



"Ss. Kliment Ohridski " - Bitola, Technical Faculty



ELABORATE

for

Second cycle of academic studies

EXAMPTIONAK

Bitola, November 2014

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INTRODUCTION

Designing sophisticated products and equipment with high performance that would be competitive on the market, it is designer engineers possess profound knowledge of mechanics, electrical engineering, computer science, automatic control systems and of course math and physics. All these attributes define Engineer Mechatronics. Modern products such as cars, cameras, medical equipment, aircraft, etc., as well as production equipment such as 3D printers, CNC machines, industrial robots, autonomous systems, etc., are consisted of numerous mechatronic and microcontroller based modules.

Such devices set requirements before engineers to be able to combine mechanical, electrical, electronic and software subsystems using advanced scientific knowledge and Engineers.

The study program in Mechatronics introduces students to the basic components of mechatronic systems and design principles by applying mechatronics to achieve the functionality they require complex processes and systems. The courses in the study program purvey students to be able to understand the problems of research and identify opportunities for innovation entering the world of work.

The study program in Mechatronics is designed for students who plan their career in the field of product development, engineering, robotics, industrial automation, technology management, innovation, etc.

Within the TEMPUS program contract no. 158644-TEMPUS -2009-DE-JPCR, Macedonia, Montenegro and Kosovo was conducted survey and research on market needs of personnel in the field of Mechatronics. The results clearly showed that industrial entities have a strong interest of executives who have interdisciplinary knowledge in the field of mechanical engineering, electronics and computer technology, from Mechatronics. Also performed a detailed analysis of the content of study programs in Mechatronics at several universities in order to obtain conclusions about the structure and composition of joint regional, interdisciplinary studies in Mechatronics. Most of the findings are incorporated in the preparation of curricula presented in this document.

1. Map of the higher education institution

Name of higher education fixed	"Ss. Kliment Ohridski " - Bitola Technical Faculty - Bitola
seat	St. "Macedonian phalanx" 33, Bitola
Type of higher education fixed	Higher education institution - Faculty
Data on founder	Assembly of the Republic of Macedonia
Data last accreditation	April 2012
Study and research Areas that have been obtained accreditation	-Mashinstvo -Elektroenergetski systems -Soobrakjajno - Transportation Engineering -Grafichko Engineering -Mehatronika (program 3 + 2) -Industrial management
Units within the higher education institution	At the University "Ss. Clement Ohridski "in Bitola 12 units (11 faculties and 1 Institute)
Study programs realized in unit extension of activity with introduction of new study programs	University study programs - 7 Expert studies - 4 University study programs in the first and second cycle <ul style="list-style-type: none"> - mechanical engineering - Engineering for Environmental and working environment - Traffic - Transportation Engineering - Traffic and Transport Systems technology - Traffic and Transport Telematics - power systems - graphic Engineering - industrial management - Mechatronics (3 + 2) Expert studies of first cycle <ul style="list-style-type: none"> - Energy and Environmental Protection environment (three years) - Road transport (three years) - Electrical Engineering, Power Engineering and electronics (three years) Specialist studies of second cycle in Expertise accidents in road traffic
Data space allocated for performing and teaching research	Technical Faculty - Bitola has usable area of 5.583,44 m ² , and that: <ul style="list-style-type: none"> • amphitheater 1 227,00 m2 • lecture 19 1613,42m2 • laboratories 9 598,24 m2 • computer center 3 310,00 m2 • multimedia center 1 150,00 m2 • workshops 4 24 64 m2 • library with reading room 2 13,95 m2 • cabinets 34 545,10 m2

