DESCRIPTION OF THE COURSE

Name of the course: **Product Design for Automated Production**	Code: **MIA01**	Semester: **1**
Type of teaching: Lectures (L) Laboratory work (LW) Course project (CP)	Hours per semester: L – 45 hours LW – 30 hours	Number of credits: **5**

LECTURER:

Prof. DSc. Ivo Malakov (FME), tel. 965 37 00, e-mail: ikm@tu-sofia.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM:

Compulsory subject from the curriculum for training of students to obtain Master's degree, specialty "Industrial Automation", Professional orientation 5.1 Mechanical Engineering, Field 5. Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE:

Methods for systematic design of products for automated manufacturing are studied. Special attention is devoted to the product's design manufacturability with consideration to automated production, assembly, and disassembly. Methods and means for orientation and palletizing of parts are studied with consideration to automated production and the resulting design requirements. Particular attention is given to methods for evaluation and optimization of the design solutions, and to methods for building optimal size ranges.

DESCRIPTION OF THE COURSE:

The students will obtain theoretical and practical knowledge related to the design of state-of-the-art products for automated production.

PREREQUISITES:

Knowledge is required in the field of "Engineering drawings", "Mechanics", "Strength of materials", "Machine elements", "Theory of machines and mechanisms".

TEACHING METHODS:

The course will be taught through up to date technical means. Laboratory work is conducted in a specialized laboratory equipped with the necessary research stands. The course projects are developed according to individual assignments.

METHOD OF ASSESSMENT:

Exam in the form of open test with an approbated unified examination and evaluation system, using a point system. The final mark takes into consideration results from laboratory work, and the developed course work.

INSTRUCTION LANGUAGE: Bulgarian.

BIBLIOGRPHY:

1.Гановски, В. С. и др. Технически средства за механизация и автоматизация на сглобяването. Справочник, С., Техника, 1990.

2.Гановски, В. С. и др. Механизация и автоматизация на монтажните процеси в машиностроенето. С., Техника, 1986.

3.Замятин, В.К. Технология и оснащение сборочного производства машиноприборостроения. Справочник. М., Машиностроение, 1995.

4. Pahl, G., W. Beitz. Konstruktionslehre. Springer- Verlag, Berlin, 2000.

5. Boothroyd, G., P. Dewhurst Design for Assembly. Salford University Industrial Center Ltd, 1992.

6. Hesse, St. Rationalization of Small workpiece feeding. Blue Digest on Automation, Festo AG&Co, 2000.

DESCRIPTION OF THE COURSE

Name of the course: **Design of Industrial Automated Systems**	Code: **MIA02**	Semester: **1**
Type of teaching: Lectures (L) Laboratory work (LW) Course project (CP)	Hours per semester: L – 45 hours LW – 30 hours	Number of credits: **5**

LECTURERS:

Prof. DSc. Ivo Malakov (FME), tel. 965 37 00, e-mail: ikm@tu-sofia.bg
Assist. Prof. PhD Velizar Zaharinov (FME), tel. 965 27 63, e-mail: vzaharinov@tu-sofia.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM:
Compulsory subject from the curriculum for training of students to obtain Master's degree, specialty "Industrial Automation", Professional orientation 5.1 Mechanical Engineering, Field 5. Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE:
The aim of the subject is for the students to learn the methods for design and analysis of industrial automated systems (IAS), to obtain skills for searching effective solutions, as well as possibilities for lowering the costs for building IAS.

DESCRIPTION OF THE COURSE:
At the end of training the student will: know the structure, functions, main building components and environment of state-of-the-art IAS; know and apply the main methods for systematic design of IAS; can evaluate and optimize design solutions; .can apply yhe main methods for engineering analysis of numerically controlled positioning systems; know the main standards related to the building of robotic production cells.

PREREQUISITES: Mechanics, Computer science, Strength of materials, Machine elements, Theory of machines and mechanisms, Electrical engineering and electronics.

TEACHING METHODS:
The course will be taught through up to date technical means. Laboratory work is conducted in a specialized laboratory equipped with the necessary research stands. The course projects are developed according to individual assignments.

METHOD OF ASSESSMENT: Exam in the form of open test with an approbated unified examination and evaluation system, using a point system. The final mark takes into consideration results from laboratory work, and the developed course work.

INSTRUCTION LANGUAGE: Bulgarian.

BIBLIOGRPHY:
1. Малаков, И. Нискостойностна автоматизация на дискретното производство, С., Издателство на ТУ – София, 2012.
2. Витлиемов, В.Д. Автоматизация и роботизация на дискретното производство. Русе, Печатна база при РУ "А. Кънчев", 1998.
3. Alavudeen, A., Venkateshwaran, N. Computer Integrated Manufacturing. PHI Learning, 2008.
4. Groover, M. Automation, Production Systems, and CIM. Pearson Higher Education Inc., 2015.
5. Hesse, St., Schunk. Robotergreifer. Hanser Velag, Muenchen, 2004.
6 Krafter, R., T. Chenielewski, M. Negiu. Robotic Engineering, Prentice Hall International Inc., 1989.
7. Pahl, G., W. Beitz. Konstruktionslehre. Springer- Verlag, Berlin, 2000.

