program](#) were completely revised and approved. Based on the requirements of the reformed qualification, TSTU in collaboration with FPI and KEEI higher education institutions have modernized the curriculum of the "Mechatronics and robotics" bachelor's education program based on the recommendations and experience of VGTU, while TUIT, TTPU and AndMI higher education institutions were completely redeveloped.

As a result, the following outcomes were obtained:

- The educational program was totally modernised based on ECTS system in the field of Mechatronics and Robotics.
- Based on the approved educational program, 6 version of curriculums were developed by UZB partners.

3. The process of admission quotas

60711500 - "Mechatronics and robotics" undergraduate education program from the 2022/2023 academic year in all higher education institutions of the project have been approved, and developed curricula have begun to be put into practice. The graphs below show the acceptance rates and growth rates for each higher education institution's Mechatronics and Robotics BS program.

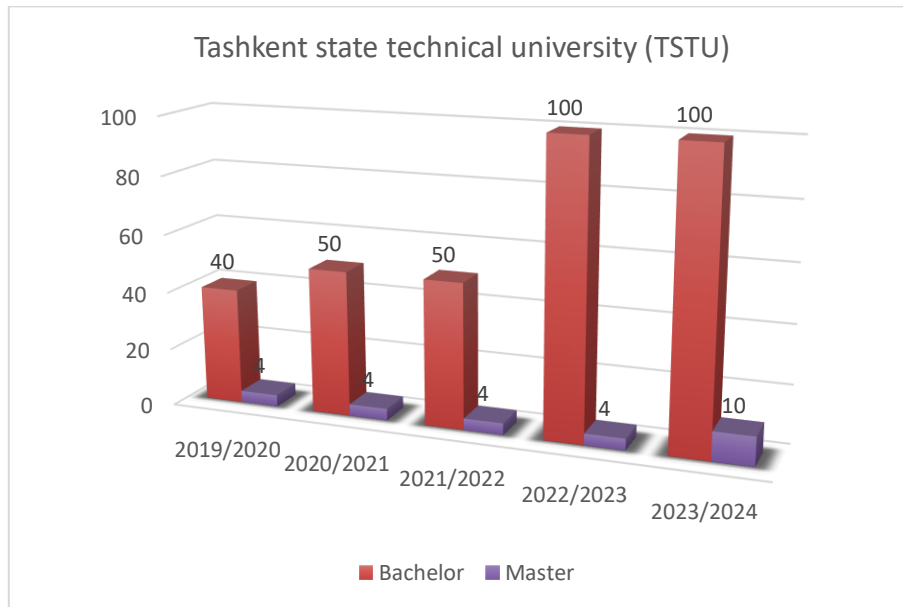
By the decision of the President of the Republic of Uzbekistan No. PQ-4947 of June 12, 2020, the decision "On the parameters of the state order for admission to higher education institutions of the Republic of Uzbekistan in the 2020/2021 academic year" was approved.

In accordance with the decision, training of personnel in the following educational areas and specialties will be launched in the higher educational institutions of the republic, based on the personnel needs of the sectors of the economy, within the framework of the ERASMUS+ CBHE projects of the European Union, starting from the 2020/2021 academic year:

- under the "MECHUZ" project: "Mechatronics and robotics" master's degree at the Andijan machine-building institute;
- "Mechatronics and robotics" bachelor degree at Fergana Polytechnic Institute.