	<ul style="list-style-type: none"> • administration 7 201,52 m2 • hall meetings 1 58,91 m2 • space for social activity 1 30,00 m2 • warehouses 1 53,50 m2 • boiler room 1 46,52 m2 • tel. cent. and room for maintenance 1 233,22 m2 • halls, staircases and toilets 1 1686,72m2
Data equipment performing and teaching research	<p>Computer and merno-regulciona equipment used in educational and scientific research process is organized into 8 laboratories and computer classrooms.</p> <ol style="list-style-type: none"> 1. thermo technical laboratory 2. The laboratory machine materials 3. Laboratory of Electrical Energy Systems 4. Laboratory for motor vehicles 5. Electrical Lab 6. Laboratory for Electronics and Electricity. measurements 7. Laboratory Multimedia 8. laboratory mechatronic 9. Electric Laboratory. machinery <ol style="list-style-type: none"> 1. Computer Classroom 304 2. Computer 305 teachers 3. Computer Classroom 307 4. Computer Classroom 408 5. Computer Classroom 413 <p>In the study provides a detailed list of equipment to be used in the study program.</p>
Number of students who obtained accreditation	465 (first cycle) + 140 (second cycle)
Number of students (first enrolled)	197 (first cycle) + 33 (second cycle)
Number of persons in the educational-scientific, scientific and teaching positions	<p>60 teachers of which:</p> <ul style="list-style-type: none"> • 25 full professors • 18 associate professors • 13 docents
Number of people in staff positions	4 assistants
Internal mechanisms security and control quality of studies	<ul style="list-style-type: none"> • Development of curricula • Realization of the teaching process • Student Assessment • Making undergraduate and master's thesis • Evaluate the quality of teaching by students with questionnaires at the end of each semester for each subject • Evaluate the quality of the study program by therefore, students in the award of diploma and • Other procedures concerning resources and logistics of the teaching process
Data last conducted external evaluation fixed	

2. General descriptors of qualifications for each cycle under the Decree on the national framework of higher education qualifications

2.1. Knowledge and understanding

- Demonstrates knowledge and understanding of the field of mechatronics which builds on the first cycle, using methodologies appropriate for solving complex issues, both systematically and creatively, it provides a basis or opportunity for originality in developing and / or applying autonomous ideas a research context.
- Ability to use an expanded and deepened knowledge.
- Showing a high level of professional competence in the fields of mechanical engineering, electronics and automation, regulation and management of technological processes, Computer Science and Informatics
- Possesses knowledge of one or more subject areas in given scientific fields, based on the most renowned international research in the field of mechatronics.

2.2. Applying knowledge and understanding

- Ability to critically, independently and creatively solve problems with some originality in new or unfamiliar environments within multidisciplinary context related to mechatronics.

2.3. Making judgment

- The ability to synthesize and integrate knowledge.
- Ability to deal with complex issues systematically and creatively, make sound judgments even on incomplete or limited information, but that include personal, social and ethical responsibilities in the application of their knowledge and judgments.
- Ability to assess and selection of scientific theories, methodologies, tools and general skills in the subject areas, and establish a new analysis and solutions on a scientific basis

2.4. Communication skills

- Ability to communicate their conclusions and recommendations with the argumentation and rationale underpinning these, to both specialist and the lay people clearly and unequivocally.
- Taking considerable responsibility for the collective results; running and initiating activities.

2.5. Learning skills

- Ability to identify personal need for further knowledge and ability for independent and autonomous activity in acquiring new knowledge and skills in social terms.
- Ability to take responsibility for further professional development and improvement.

3. Specific descriptors of qualifications that determine learning outcomes for individual study program under the Decree on the national framework of higher education qualifications

3.1. Knowledge and understanding

- Shows a profound knowledge and understanding of the laws of the areas of Mechatronics that the student has chosen to develop special expertise, such as simulation of mechatronic systems, intelligent sensor-actuator systems, the automotive industry, Embedded and Real Time Control Systems, robots, mikroelektromehanichki systems - MEMS intelligent computer assisted manufacturing systems, vibration control.
- Systematically and creatively explains and discusses current research and development, concepts, principles and theories relating to the chosen field of specialization in the field of mechatronics.
- Keep up with the latest developments in selected areas of mechatronics, which provides a basis for originality in developing and applying autonomous ideas in a research context.

3.2. Applying knowledge and understanding

- Examine, analyze, develop, optimize and manage the process of developing various mechatronic systems, specific to various industries, with special emphasis on modern concepts with input intelligently manage and control real-time mehatronichkite systems, using knowledge of microelectronics, and hardware in the loop concepts, in part that the student has chosen to develop special research.
- Independently and creatively proposes solutions to problems with some originality and consistent application of interdisciplinary and multidisciplinary approach.
- Apply innovative methods to solve unfamiliar and incompletely defined problems, using advanced mathematical, scientific, IT and engineering expertise.

3.3. Making judgment

- Synthesize and integrate knowledge in areas related to Mechatronics the area which the student chooses darazvie special expertise : simulation of mechatronic systems, intelligent sensor-actuator systems, systems in the automotive industry, Embedded and Real Time Control Systems, robots, mikroelektromehanichki systems - MEMS intelligent computer assisted manufacturing systems, vibration control.
- Critically evaluate data, adopt proper assessment and inferences, even on the basis of incomplete or limited information, using current computer technology
- Explores the application of new and emerging technologies, innovations and positive experiences in Mechatronics

3.4. Communication skills

- Clearly and unambiguously present the findings, facts and research results before professional audiences, and shows the ability to adjust the style and form of expression before unskilled audience.