DISCRIPTION OF THE COURSE

Name of the course: **Modern Technologies in Automated Machine-building Productions**	Code: **MIA03**	Semester: **1**
Type of teaching: Lectures (L) Laboratory work (LW)	Hours per semester: L - 30 hours LW - 30 hours	Number of credits: **4**

LECTURER:

Assoc. Prof. PhD Stiliyan Nikolov (FME), tel. 965 3765,   e-mail: st_nikolov2@tu-sofia.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM:

Compulsory subject from the curriculum for training of students to obtain Master's degree, specialty "Industrial Automation", Professional orientation 5.1 Mechanical Engineering, Field 5. Technical Sciences.

AIMS OF THE COURSE:

The aim of the course "Modern Technologies in Automated Machine-building Productions" is to acquaint students with those used in modern automated production systems computer and production technologies.

DISCRIPTION OF THE COURSE:

Modern computer technologies and systems used in industrial automation are considered. Non-traditional machine-building technologies and the possibilities for their automation when used in automated production systems are presented.

PREREQUISITES

Knowledge of computer technology, automation and robotization of production is required.

TEACHING METHODS

Lectures are presented using modern technical means. Laboratory classes are held in computer labs equipped with the necessary hardware and software. Support materials have been prepared for lectures and laboratory exercises. Serious attention is paid to the individual student activities.

METODS OF ASSESSMENT:

The exam is at the end of the I semester and including solving theoretical test.

INSTRUCTION LANGUAGE: Bulgarian.

BIBLIOGRAPHY:

1. Николов Ст., CAD/CAM/CAE системи в машиностроенето, издателство на ТУ- София, ISBN 978-619-167-412-1, 2020.
2. Тодоров Г., К. Камберов, Виртуално инженерство CAD/CAM/CAE&PLM Технологии, Дайрект Сървисиз ООД, ISBN 978-691-7171-15-0, 2015.
3. Nof Sh. Y., Springer Handbook of Automation, Springer, ISBN: 978-3-540-78830-0, 2009.
4. Helmi A., Manufacturing Technology Materials, Processes, and Equipment, CRC Press, ISBN-13: 978-1-4398-9708-9, 2012.
5. Patrick Kaltjob, Mechatronic Systems and Process Automation Model-Driven Approach and Practical Design Guidelines, CRC Press, ISBN-13: 978-0-8153-7079-6, 2018.

DESCRIPTION OF THE COURSE

Name of the course: **Control and Monitoring in Industrial Automated Systems**	Code: **MIA04**	Semester: **1**
Type of teaching: Lectures (L) Laboratory work (LW)	Hours per semester: L - 30 hours LW - 15 hours	Number of credits: **3**

LECTURER:

Prof. Eng. Pancho Tomov, PhD (FME), tel. 965 2980, e-mail: pkt@tu-sofia.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM:
Compulsory subject from the curriculum for training of students to obtain Master's degree, specialty "Industrial Automation", Professional orientation 5.1 Mechanical Engineering, Field 5. Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE:
After completing the course students must know the basic principles, functional characteristics and features of the control of mechatronic systems for industrial applications. The applications of programmable controllers in the control and synthesis of control structures based on them. To acquire basic knowledge of the types of control devices, the possibilities and the scope of application in industrial systems. Be able to analyze and optimize existing control systems and monitor process parameters.

DESCRIPTION OF THE COURSE:
Main topics: Main functional characteristics and features of control of mechatronic systems for industrial applications., Purpose of control systems, types according to the feedback, characteristics, adaptive control systems; Structural synthesis of control devices. Types and choice of synthesis method. Real Properties of Elements and Structural Constraints in Synthesis, Comparison of Functionality of Programming Languages Step Diagram (LD), Functional Block Diagram (FBD), Sequential Function Diagram (SFC), Instruction List (IL), Structured Text (ST), Integrated development environments.

PREREQUISITES:
The course is based on the acquired knowledge in the bachelor's degree.

TEACHING METHODS:
Lectures delivered using slides in electronic format, Integrated development environments computer and multimedia projector.

METHOD OF ASSESSMENT: Written exam.

INSTRUCTION LANGUAGE: Bulgarian.