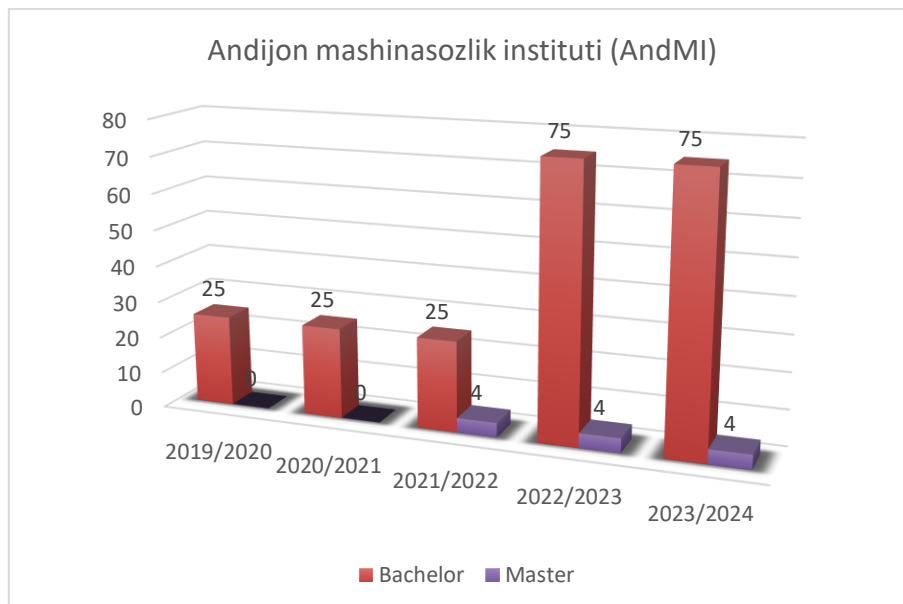


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TSTU Admission Quota Chart

The number of students admitted to the Tashkent State Technical University (TSTU) is 366, which 340 are bachelor's and 26 are master's students.

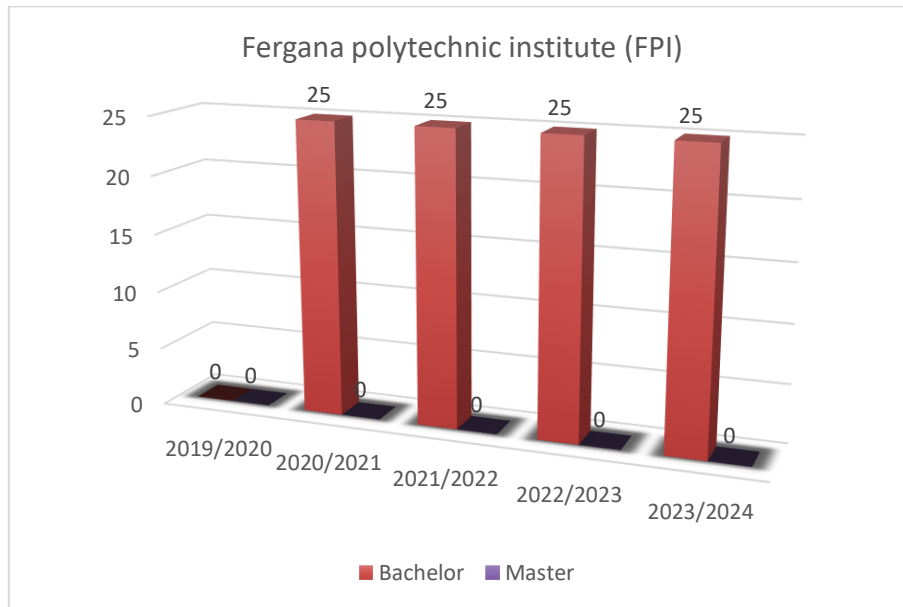


AndMI admission quota chart

The number of students admitted to Andijan machine-building institute (AndMI) is 237, which 225 are bachelor's and 12 are master's students.