- Effectively participate in multidisciplinary teams as team leader or as an expert.
- Assumes significant responsibility for both individual and collective results, initiate and lead activities in the field of Mechatronics which improved.

3.5. Learning skills

- Identify personal need for further education and independent action for self gain new knowledge and skills in the wider social context.
- Ability to take responsibility for continuous individual learning in a private setting in the field of Mechatronics in which the student has chosen to develop special expertise.

4. Decision on adoption of the study program of Teaching and Scientific Council of Faculty of Technical Sciences - Bitola.

The session of the Academic-Scientific Council of Faculty of Technical Sciences - Bitola held on 18.11.2014 yr., Was reviewed and a decision no. 02.-874/26, adopted the proposal to introduce a study program in Mechatronics second cycle studies. The decision was given in addition.

5. Decision on adoption of the study program by the Senate of the University "Ss. Kliment Ohridski "- Bitola

The session of the Senate of the University "Ss. Kliment Ohridski "- Bitola, held on _god., By decision no., it was approved study program in Mechatronics second cycle studies. The decision was given in addition.

6. Scientific research area, field and field, a part of the study program

According to the International Standard Classification of Education - ISCED and the International Fraskatieva classification study program in Mechatronics belongs in the scientific area of technical and technological sciences (2).

In accordance with the interdisciplinary and multidisciplinary character mechatronics is defined as synergistic integration of fields: Engineering (214), electrical engineering (202), electronics and equipment (204) Computer Science and Informatics (212), regulation and management of technological processes (218) .

7. Type of study program (university or vocational studies)

This study program enables students to perform activities in industry, engineering, science and higher education in the business world and society at large, through the development and application of acquired scientific knowledge and achievements. According to the said contribution, the study program has the character of university studies.

8. Education level (first or second cycle)

The study program is second-cycle university studies according to the model 4 + 1.

9. Purpose and justification for the study program

Technical Faculty in Bitola continuously monitor changes in the environment and its activities are adapted to the requirements resulting from those changes. Faced with the challenge to provide current, modern and quality curricula, which also represents a strategic objective, this educational institution for decades to successfully meet the challenges of the new economy and thus make a valuable contribution to the development of the University "Ss. Kliment Ohridski" - Bitola.

The purpose of this study program is to train future staff with basic scientific knowledge and practical experience in the areas that are part of mechatronics, mechanical engineering, electrical engineering, electronics, control and management systems, and computer science. The strong integration of mechanical and electrical components in various products requires professionals who think in a different way, that is new, integrated philosophy in developing new products in various branches of industry.

A great advantage of the Technical Faculty in Bitola is the fact that there are already mechanical and electrical department, so the available staff fully cover the proposed curriculum.

These analyzes are derived from surveys and research conducted on industrial entities in the first phase of this project, presented the DRIMS workshop in Ohrid (July 2010) showed that the industry is highly interested in this staff has interdisciplinary knowledge and skills. Despite ochekuvaio interest in employing such staff in the development of new products, the poll came the conclusion that industrial entities are exceptionally interested in the use of such personnel and the maintenance of expensive and sophisticated equipment, which is no less significant. All these findings only confirm the justification and the real need to introduce study program in mechatronics.

10. Age and duration of semesters of study program and credits that the student acquires

The study program of the second cycle is a period of 1 year or 2 semesters.

11. ECTS credits that the student acquires

For successful completion of the second cycle students should acquire 60 credits.

12. Method of financing

Since the study program will be implemented with the existing human, technical and spatial resource owned by the Technical Faculty Bitola, it will not imply additional financial burdens on the budget of the Republic of Macedonia.

13. Terms of enrollment

Conditions and criteria for registration are defined by competition for enrollment of students in the first year of graduate studies at the University "Ss. Kliment Ohridski" - Bitola.

14. Information on continuing education

After completion of the second cycle of university studies, the student can continue his education at the third cycle studies.

15. Determined ratio between compulsory and optional subjects, with a list of compulsory subjects, list of electives and defined way of selecting objects

The subjects in the second cycle of university studies degree program in Mechatronics are categorized into three main groups, according to amendments to the Law on Higher Education (Official. Gazette no. 17 of 11.02.2011)

и namely: core courses, electives that students independently chosen from all subjects at the university unit

and elective courses that students self-select in the list

free electives offered by each unit of the University individually. According to the legislation (Law on Amendments to the Higher Education Act no. 103 of 19.08.2008.) Faculty will perform clinical teaching for 10% of compulsory and 10% from elective courses in each academic year.