BIBLIOGRAPHY:
1. Томов П. Системи за наблюдение и управление в мехатрониката София 2019, Издателство на ТУ-София, ISBN 978-954-397-396-4.
2. Zelio Logic Programming Guide, 10. 2017 Schneider Electric.
3. Tomov P., D. Chakarsky, , Automation and automated mechatronic systems in machinery, Publisher: Scholars' Press, 2019, ISBN 978-613-8-91286-6.
4. Dorf, R. Modern Control Systems. Addison Wesley Publishing Company, 2002.
5. Golten, J. Control System Design and Simulation. McGraw-Hill, 2006.
6. https://support.industry.siemens.com/cs/document/24891816/logo!soft-comfort-v5-0!?dti=0&pnid=13613&lc=en-WW.

<div align="center">**DESCRIPTION OF THE COURSE**</div>

Name of the course: **Computer Modelling and Research of Automated Systems**	Code: **MIA05**	Semester: **1**
Type of teaching: Lectures (L) Laboratory work (LW) Course work (CW)	Lessons per week: L - 30 hours LW - 15 hours	Number of credits: **3**

LECTURER:

Assoc. Prof. PhD Vanya Georgieva, (FME), tel. 965 3767, e-mail: vgeorgieva@tu-sofia.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM:
Compulsory subject from the curriculum for training of students to obtain Master's degree, specialty "Industrial Automation", Professional orientation 5.1 Mechanical Engineering, Field 5. Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE:
The aim of the KMRAS training is to acquaint students with the main aspects of modelling automated systems and to deepen and expand their knowledge in the field of effective use of engineering research in their design and construction.

DESCRIPTION OF THE COURSE:
The main methods for modeling and simulation of automated systems are considered. Special attention is paid to the development of mathematical models and research in order to reproduce the behavior of real automated systems.

PREREQUISITES:
Basic knowledge of modelling and simulation is required to perform effective design and research of various automated systems.

TEACHING METHODS:
The lectures are conducted with the help of modern multimedia equipment. The laboratory exercises are conducted in a special laboratory with modern computer equipment and software for design and research of automated systems. Course assignments are developed on individual assignments.

METHODS OF ASSESSMENT:
A written examination is conducted according to an approved unified system for testing and assessment, using a point system. The test is open-ended, including questions from lecture material and laboratory work. When forming the final grade, the results of the course work are also taken into account.

INSTRUCTION LANGUAGE: Bulgarian.

BIBLIOGRAPHY:
1. Тодоров Н., Д. Чакърски, Автоматизация на проектирането в машиностроенето. С., Техника, 1994.
2. Чакърски и к-в. Промишлени роботи, роботизирани технологични модули и системи. Част 1 и Част 2. МП "Издателство на ТУ-София", 2003.
3. Agam Kumar Tyagi, MATLAB and Simulink for Engineers, Oxford University Press, 2012.
4. Mikell P Groover, Automation, Production Systems, and Computer-Integrated Manufacturing - 4th Edition, ISBN -13: 978013349961-2, ISBN-10: 013349961-8, USA, 2015.

<p style="text-align:center">**DISCRIPTION OF THE COURSE**</p>

Name of the course: **Monitoring and Maintenance of Automated Manufacturing Systems**	Code: **MIA06**	Semester: **1**
Type of teaching: Lectures (L) Laboratory work (LW)	Hours per semester: L – 30 hours LW – 15 hours	Number of credits: **3**

LECTURERS:

Assoc. Prof. Eng. Reneta Dimitrova, PhD (FME), tel. 965 3846, rkd@tu-sofia.bg
Assist. Prof. Eng. Slav Dimitrov, PhD (FME), tel. 965 3846, e-mail: sbd@tu-sofia.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM:
Compulsory subject from the curriculum for training of students to obtain Master's degree, specialty "Industrial Automation", Professional orientation 5.1 Mechanical Engineering, Field 5. Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE:
The aim of the training is through system approach and practical experience to provide students with basic knowledge and skills related to troubleshooting of electrical and software problems. The problems could be identified manually or using special software products.

DISCRIPTION OF THE COURSE:
Overview of special software products and introduction to the basic approaches in electrical circuits of industrial automation. The focus is on monitoring of problems and their troubleshooting in the industrial systems. Sufficient time is ensured for introduction and monitoring of different processes in real environment. Analysis of mistakes done during the implementation of the basic products and modernization according to the needs of automated systems.

PREREQUISITES:
Informatics, Electrical Engineering Principles, Electronic Engineering, Automation of Discrete Production Engineering, Programming of Automated Manufacturing Machines, Electronic Regulation and Control Devices and Systems

TEACHING METHODS:
Lectures are presented using modern technical equipment. Laboratory classes are held in computer labs equipped with the necessary hardware and software.

METODS OF ASSESSMENT:
The course ends with exam; the assessment is formed by the result from the test. The exam is written and includes a test with open ended questions. The duration of the exam is two school hours.

INSTRUCTION LANGUAGE: Bulgarian.