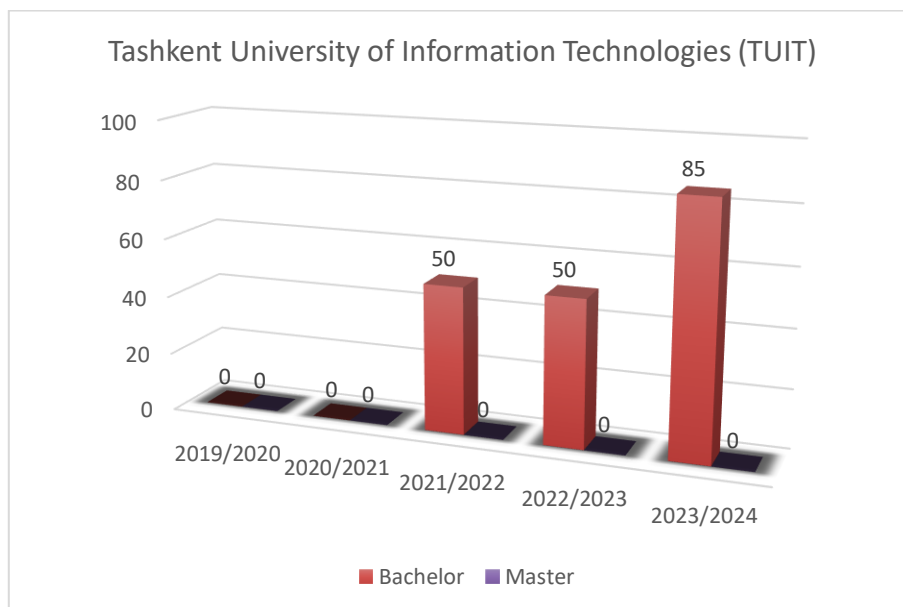


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FPI Admission Quota Chart

The number of students admitted to Fargo Polytechnic Institute (FPI) is 100, and all of them are bachelor's students.

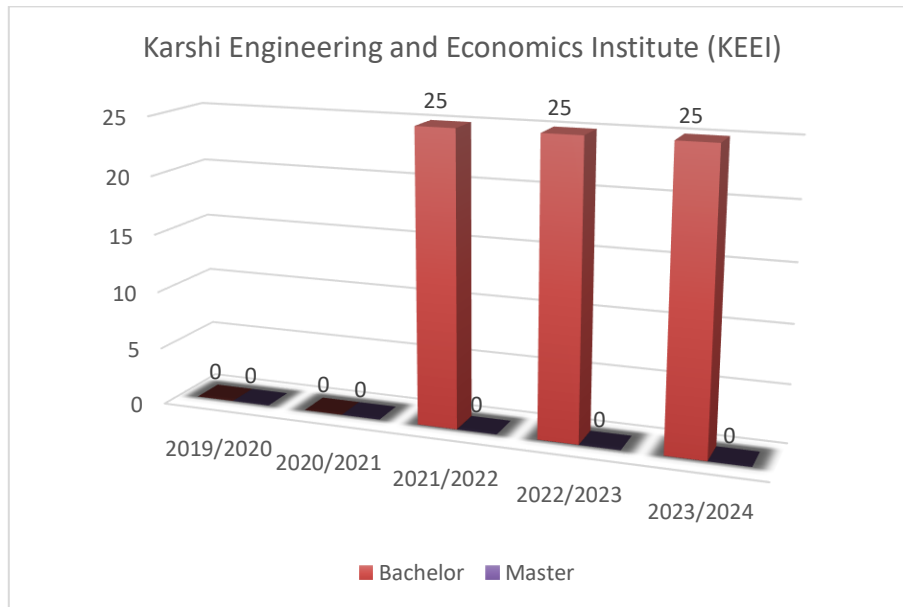


TUIT Admission Quota Chart

The number of students admitted to the higher educational institution of Tashkent University of Information Technologies (TUIT) is 185, all of them are bachelor's students.



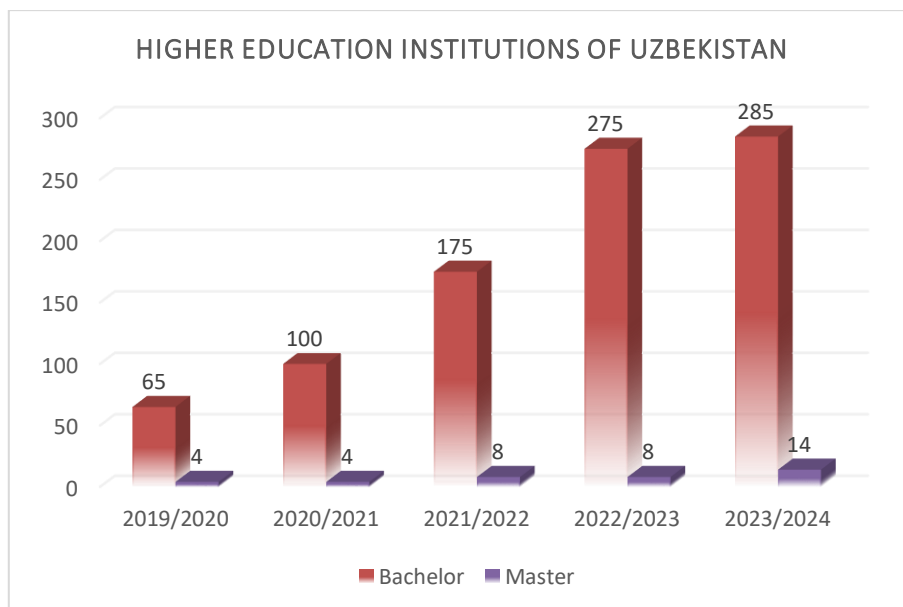
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KEEI Admission Quota Chart