Table 1. Determined ratio between compulsory and optional subjects

type	Number of spin.	credits	rate
required items	4	24	50%
Practical work			
Electives - TFB	2	12	37.5%
Master thesis	1	18	
Electives - UKLO	1	6	12.5%
	Total:	60	100%

The second cycle includes a total of 4 compulsory subjects, which the student has provided 24 loans. The number of electives that students independently selected from among all subjects, represented by the University unit was 2, which the student has provided 12 loans, while the number of elective courses that students independently choose from the list free electives, proposed by each unit of the University in particular, is 1 and they provide the student has 6 credits. Thesis carries 18 credits.

Table 2. List of compulsory courses

code	Title case	Kadar who will participate in realization of teaching	ECTS loans
MEH901	And embedded systems the real-time	Assoc. Dr. Mile Petkovski Vonr. prof. Dr. Mitko Kostov	6
MEH902	Signal Processing	Vonr. prof. Dr. Mitko Kostov OK. prof. Dr. Cvetko Mitrovski	6
MEH903	Control vibration	OK. prof. Dr. Tale Geramitcioski, Vonr. prof. Dr. Ljupco Trajchevski	6
MEH1001	Identification systems	Vonr. prof. Dr. Gordana Janevska Assoc. Dr. Mile Petkovski Assoc. Dr. Elena Kotevska	6

In accordance with current regulations student has the right to independently choose 30% of the cases represented the unit and 10% of the subjects proposed by each unit of the University individually. Table 3 is a sample list of electives that directly deepen students' knowledge of mechatronics and / or a wider interest in the study program.

Table 3. Draft list of electives

code	Title case	Kadar who will participate in realization of teaching	ECTS loans
MEH904	Discrete systems management	OK. prof. Dr. Cvetko Mitrovski Assoc. Dr. Mile Petkovski	6
MEH905	microprocessors and microcontrollers	OK. prof. Dr. Cvetko Mitrovski Assoc. Dr. Mile Petkovski	6
MEH1002	Systems for real time and hardware in the loop	Assoc. Dr. Mile Petkovski Vonr. prof. Dr. Gordana Janevska	6
MEH1003	Mikroelektromehanichki Systems - MEMS	Vonr. prof. Dr. Ratka Neshkovska OK. prof. Dr. Elizabeth Bahtovska	6
MEH1004	modern production technology	OK. prof. Dr. Stojanche Nysse Vonr. prof. Dr. Ljupco Trajchevski	6
MEH1005	Selected chapters from the field of CAD / CAM technologies	OK. prof. Dr. Stojanche Nysse OK. prof. Dr. Tale Geramitcioski	6

Depending on the workload of teachers, student needs and demands of the industry before each semester faculty publishes a list of active electives and their schedule by semesters.

Also, given the fact that this study program is designed for the needs of industry, provided continuous modernization program depending on the requirements of industrial entities.

Distribution of subjects per semester:

	code	semester 9		fund	ECTS
1	MEH901	Embedded systems and real-time control		2 + 2	6
2	MEH902	Signal Processing		2 + 2	6
3	MEH903	Control vibration		2 + 2	6
4		Optional TFB (MEH904, MEH905)		2 + 2	6
5		optional UKLO			6

	code	semester 10		fund	ECTS
1	MEH1001	Identification systems		2 + 2	6
2		Optional TFB (MEH1002, MEH1003, MEH1004, MEH1005)		2 + 2	6
3		Master thesis			18

Table 4. List of recommended optional subjects of broad interest to stud.programa

Title case

1. Electric cars and vehicles
2. Intelligent management of distribution networks and micro
3. FEM in engineering practice
4. Mathematical modeling of electrical machines and devices
5. Methods of experimental studies in mechanical constructions
6. Digital image processing
7. Multirezoluciska analysis and reconstruction of signals

The student is obliged to prepare and publicly defend master's thesis, which is valued at 18 credits.

The previous one can conclude that the structure of the study program in terms of the representation of compulsory and optional subjects, in accordance with the Law on Higher Education and the amendments to the Higher Education Act and Rules Compatibility bias. Also, the projected fund classes for lectures, exercises and additional activities per week, within this study program is in compliance with the Law on Higher Education.