BIBLIOGRAPHY:
1. Dimitrova R., G. Hadjikosev. Guide for laboratory exercises in automation of discrete production. IC of TU - Sofia, 2013.
2. Ganovski, VS. Automation and automated lines in mechanical engineering. Sofia, Technique, 1976.
3. Nikolov St. and c., Complex automation of discrete production, IC of TU - Sofia, ISBN 978-619-167-153-3, 2020.
4. Ganovski, V., D. Damiyanov, D. Chakarski. Basics of automation, robotics and GAPS. Sofia, Technique, 1994.

DISCRIPTION OF THE COURSE

Name of the course: **Digitalization of Manufacturing Processes**	Code: **FaMIA01**	Semester: **1**
Type of teaching: Lectures (L) Laboratory work (LW)	Hours per semester: L - 30 hours LW - 30 hours	Number of credits: **4**

LECTURERS:

Assoc. Prof. Eng. Stiliyan Nikolov, PhD (FME), tel. 965 3865,
e-mail: st_nikolov2@tu-sofia.bg
Assist. Prof. Eng. Slav Dimitrov, PhD (FME), tel. 965 3846, e-mail: sbd@tu-sofia.bg
Assist. Prof. Eng. Dimitar Totev (FME), tel. 965 3846, e-mail: dkt@tu-sofia.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM:
Facultative subject from the curriculum for training of students to obtain Master's degree, specialty "Industrial Automation", Professional orientation 5.1 Mechanical Engineering,
Field 5. Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE:
The aim of the training is through simulation of processes and practical experience to provide students with basic knowledge and skills related to digitalization of processes and data collection.

DISCRIPTION OF THE COURSE:
Overview of special software products and introduction to the basic approaches for digitalization of processes. The focus is on introduction of different programing environments for data storage and implementation of simulation environments for preventive and diagnostic activities. Sufficient time is ensured for development of "MES" systems. Implementation of system approaches for preventive diagnostics and protection of machines and equipment from outages.

PREREQUISITES:
Informatics, Electrical Engineering Principles, Electronic Engineering, Automation of Discrete Production Engineering, Programming of Automated Manufacturing Machines, Electronic Regulation and Control Devices and Systems

TEACHING METHODS:
Lectures are presented using modern technical equipment. Laboratory classes are held in computer labs equipped with the necessary hardware and software.

METODS OF ASSESSMENT:
The course is with continuous assessment; the assessment is formed by results of the practical work and an essay on related topic.

INSTRUCTION LANGUAGE: Bulgarian.

BIBLIOGRAPHY:
1. Dimitrova R., G. Hadjikosev. Guide for laboratory exercises in automation of discrete production. IC of TU - Sofia, 2013.
2. Ganovski, VS. Automation and automated lines in mechanical engineering. Sofia, Technique, 1976.
3. Nikolov St. and c., Complex automation of discrete production, IC of TU - Sofia, ISBN 978-619-167-153-3, 2020.
4. Ganovski, V., D. Damiyanov, D. Chakarski. Basics of automation, robotics and GAPS. Sofia, Technique, 1994.

DISCRIPTION OF THE COURSE

Name of the course: **Computer Programming of CNC Machines and Industrial Robots**	Code: **MIA07**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW) Course project (CP)	Hours per semester: L - 30 hours LW - 30 hours	Number of credits: **4**

LECTURER:

Assoc. Prof. PhD Stiliyan Nikolov (FME), tel. 965 3765,   e-mail: st_nikolov2@tu-sofia.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM:
Compulsory subject from the curriculum for training of students to obtain Master's degree, specialty "Industrial Automation", Professional orientation 5.1 Mechanical Engineering, Field 5. Technical Sciences.

AIMS OF THE COURSE:
The aim of the course "Computer Programming of CNC Machines and Industrial Robots" is to acquaint students with the methodology and tools for programming CNC machines and industrial robots, using computer systems. These will enable them to develop control programs for CNC machines and industrial robots used in the automated productions.

DISCRIPTION OF THE COURSE:
The basic principles and stages of work in the use of various software packages for computer programming of CNC machines, industrial robots and other automation equipment with programmable control are discussed.

PREREQUISITES:
Basic knowledge of programming CNC machines and industrial robots, automation and robotization of production is required.

TEACHING METHODS:
Lectures are presented using modern technical means. Laboratory classes are held in computer labs equipped with the necessary hardware and software. The theme of course project is related to the study of the course material and requires students to independently solve specific practical problem. Support materials have been prepared for lectures and laboratory exercises. Serious attention is paid to the individual student activities.

METODS OF ASSESSMENT:
The exam is at the end of the II semester and including solving theoretical test.

INSTRUCTION LANGUAGE: Bulgarian.

BIBLIOGRAPHY:
1. Николов Ст., CAD/CAM/CAE системи в машиностроенето, издателство на ТУ- София, ISBN 978-619-167-412-1, 2020.
2. Тодоров Г., К. Камберов, Виртуално инженерство CAD/CAM/CAE&PLM Технологии, Дайрект Сървисиз ООД, ISBN 978-691-7171-15-0, 2015.
3. Хаджикосев Г., Автоматизирани производствени системи, ISBN 978-954-438783-9, издателство на ТУ-София, 2009.
4. Nof Sh. Y., Springer Handbook of Automation, Springer, ISBN: 978-3-540-78830-0, 2009.