The number of students admitted to the higher educational institution of Karshi Engineering and Economics Institute (KEEI) is 75, all of them are bachelor’s students.

A total of 963 students were admitted to all higher education institutions. 898 of them are bachelor’s students and 38 are master’s students.



Admission quota chart of higher education institutions of Uzbekistan

Educational and methodological support of subjects were being formed based on the educational programs formed within the framework of the project. Each partner higher [10]

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education institution of Uzbekistan developed the educational materials of at least two subjects in the Uzbek language. All created [educational materials](#) were published on the project's official website.

[11]

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4. Testing and adapting process.

Testing and adapting of curriculum, materials and methods after developed the program, starting selected courses in HEIs in Uzbekistan. Testing will be carried out by participants from all partners and realised two phases. First, courses will be tested by teachers, experts and public authorities. Second, courses will be tested by students in frame of regular teaching process. Feedback will be gained through evaluation questionnaires on results of which modifications within training curricula and courses will be done.

5. Evaluation questionnaire

Thank you for agreeing to take part in this important survey. Be assured that all the answers you provide will be kept in the strictest confidentiality.

A. Demographics Questions

1. What's your position?	
Student / Trainee	
Teaching staff / Trainer	
Academic staff / Researcher	
Administrative staff	
Engineering specialist	
Public authority	

2. Which course did you attend?	
Bachelors programme in Mechatronics	
Mechatronics new course	
Mechatronics updated Bachelor course	
Mechatronics updated Master course	
Train the Trainers course	
Central Training Center course (AndMI)	

3. What is your gender?	
Female	
Male	
Other	
Prefer not to say	

4. What is your age?	
18-24 years old	
25-34 years old	
35-44 years old	



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45-54 years old	
Over 55 years old	

5. What is your nationality?

6. What is the highest degree or level of school you have completed? If you are currently enrolled in school, please indicate the highest degree you have received.	
Less than a high school diploma	
High school degree or equivalent	
Bachelor's degree (e.g. BA, BS)	
Master's degree (e.g. MA, MS, Med)	
Doctorate (e.g. PhD, EdD)	
Other (please specify)	

7. What is your current employment status?	
Employed full-time (40+ hours a week)	
Employed part-time (less than 40 hours a week)	
Unemployed (currently looking for work)	
Unemployed (not currently looking for work)	
Student	
Self-employed	
Unable to work	
Retired	

B. Course Evaluation

8. Please, rate the following course attributes from 1 to 5.
(1=insufficient, 2=hardly sufficient, 3=reasonable, 4=good, 5=excellent)

I. Course Expectations						
Understanding of course expectations and assignments	1	2	3	4	5	n/a
The extent course covered the content you were expecting	1	2	3	4	5	n/a
II. Course Structure and Content						
Understanding of the course structure	1	2	3	4	5	n/a
Consistency of the course content with the objectives	1	2	3	4	5	n/a
Relevance of the course content	1	2	3	4	5	n/a



MechaUZ_D.2.3_Testing and adapting_V.3

Confidence level for completing the knowledge or skill presented	1	2	3	4	5	n/a
Amount of material covered	1	2	3	4	5	n/a
Balance of time between theory and practical exercise/labs	1	2	3	4	5	n/a
Size of training group	1	2	3	4	5	n/a
Enjoyment of the course	1	2	3	4	5	n/a
III. Timing						
Time allocated to cover all topics	1	2	3	4	5	n/a
Time allocated to share discussions between participants	1	2	3	4	5	n/a
Time to complete course appropriate	1	2	3	4	5	n/a
IV. Overall Experience						
Technical quality of the course materials	1	2	3	4	5	n/a
Availability of technical support	1	2	3	4	5	n/a
Confidence you feel about your knowledge on Mechatronics	1	2	3	4	5	n/a
Achievement of your personal learning goals or objectives	1	2	3	4	5	n/a
Overall assessment of course	1	2	3	4	5	n/a