16. Data on the space provided for the implementation of the study program

Technical Faculty - Bitola has a usable area of 5.583,44 m², including:

amphitheater - 1	227,00 m ²
lecture - 19	1613,42 m ²
Laboratories - 9	598,24 m ²
computing center - 3	310,00 m ²
Multimedia Center - 1	150,00 m ²
workshops - 4	245,64 m ²
library with reading room - 2	113,95 m ²
cabinets - 34	545,10 m ²
Administration - 7	201,52 m ²
room sessions - 1	58,91 m ²
space for social activity - 1	30,00 m ²
warehouses - 1	53,50 m ²
boiler room - 1	46,52 m ²
phone. Plant and facility maintenance	233,22 m ²
halls, corridors, staircases and toilets	1686,72 m ²

According to the attached Technical Faculty - Bitola has capacities and facilities for the teaching of this kind of study.

17. List of equipment intended for the realization of the study program

Fakuletot is equipped with modern technical means that allow the application of modern teaching methods. Following is an overview of the laboratories used to carry out the practical work of the study program in Mechatronics.

Mechatronics Laboratory It is designed for teaching in subjects in the field of mechatronics, robotics, autonomous mobile devices and microprocessor based systems. It is equipped with modern equipment procured under the TEMPUS - DRIMS project. Following is a list of the more significant equipment installed in the laboratory.

No. Piece. code			NI Academic Site License - Department Teaching, with 2 years Standard Service Program, includes LabVIEW Core, Controls and Embedded, and Signal Processing and Communications Software:
1	15	779051-01	USB-6008 12-bit, 10kS / s Multifunction I / O and NI-DAQmx Software
2	1	781157-01	cDAQ-9174, CompactDAQ chassis (4 slot USB)
3	1	780495-01	NI WLS-9163 IEEE 802.11b / g Wireless Carrier for C Series Modules and NI-DAQmx Driver Software
4	2	779471-01	USB Single Module Carrier for C Series Modules (see USB-9162 webpage for module compatibility)
5	1	779781-01	NI 9219 4 Ch-Ch Isolated, 24-bit, $\pm 60V$, 100S / S Univeral AI Module
6	1	779521-01	NI 9237 4-Ch 50 kS / s per Channel, 24-Bit Bridge Analog Input Module
7	1	779013-01	NI 9201 8-Channel, 12-Bit, ± 10 VDC, 500 kS / s, Analog Input Module
8	1	779680-01	NI 9234, 24-Bit Sigma-Delta ADCs, 51.2 kS / s Max Samp Rate, 4 Input Simultaneous, Software Selectable IEPE and AC / DC Coupling, Anti- Aliasing Filters, 102 dB Dynamic Range
9	1	780918-01	cRIO-9114 8-slot Virtex-5 LX Reconfigurable Chassis for 50 CompactRIO
10	1	780718-01	CRIO-9022, Real-Time PowerPC Embedded Controller for CompactRIO, 533 MHz, 2 GB storage, 256 MB DRAM
11	1	779003-01	NI 9474 8-Channel 24 V, 1 us, High-Speed Sourcing Digital Output Module
12	1	779006-01	NI 9481 4-Ch 30 VDC (2 A), 60 VDC (1 A), 250 VAC (2 A) EM Form A SPST Relay Module
13	1	779009-01	NI 9423 8-Channel 24 V, 1 us, High-Speed Sinking Digital Input Module
14	1	779012-01	NI 9263 4-Channel, 16-Bit, ± 10 V, 100 kS / s per Channel, Analog Output Module
15	1	779351-01	NI 9401 8-Channel, 100 ns, TTL Digital Input / Output Module
16	1	779519-01	NI 9205 32-Channel ± 10 V, 250 kS / s, 16-Bit Analog Input Module
17	1	779781-01	NI 9219 4 Ch-Ch Isolated, 24-bit, $\pm 60V$, 100S / S Univeral AI Module
18	1	781068-01	NI 9207 8-ch (current) + 8-ch (voltage) combo module, 24bit with 50 / 60Hz rejection
19	1	781093-01	NI PS-15 Power Supply, 24 VDC, 5 A, 100-120 / 200-240 VAC Input
20	1	779006-01	NI 9481 4-Ch 30 VDC (2 A), 60 VDC (1 A), 250 VAC (2 A) EM Form A SPST Relay Module
21	1	780465-01	sbRIO-9632 400 MHz Controller and 2M Gate FPGA, Multifunction
22	1	40301.230.25	LEGO FLL Robot Set NXT 2011
23	2	40301.230.063	LEGO MINDSTORMS Education NXT-Basic-Set (9797)
24	2	40301.230.077	LEGO MINDSTORMS Education Resource-Set 2.0 for 9797
25	1	40307.230.001	TETRIX Education Basic-Set
26		EASY MAX PRO	EASY MAX Pro Development boards for Texas instruments TIVA C Series Microcontrollers