DISCRIPTION OF THE COURSE

Name of the course: **Structure, Functions and Application of Remote Control Systems**	Code: **MIA08**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW)	Hours per semester: L – 30 hours LW – 30 hours	Number of credits: **4**

LECTURERS:

Prof. Eng. Pancho Tomov, PhD (FME), tel. 965 3763, e-mail: pkt@tu-sofia.bg
Assist. Prof. Eng. Slav Dimitrov, PhD (FME), tel. 965 3846, e-mail: sbd@tu-sofia.bg
Assist. Prof. Eng. Dimitar Totev (FME), tel. 965 3846, e-mail: dkt@tu-sofia.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM:
Compulsory subject from the curriculum for training of students to obtain Master's degree, specialty "Industrial Automation", Professional orientation 5.1 Mechanical Engineering, Field 5. Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE:
The aim of the training is through system approach and practical experience to provide students with basic knowledge and skills related to configuration and usage of remote control systems. Implementation of methodology for monitoring of buildings and equipment.

DISCRIPTION OF THE COURSE:
Overview of special software products and introduction to the basic approaches in implementation of information and monitoring systems. The focus is on different applications for implementation of remote control systems. Utilization of different remote systems and cloud spaces for data storage and data comparison. Sufficient time is ensured for work with hardware products for monitoring of basic processes.

PREREQUISITES: Informatics Electrical Engineering Principles, Electronic Engineering, Automation of Discrete Production Engineering, Programming of Automated Manufacturing Machines, Electronic Regulation and Control Devices and Systems

TEACHING METHODS:
Lectures are presented using modern technical equipment. Laboratory classes are held in computer labs equipped with the necessary hardware and software.

METODS OF ASSESSMENT:
The course ends with an exam, the assessment is formed by the results from the test with a weighting factor of 0.3, practical part with a weighting factor of 0.3 and solving a problem with a weighting factor of 0.4. The exam is written and includes a test with open ended questions and practical part. In the exam are included practical examination and solving of problems. The duration of the exam is two school hours.

INSTRUCTION LANGUAGE: Bulgarian.

BIBLIOGRAPHY:
1. Dimitrova R., G. Hadjikosev. Guide for laboratory exercises in automation of discrete production. IC of TU - Sofia, 2013.
2. Ganovski, VS. Automation and automated lines in mechanical engineering. Sofia, Technique, 1976.
3. Nikolov St. and c., Complex automation of discrete production, IC of TU - Sofia, ISBN 978-619-167-153-3, 2020.
4. Ganovski, V., D. Damiyanov, D. Chakarski. Basics of automation, robotics and GAPS. Sofia, Technique, 1994.

<p style="text-align:center">**DESCRIPTION OF THE COURSE**</p>

Name of the course: **Computer Methods for Optimization of Automated Production Systems**	Code: **MIA09**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW) Course work (CW)	Lessons per week: L – 30 hours LW – 30 hours	Number of credits: **4**

LECTURER:

Assoc. Prof. PhD Vanya Georgieva, (FME), tel. 965 3767, e-mail: vgeorgieva@tu-sofia.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM:
Compulsory subject from the curriculum for training of students to obtain Master's degree, specialty "Industrial Automation", Professional orientation 5.1 Mechanical Engineering, Field 5. Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE:
Aim of the course in CMOAPS is to acquaint students with the computer methods for parametric and structural optimization of automated production systems, which are most widely used in industrial automation.

DESCRIPTION OF THE COURSE:
The methods for optimization of the parameters and structures of automated production systems and selection of a competitive variant during their construction are considered, as well as the possibilities for increasing the productivity and reliability of operating and newly designed automated production systems.

PREREQUISITES: Basic knowledge of the use of computer equipment and the principles of operation of automated production systems, for their effective design and selection of the optimal variant for their construction.

TEACHING METHODS:
Lectures delivered using modern multimedia technology. The laboratory exercises are conducted in specialized laboratories in the presence of the necessary computer equipment and software, consolidating and expanding the acquired knowledge in the lectures. Course assignments are developed on individual assignments.

METHODS OF ASSESSMENT:
A written exam is conducted according to an approved unified system for testing and assessment, including questions from the lecture material and laboratory exercises. When forming the final grade, the results of the course work are also taken into account.

INSTRUCTION LANGUAGE: Bulgarian.