9. Which aspects of the course did you find most interesting or useful?

10. Which aspects of the course did you find the least interesting or useful?

11. Would you identify three important concepts or ideas that you learned in this course?

12. What topics would you have liked to see addressed that were not covered?

13. Would you prefer to take this course online or in the classroom? Why?

14. Do you have further comments and suggestions for improving the course?

15. Would you recommend this course to your colleagues, friends, etc.?



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16. Can we contact you later?

No

Yes, here are my contact details (name, email)

As mentioned previously, as part of the evaluation questionnaire, due to its importance to the overall scope and objectives of the project, there was a distinct one regarding project target groups' perceptions (students of Engineering programs in Uzbekistan HEIs; professors and researchers of Mechanical and Computer Engineering Departments in Uzbekistan HEIs; number of professionals from industrial companies) in correlation to developed Mechatronics courses within MechaUZ project. In this questionnaire, there were 28 responses, lower number than initially scheduled; 32% were academic staff and researchers, while other 32% were students/trainees, 25% teaching staff/trainers and 11% administrative staff. Most of them (29%) attended BSc programme in Mechatronics, while 25% attended the Train the Trainers course; 18% joined Mechatronics new course and 14% the Central Training Center course (AndMI). It is worth to mention that 93% of participants were male, while most of respondents (39%) were between 25 and 34 years old, while 29% younger than 24 years old. More than 60% of participants holds a postgraduate degree (Master's or/and Doctorate) and 50% of respondents was a full-time employer.

Regarding their expectations, 79% of questionnaire participants rate as excellent the understanding of course expectations and assignments and only 5 out of 28 respondents mentioned that that these courses were non applicable; on the same pathway, 68% of participants felt that the extent course covered the content they were expecting at excellent level, even though 4 respondents rate the content as reasonable and good. Concerning course structure and content, 79% of participants rate as excellent the consistency of the course content with the objectives, while 72% of them rate as excellent the relevance of the course content; the need for incorporating more practical topics in courses was revealed out of respondents' rating on balance of time between theory and practical exercise/labs, since 61% rate it as excellent, while 18% as good. And even though, only 46% of participants is feeling confident for completing the knowledge or skill presented, when they were asked to rate the enjoyment of course, 79% of them rated as excellent (only 4% as good).

About the aspects of the course that participant found most interesting or useful, there were plenty of different answers during survey, with more indicative the ones related to practical side of course, new methods, PLC programming, IoT courses, working with sensors and actuators, application of theoretical knowledge in real-case projects, as well as, new laboratory equipment. Moreover, it is worth to mention that when participants correspondingly were asked to indicate which aspects of the course were the least interesting or useful, almost all respondents replied that there were no such aspects in the courses. And maybe, that was the main reason that all participants answered that they would recommend this course to their colleagues and friends (*"I'd wholeheartedly recommend this course to anyone interested in engineering, robotics, automation, or even just the intersection of different technical disciplines"*; *"I have already recommended"*; *"Definitely yes, I would recommend it to all interested in engineering"*).

[15]



MechaUZ_D.2.3_Testing and adapting_V.3

Finally, when participants were asked to indicate topics that would have liked to see addressed that were not covered, most of them answered that many topics were well covered; however, few answers indicate the topic of ethical and social implications of Mechatronics, digital twin technologies, HRI, projects on IoT, industrial robotics and automotive Mechatronics. Additionally, when they were asked to make any comments and suggestions for improving the courses, besides the comments mentioning that everything was well organized and more similar courses should be developed, one participant declared that *“while the technical aspects are crucial, incorporating elements of professional development and soft skills training can greatly benefit students; this can include communication skills, project management, and teamwork, which are essential for success in any engineering field”*, while other respondents mentioned the *“organization of additional online and offline courses of professors with international experience”*.