27	1	33521A	Agilent -Channel Function / Arbitrary Waveform Generator, 30 MHz sine, square, triangle, ramp, pulse, noise, sin (x) / x, exponential rise & fall, cardiac, DC volts, arbitrary, AM, FM, PM, SK, PWM 16 bits, 250 MSa / s, 1 million points, optional 16 million points LAN, USB, GPIB, Power supply: 230 V
28	2	E3630A	Agilent Multiple Output Bench Power Supplies 15W, 20V, 2.5A, 3 outputs 35W, DC Bench Power Supply, Triple Output
29	2	U1242B	Agilent Handheld Digital Multimeter, 10000 counts, dc & ac voltage, dc & ac current, resistance, frequency, continuity with beeper, capacitance, temperature, switch counter, harmonic ratio, dual and differential temperature Accuracy: 0.09%, Speed: 7 rdgs / s, Power supply: 230 V
30	1	34401A	Agilent Industry Standard Digital Multimeter, 6½ Digits: dc & ac voltage, dc & ac current, 2 & 4 wire resistance, frequency & period, continuity, diode test Accuracy: 0.0035%, Speed: 1000 rdgs / s, Connectivity: GPIB, RS232, IntuiLink SW Power supply: 230 V
31	1	DSO1002A	Agilent Portable oscilloscope Bandwidth: 60 MHz, Sample rate: 2 GSa / s, Channels: 2, Max Memory Depth: 20 kpts Power supply: 230 V

Laboratory of Electronics and measurement acquisition systems It is designed to implement the laboratory and practical classes on subjects of these fields. It is equipped with 8 positions for 2-3 students and has numerous measurement and control equipment which perform exercises (Personal computers, Multifunctional Card "Advantek" type PCI-1710L ..., Lemilica and bolts SET, Mulimetri, current clamps with Clamp Multimeter , oscilloscope MA-4048, regulation tpafotRN 110 / 4A, resistant inductive and

capacitive decades rotamers Type 102, stroboscope March 3903 It is equipped with several computer work stations for simulation and analysis of electronic circuits and measurement acquisition systems. Also lab licensed the software package for simulation and analysis of el. circuits, instruments and systems National Instruments LabView.

Laboratory of Electrical Engineering and Electrical Measurement It is designed to implement the laboratory and practical classes on subjects from basics of electrical engineering and electrical measurements. It is equipped with 8 positions for 2-3 students and has numerous measurement and control equipment which perform exercises (function generators, rectifiers, oscilloscopes, regulation transformers, resistance, inductive and capacitive decades voltage sources, multimeters, viskonaponski probes, wattmeters, potentiometers, etc.).

Laboratory of electrical machines It is designed for testing and analysis electrical machines. Equipped with single-phase transformers, three phase transformers, regulation-phase transformers, three-phase Variable Transformer, single-phase and three-phase asynchronous motors, power meters, measuring instruments, ammeters, voltmeters and wattmeters analog and digital, measuring current clamps, gauge the electromagnetic field at low frequencies instrument for measuring the electromagnetic field at very high frequencies. Please equipment performed a series of laboratory exercises to familiarize students with the practical aspects of analysis and testing of electrical machines. Also laboratory possesses software packages for simulation and analysis of electric machines.

18. Syllabi with information in accordance with Article 4 of this Regulation (Annex no. 3)

Appendix

19. List of teaching staff with data referred to in Article 5 of this Regulation (Annex no. 4)

In the teaching of the study program in Mechatronics will participate the following teachers:

First	OK. prof. Dr. Cvetko Mitrovski	
Second	OK. prof. Dr. Tale Geramitcioski	
Third	OK. prof. Dr. Elizabeth Bahtovska	
4th	OK. prof. Dr. Stojanche Nysse	
5th	Vonr. prof. Dr. Gordana Janevska	
6th	Vonr. prof. Dr. Ratka Neshkovska	
7th	Vonr. prof. Dr. Ljupco Trajchevski	
8th	Vonr. prof. Dr. Mitko Kostov	
9th	Assoc. Dr. Mile Petkovski	
10th	Assoc. Dr. Elena Kotevska	

20. A statement from the teacher for giving consent to participate in the teaching in certain subjects of the study program

Appendix

21. Consent of the higher education institution for teacher participation in the realization of the study program

Appendix

22. Information on the number of students enrolling in the first year of the study program

The number of students enrolling for the second cycle in the first year of the study program is determined by a competition to enroll students for the second cycle of the University "Ss. Kliment Ohridski " - Bitola.