BIBLIOGRAPHY:
1. Гановски Вл., Ил. Бояджиев, Л. Клочков. Автоматични линии. Учебник. Печатна база ВМЕИ, София, 1989 г.
2. Чакърски Д., В. Георгиева, Ив. Янакиев, Ръководство за упражнения по дисциплината „Автоматизация на проектирането", ISBN 945-438-440-5, ТУ- София, 2004.
3. Mikell P Groover, Automation, Production Systems, and Computer-Integrated Manufacturing - 4th Edition, ISBN -13: 978013349961-2, ISBN-10: 013349961-8, USA, 2015.
4. Sven Apel, Don Batory, Christian Kästner, Gunter Saake. Feature-Oriented Software Product Lines, Springer-Verlag Berlin Heidelberg, 2013.

DISCRIPTION OF THE COURSE

Name of the course: **Design of Special Mechatronic Devices and Systems**	Code: **MIA10**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW) Course work (CW)	Hours per semester: L – 30 hours LW – 30 hours	Number of credits: **4**

LECTURER:

Assoc. Prof. Eng. Reneta Dimitrova, PhD (FME), tel. 965 3846, rkd@tu-sofia.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM:
Compulsory subject from the curriculum for training of students to obtain Master's degree, specialty "Industrial Automation", Professional orientation 5.1 Mechanical Engineering, Field 5. Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE:
The aim of the training is through a systematic approach to give students the basic knowledge and skills related to the requirements for the construction of special devices and systems in terms of design, technological and organizational aspects of design and the main stages of creating special devices and systems.

DISCRIPTION OF THE COURSE:
The prerequisites and ways for improvement of the special devices and systems, as well as their elements are considered. The emphasis is on a systematic approach in the design of special devices and systems. The respective place of the principles and methodologies for design of special devices and systems, as well as of the organization of their design, production and implementation is also given. The ways to increase the efficiency in the design of special devices and systems are analyzed.

PREREQUISITES: Design and CAD, Machine elements, Introduction to the Design Process in Mechatronic Systems, Automation of discrete production.

TEACHING METHODS:
Lectures are presented using modern technical means. Laboratory classes are held in computer labs equipped with the necessary hardware and software.

METODS OF ASSESSMENT:
The course ends with an exam, the assessment is formed by two components: assessment of course work, set at the beginning of the semester with a weighting factor of 0.3 and evaluation of the exam test with a weighting factor of 0.7. The exam is written and includes the solution of a theoretical test, which tests the student's knowledge and ability to apply what he has learned in solving specific tasks. The duration of the exam is two school hours.

INSTRUCTION LANGUAGE: Bulgarian.

BIBLIOGRAPHY:
1. Ganovski, VS, IK Boyadzhiev, TD Neshkov, Likov TS.. Mechanization and automation of assembly processes in mechanical engineering. S., Technique, 1986.
2. Dimitrova R., G. Hadjikosev. Guide for laboratory exercises in automation of discrete production. IC of TU - Sofia, 2013.
3. Malakov, I. Low-cost automation of discrete production. ISBN 978-954-438-799-0, TU Publishing House - Sofia, 2009.
4. Chakarski D. and c. Complex automation of discrete production. IC of TU - Sofia, 2010, 2015 and 2020.

DISCRIPTION OF THE COURSE

Name of the course: **Configuration and Programming of PLC**	Code: **MIA11.1**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW)	Hours per semester: L – 30 hours LW – 15 hours	Number of credits: **3**

LECTURERS:

Prof. Eng. Pancho Tomov, PhD (FME), tel. 965 3763, e-mail: pkt@tu-sofia.bg
Assist. Prof. Eng. Slav Dimitrov, PhD (FME), tel. 965 3846, e-mail: sbd@tu-sofia.bg
Assist. Prof. Eng. Dimitar Totev (FME), tel. 965 3846, e-mail: dkt@tu-sofia.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM:
Optional subject from the curriculum for training of students to obtain Master's degree, specialty "Industrial Automation", Professional orientation 5.1 Mechanical Engineering, Field 5. Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE:
The aim of the training is through system approach and practical experience to provide students with basic knowledge and skills related to configuration, implementation of variables and program code for programmable logic controllers. Implementation of the program code and special functions is done in special programming environments.

DISCRIPTION OF THE COURSE:
Overview of special software products and introduction to the basic approaches in programing of logic controllers. The focus is on introduction of different controllers, configuration of systems and implementation of program code. Sufficient time is ensured for introduction of different processes and practical tasks.

PREREQUISITES:
Informatics Part I, Electrical Engineering Principles, Electronic Engineering, Automation of Discrete Production Engineering, Programming of Automated Manufacturing Machines, Electronic Regulation and Control Devices and Systems

TEACHING METHODS:
Lectures are presented using modern technical equipment. Laboratory classes are held in computer labs equipped with the necessary hardware and software.

METODS OF ASSESSMENT:
The course is with continuous assessment; the assessment is formed by results of the practical work and an essay on related topic.

INSTRUCTION LANGUAGE: Bulgarian.