23. Information provided mandatory and additional literature

In the course programs of study program (Appendix 3) are given detailed information about the literature used in their implementation. In addition, the Faculty has its own library with a rich book fund of over

6,000 domestic and foreign monographs and numerous domestic and foreign professional magazines that fully cover mandatory and additional literature on the subjects of the study program. Of particular importance are the titles that are part of the government's project for translation of 1,000 professional and scientific books for higher education, the best and most universities in the United States, England, France and Germany. Some of them are from the area and were selected in collaboration with all state and private universities in the country, and used the world's most respected educational institutions. Additionally within TEMPUS - DRIMS project was conducted supplying quite contemporary literature in the field of mechatronics and written materials and lectures by the participants of the project.

List of purchased books in the field of mechatronics within DRIMS project:

First	Actuators , Hartmut Janocha (Editor), Springer Verlag, Berlin (2004)
Second	Hands-On Introduction LabVIEW for Scientists and Engineers , John Essick, 2009
Third	Hydraulic Components Design and Selection , Fitch EC, Hong IT., BarDyne Inc, 2008
4th	Intelligent Sensor Systems , J. Brignell and N. White, Revised Ed., IOP, 1996
5th	Introduction to Mechatronics and Measurement Systems , David G. Alciatore, Michael B. Hstand., McGraw-Hill, ISBN 007-125407-2, Boston
6th	Introduction to Robotics: Mechanics and Control , Craig, JJ, 3rd ed. Pearson Education, 2005 (2nd ed. 1989, 1st ed. 1986)
7th	LabVIEW 2009 Student Edition , Robert H. Bishop, 2010 Pearson Prentice
8th	LabVIEW for everyone , J. Travis, Jim Kring, 3 Edition, 2007 Pearson
9th	Mechatronic Systems, Control, Logic and Data Acquisition , Bishop, R., (Ed.), CRC Press Taylor & Francis Group, LLC, 2008, ISBN 978-0-8493-9260-3
10th	Mechatronic Systems, Sensors and Actuators , Robert H. Bishop (Ed.), CRC Press, ISBN 978-0-8493-9258-0, Boca Raton (2008)
11th	Mechatronic Systems: Fundamentals , Isermann, R., Springer, 2005, ISBN 1852339306
12th	Mechatronics - An Integrated Approach , Clarence W. de Silva, CRC Press, ISBN 0-8493-1274-4, Boca Raton (2005)
13th	Mechatronics: Electronic Control Systems in Mechanical Engineering , Bolton, W., 4th Edition, Pearson, 2008, ISBN 978-0132407632
14th	Mechatronics , Cetinkunt, S., John Wiley & Sons, Inc., 2007, ISBN-13 978-0-471-47987-1
15th	MEMS - a practical guide to design, analysis and applications , Jan G. Korvink, Oliver Paul, Springer, ISBN 3-540-21117-9, Heidelberg (2006)
16th	MEMS Mechanical Sensors , Stephen Beeby, Graham Ensell, Michael Kraft, Neil White, Artech House, Boston (2004)
17th	Mobile Robotics: A practical introduction , Nehmzow, U., Springer Verlag, Heidelberg, SBN: 1-85233-173-9
18th	Numerical simulation of mechatronics sensors and actuators , Manfred Kaltenbacher Springer Verlag, Berlin (2004)
19th	Pneumatic Drives: System Design, Modelling and Control , Beater P., Springer, 2007

20.	Principles of Robot Motion: Theory, Algorithms, and Implementation , Howie C. [et al.]. MIT Press, 2005.
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List of items that are prepared teaching materials.

Introduction to mechatronics	Milena Djukanovic, UCG Jovana Jovanova, Nake Babamov, UKIM
Sensors, measurement and signal conditioning	Zlatko Petreski, UKIM Petar Vukoslavcevic, UCG
Actuators in mechatronics	Agron Pajaziti, UNI-PR Aleksandar Markovski, UKLO
Mechatronic systems	Viktor Gavriloski, UKIM, With support of Gunter Starke, APS-ECM
Modeling and simulation of mechatronic	Gordana Janevska, UKLO, With support of Martin Kozek, TUWien
Embedded and real time control systems	Mile Petkovski, Ilija Jolevski, UKLO
MEMS	Milena Djukanovic, UCG, With support of Klaus Peter Kaemper, ACUAS
Intelligent sensor actuator systems	Agron Pajaziti, UNI-PR Zoran Mijanovic, UCG
Computer integrated manufacturing	Aleksandar Markoski, Andrijana Bocevska, UKLO, Shaban Buza, UNI-PR, With support of Todor Neshkov,
Intelligent manufacturing systems	Aleksandar Markoski, Andrijana Bocevska, UKLO Shaban Buza, UNI-PR, With support of Todor Neshkov,
Mobile systems	Arbnor Pajaziti, UNI-PR Darko Danev, UKIM
Vibration control	Viktor Gavriloski, UKIM, With support of Martin Kozek, TUWien
Real time systems and hardware in the loop	Mile Petkovski, UKLO, With support of Martin Kozek, TUWien
Robotics	Arbnor Pajaziti, UNI-PR Marina Mijanovic Markus, UCG

24. Information on website

www.tfb.edu.mk

25. Professional or academic title which confers the student after completion of the study program

Students nakrajotnauniverzitetskite studiid
second cycle (with completion of all exams ending defense of the thesis), and meeting the required minimum of 60 European points, acquire title "Master of Technical Sciences in the field of Mechatronics" or **"Master of Technical Sciences in the field of Mechatronics "**.

26. Activities and mechanisms to develop and maintain the quality of teaching

- control the quality of teaching in accordance with the legislation and ensuring the active role of students in the evaluation of the quality of programs;
- interviewing students for an indication of possible improvement of teaching and the organization of studies;
- monitoring the professional engagement of the student after its completion, communicating with students who have completed studies for insight into the applicability of knowledge and skills acquired in their studies.
- self-evaluation
- external evaluation
- taking appropriate measures to improve the quality of study programs, teaching literature and teachers.

27. Results derived from self-evaluation (November 2012)

Based on the process of self-evaluation can be concluded that the Faculty shows a trend of constantly upgrading and improving the educational process and scientific research. Namely, in terms of most value to the research criteria can be concluded that the faculty show positive results.

SWOT analysis

- Technical Engineering as the largest unit of the University "Ss. Kliment Ohridski" - Bitola, is a very important institution of higher education in the southwestern region of Macedonia, because it is the only country that educates personnel from six different technical disciplines.
- Study programs are modern and adapted to the European Credit Transfer System, a relatively flexible, compatible with the requirements of the labor market, and some of them are in English.
- The items provided to all study programs of the first cycle of Technical Sciences completely covered with teachers employed in Technical Sciences. The structure of teachers profession and age is satisfactory. Due to the small number of suitable assistants, teachers of some subjects and perform exercises. All assistants are in the final phase with the preparation of their doctoral dissertations.
- All subjects of all study programs of the second cycle of Faculty of Technical Sciences are covered with teachers employed in Technical Sciences. Teachers fully cover teaching, including lectures and exercises.
- For all study programs of first and second cycle of Faculty of Technical Sciences - Bitola literally apply ECTS in the educational process in accordance with the Rules for the implementation of ECTS at the University "Ss. Kliment Ohridski".
- The Technical Faculty in Bitola attention is paid to the involvement and active participation of students in the activities. As early phases of drafting of project proposals and the preparation of the application to take account of student involvement and consistent implementation of the planned activities. As can be seen from the data on the mobility of students they are very actively involved in various TEMPUS, INTERREG, ERASMUS, DAAD and other projects under which realized numerous tours abroad, and financial support for student residence provides from project budgets.
- The study programs at the Technical Faculty in Bitola devised and manufactured in accordance with international experiences. The active participation of staff from the Technical Faculty in many Tempus projects enable gaining extensive experience and knowledge of study programs in the same and related areas at other universities from different countries. In most

cases these findings are incorporated into the curriculum and in the last few years, new study programs are made in order in the fastest way possible in the future to achieve the ultimate goal: a common internationally recognized degrees (double degree and joint degree) with various renowned universities worldwide that already is cooperation at different levels.

- The number of publications of the teaching staff at the Technical University, included in first and second cycle is satisfactory and suggests fruitful activity tends to increase significantly in the recent period.
- During the samoevaluacijata faculty organized several scientific conferences, workshops and scientific meeting, and a greater number of guest lectures by foreign lecturers, in which participated representatives of the Technical Faculty.