BIBLIOGRAPHY:
1. Dimitrova R., G. Hadjikosev. Guide for laboratory exercises in automation of discrete production. IC of TU - Sofia, 2013.
2. Ganovski, VS. Automation and automated lines in mechanical engineering.
Sofia, Technique, 1976.
3. Nikolov St. and c., Complex automation of discrete production, IC of
TU - Sofia, ISBN 978-619-167-153-3, 2020.
4. Ganovski, V., D. Damiyanov, D. Chakarski. Basics of automation, robotics and GAPS.
Sofia, Technique, 1994.

DESCRIPTION OF THE COURSE

Name of the course: **Industrial Networks**	Code: **MIA11.2**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW)	Hours per semester: L - 30 hours LW - 15 hours	Number of credits: **3**

LECTURER:

Prof. Eng. Pancho Tomov, PhD (FME), tel. 965 2980, e-mail: pkt@tu-sofia.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM:
Optional subject from the curriculum for training of students to obtain Master's degree, specialty "Industrial Automation", Professional orientation 5.1 Mechanical Engineering, Field 5. Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE:
After completing the course students must know the basic principles, functional characteristics and features of basic network topologies and protocols in industrial communications at different hierarchical levels - TCP/IP, Industrial Ethernet, PROFIBUS, CAN, as well as the functional features of communication "master-slave" in mechatronic systems. The connection between the Internet and industrial communication is considered, as well as the tendencies in the future development of the industrial networks.

DESCRIPTION OF THE COURSE:
Main topics: Basic principles and organization in building computer networks Classification. Network protocols TCP/IP protocol. Definition of industrial network, analysis of compliance with computer networks, Basic network topologies in industrial communications. Protocols - PROFIBUS, CAN. Industrial Ethernet definitions, principle of operation Network topologies - Bus, Ring, Star, Extended star. Connection between the Internet and industrial communication. Future development of industrial communications as a means of remote access to various local control modules, which can be from different manufacturers and allow access through standard automation protocols.

PREREQUISITES:
The course is based on the acquired knowledge in the bachelor's degree.

TEACHING METHODS:
Lectures delivered using slides in electronic format, computer and multimedia projector.

METHOD OF ASSESSMENT: Written exam.

INSTRUCTION LANGUAGE: Bulgarian.

BIBLIOGRAPHY:
1. Industrial Network Basics: Practical Guides for the Industrial Technician, by Gary D Anders, 2014.
2. Practical Industrial Data Communications, Deon Reynders, Steve Mackay, Steve Mackay, 2004 Elsevier Ltd.
3. How Does Modbus Communication Protocol Work?, By Wally Gastreich, 2018.
4. https://www.st.com/resource/en/application_note/cd00004273-lin-local-interconnect-network-solutions-stmicroelectronics.pdf.
5. https://www.newark.com/pdfs/techarticles/introToLIN.pdf.
6. https://www.quantil.com/content-delivery-insights.

DESCRIPTION OF THE COURSE

Name of the course: **Machine Vision Systems**	Code: **MIA12.1**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW)	Hours per semester: L – 30 hours LW – 15 hours	Number of credits: **3**

LECTURERS:

Assoc. Prof. PhD Stiliyan Nikolov (FME), tel. 965 3765, e-mail: st_nikolov2@tu-sofia.bg
Assist. Prof. PhD Velizar Zaharinov (FME), tel. 965 2763, e-mail: vzaharinov@tu-sofia.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM:
Optional subject from the curriculum for training of students to obtain Master's degree, specialty "Industrial Automation", Professional orientation 5.1 Mechanical Engineering, Field 5. Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE:
Aim of the course is to introduce the students to methods, techniques, software and hardware tools, used in the field of machine vision, and applied to problems from the field of industrial automation.

DESCRIPTION OF THE COURSE:
The students will obtain theoretical and practical knowledge related to industrial automation systems using machine vision – their design, maintenance and operation.

PREREQUISITES:
Knowledge is required in the field of programming, linear algebra and analytic geometry, and automated control systems.

TEACHING METHODS:
The course will be taught through up to date technical means. Laboratory work is conducted in laboratory equipped with computer workstations, and the necessary hardware and software.

METHOD OF ASSESSMENT:
End-of-term written examination on theoretical issues and practical examination of the students' skills on applying computers for solving engineering assignments.

INSTRUCTION LANGUAGE: Bulgarian.

BIBLIOGRPHY:
1. Davies, E. (2012) Computer & Machine Vision: Theory, Algorithms, Practicalities, Fourth Edition, Elsevier, ISBN: 978-0-12-386908-1.
2. Dickmanns, E. (2007) Dynamic Vision for Perception and Control of Motion, Springer, ISBN: 978-1-84628-637-7.
3. Vernon, D. (1991) Machine Vision: Automated Visual Inspection and Robot Vision, Prentice Hall, ISBN: 0-13-543398-3.
4. Florczyk, S. (2005) Robot Vision, Wiley-VCH, ISBN: 3-527-40544-5.
5. Solomon, J. (2015) Numerical Algorithms: Methods for Computer Vision, Machine Learning, and Graphics, CRC Press, ISBN-13: 978-1-4822-5189-0.

DISCRIPTION OF THE COURSE

Name of course: **Control of Mechatronic Devices and Systems**	Code: **MIA12.2**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW)	Hours per semester: L – 30 hours LW – 15 hours	Number of credits: **3**

LECTURERS:

Assoc. Prof. Eng. Reneta Dimitrova, PhD (FME), tel. 965 3846, rkd@tu-sofia.bg
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Technical University of Sofia

COURSE STATUS IN THE CURRICULUM:
Optional subject from the curriculum for training of students to obtain Master's degree, specialty "Industrial Automation", Professional orientation 5.1 Mechanical Engineering, Field 5. Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE:
The aim of the training is through a systematic approach to give students the basic knowledge and skills related to the requirements for the management of special devices and systems in terms of design, technological and organizational aspects of management and the main stages of programming special devices and systems.

DISCRIPTION OF THE COURSE:
The prerequisites and ways for improvement of the special devices and systems, as well as their elements are considered. The emphasis is on a systematic approach to the management of special devices and systems. The respective place of the principles and methodologies for management of special devices and systems, as well as of the software for management development is given. The ways to increase the efficiency in the management of special devices and systems are analyzed.

PREREQUISITES:
Design and CAD, Machine elements, Introduction to the Design Process in Mechatronic Systems, Automation of discrete production, Electronic control systems, Sensors and actuators, Intelligent production systems.

TEACHING METHODS:
Lectures are presented using modern technical means. Laboratory classes are held in computer labs equipped with the necessary hardware and software.

METODS OF ASSESSMENT:
The course ends with an ongoing assessment, as the assessment is formed by two components: assessment of an open test with a weighting factor of 0.5 and assessment of the development and defense of an abstract with a weighting factor of 0.5.

INSTRUCTION LANGUAGE: Bulgarian.

BIBLIOGRAPHY:
1. Ganovski, VS, IK Boyadzhiev, TD Neshkov, Likov TS.. Mechanization and automation of assembly processes in mechanical engineering. S., Technique, 1986.
2. Dimitrova R., G. Hadjikosev. Guide for laboratory exercises in automation of discrete production. IC of TU - Sofia, 2013.
3. Malakov, I. Low-cost automation of discrete production. ISBN 978-954-438-799-0, TU Publishing House - Sofia, Sofia, 2009.
4. Chakarski D. and c. Complex automation of discrete production. IC of TU - Sofia, 2010, 2015 and 2020.

Name of the course: **Communication and Presentation Competencies**	Code: **FaMIA02**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW)	Hours per semester: L – 30 hours LW – 30 hours	Number of credits: **4**

LECTURER:

Assoc. Prof. Eng. Reneta Dimitrova, PhD (FME), tel. 965 3846, rkd@tu-sofia.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM:
Facultative subject from the curriculum for training of students to obtain Master's degree, specialty "Industrial Automation", Professional orientation 5.1 Mechanical Engineering, Field 5. Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE:
The aim of the training is to acquire knowledge and skills of students related to improving their personal communication, formation of communication and presentation competencies for different situations, as well as improving oral and presentation skills in a scientific environment.

DISCRIPTION OF THE COURSE:
The types of information and communication are considered. Emphasis is placed on information requirements as well as the basic functions and principles of communication. Behavior in front of an audience during monologue and dialogue is considered. The respective place of the preparation and compilation of scientific documents is also given - abstract, article, diploma work, dissertation, abstract, etc. Emphasis is placed on communication, rhetorical and presentation competencies in the preparation of presentations, defense of dissertations and dissertations in an academic environment.

PREREQUISITES:
Basic computer skills.

TEACHING METHODS:
Lectures are presented using modern technical means. Laboratory classes are held in computer labs equipped with the necessary hardware and software.

METODS OF ASSESSMENT:
The course ends with an ongoing assessment, as the assessment is formed by two components: assessment of the development of a scientific topic with a weighting factor of 0.5 and assessment of the defense of a presentation of a scientific topic with a weighting factor of 0.5.

INSTRUCTION LANGUAGE: Bulgarian.

BIBLIOGRAPHY:
1. Aristotle. Rhetoric, S., 1993.
2. Vedar J., Rhetoric and oratory, Sofia, 2000.
3. Mavrodieva, I. How to present successfully ?, Sofia, 2007.
4. Pashov P., Parvev, Hr. , Spelling and Orthographic Dictionary of the Bulgarian Language, Sofia, 2002. 5. Pease A., A. Garner, Body Language, 2000.
6. Pease A., B. Pease, The Art of Conversation, 2009.
7. Rumenchev, C. Nonverbal communication, S., 2006.