DESCRIPTION OF THE COURSE

Name of the course: **Linear Control Systems**	Code: **BpAICE01**	Semester: **5**
Type of teaching: Lectures (L) Laboratory work (LW)/Seminars (S) Course work (CW)	Hours per semester: L – 45 hours S – 0 hours LW – 28 hours	Number of credits: 6

LECTURER(S):
Assoc. Prof. PhD and DSc Borislav Penev, tel.: 032-659-527, e-mail: bpenev@tu-plovdiv.bg
Assist. Prof. Vasil Popov, PhD (FEA), tel.: 359 896282030, e-mail: vasil_popov@tu-sofia.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Compulsory subject from the curriculum for training of students to obtain Bachelor's degree, specialty "Automation, Information and Control Engineering", Professional orientation 5.2 "Electrical Engineering, Electronics and Automation", General Engineering, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: The aim of the syllabus is to provide the fundamentals of the linear continuous control systems' consideration, as well as the fundamentals of the theory of the digital control systems from the input-output point of view. The course topics form the basics of the next course "Multi-Input and Multi-Output Control Systems". The course precedes the next course "Servo Drives and control for Robotics Applications". The course enhances the skills in MATLAB, SIMULINK programing in studying control systems.

DESCRIPTION OF THE COURSE: The foundations of the analysis and synthesis of the linear continuous control systems are considered: Canonical forms for the state-space representations, Transient matrix, Controllability, Observability, Stability, State feedback synthesis using pole placement. The other group of topics concerns the foundations of the discrete control systems – mathematical description by input-output relations, Z-transformation, discrete transfer function, analog-to-digital and digital-to-analog convertors, discrete representation of the linear continuous systems, stability and performance, digital realization of continuous time controllers. The course work is aimed at application of the considered methods at studying the control systems.

PREREQUISITES: Automatic Control Theory.

TEACHING METHODS: Lectures, classical and using slides, laboratory and course works, work in teams, protocols' and course work description preparation and defence.

METHOD OF ASSESSMENT: Written exam (80%), laboratory work (10%) and course work (10%).

INSTRUCTION LANGUAGE: in Bulgarian

BIBLIOGRAPHY:
Н. Маджаров, Е. Хараланова, Инженерни методи за изследване на линейни системи за управление, ТУ-София, 2004. 2. К. Ищев, Теория на автоматичното управление, ТУ-София, 2007. 3. G. Franklin, J. D. Powell, A. Emami-Naeini, Feedback control of dynamic systems, 2005. 4. B. Kuo, F. Golnaraghi, Automatic Control Systems, Prentice-Hall International, Inc, 2002.

DESCRIPTION OF THE COURSE

Name of the course: **Technical devices for automation**	Code: **BpAICE02**	Semester: 5
Type of teaching: Lectures(L) Laboratory work (LW)/Tutorials (T)	Hours per semester: L – 30hours T– 0 hours LW – 19 hours	Number of credits: 4
Course project (CP)	Code: **BpAICE03**	Number of credits: 1

LECTURER(S):
Assistant, Prof. Eng. Vasil Popov, (FEA) tel.: +359 896282030, e-mail: vasil_popov@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: The subject is compulsory for students regular course specialty "Automatics, Information and Control Engineering" for educational-qualification level "bachelor".

AIMS AND OBJECTIVES OF THE COURSE: The aim of the course is to develop engineering-applied way of thinking of students, which is required for means of automation.

DESCRIPTION OF THE COURSE: The main topics concern: Basic equations and characteristics of linear laws for control. Transfer function, transitive function and frequency characteristics of P, I, PI, PD and PID controllers. Basic equations and characteristics of discrete laws for control. Two-points, tree-points and multi-points regulators. Controller with constant speed. Review of basic pneumatic elements. Discrete pneumatic automatics. Schemes with operating amplifier which realize types of dynamical units and laws for control. Digital controllers. Programming realizations of type units and basic laws of control.

PREREQUISITES: Control Theory, Electrical Engineering, Electronics.

TEACHING METHODS: Lectures, using slides, case studies, laboratory and course project, work in teams, protocols and course project description preparation and defence.

METHOD OF ASSESSMENT: Written assessments in the end of fifth semester (80%), laboratories (20%). The course project has a separate assessment

ИНINSTRUCTION LANGUAGE:in Bulgarian

BIBLIOGRAPHY:
1. Драготинов И., Кр. Кутрянски, Ж. Стойчев, Г. Терзийски, Технически средства за автоматизация, Академично издателство на УХТ - Пловдив, 2015.

2. Николов Е., Технически средства за автоматизация, II част, ТУ-София, 2003.

3. Костов К., Е. Николов, Технически средства за автоматизация, ВМЕИ, София, 1988.

4. Гарипов Е., Цифрови системи за управление, I част, Проектиране на ПИД регулатори, ТУ-София, 2004.

DESCRIPTION OF THE COURSE

Name of the course: **Microprocessor systems**	Code: **BpAICE04**	Semester: **5**
Type of teaching: Lectures (L) Laboratory work (LW)	Hours per semester: L – 45 hours S – 0 LW – 28 hours	Number of credits: **6**

LECTURER(S):
Assoc. Prof. Sevil Ahmed-Shieva, PhD (FEA) tel.: 032 659 583, e-mail: sevil.ahmed@tu-plovdiv.bg

Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Compulsory training of students to obtain Bachelor's degree, specialty Automation, Information and Control Engineering, Professional orientation 5.2 Electrical Engineering, Electronics and Automation, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: At the end of the course the students are expected to have basic knowledge in the field of microprocessor systems (MPS) used in control systems, including: system architecture, principles of operation, microprocessor program model, system instructions, methods of addressing, configuration of input/output, as well as practical skills in developing programs for microprocessor systems in the context of embedded systems for control and data acquisition (mainly in C language).

DESCRIPTION OF THE COURSE: This course introduces basic knowledge on computer architectures oriented mainly to architecture of control systems. The main topics concern: Architecture of microcomputer systems; Organization and architecture of microprocessors; Physical and logical memory organization; Input/Output system – standard and process peripheral devices, organization; Advanced architectures. The main goal of the course is the design aspects of microcomputer systems oriented to control applications. Design and exploitation of applications oriented to different domains is discussed too.

PREREQUISITES: Mathematics I, Mathematics II, Programming I, Programming and mathematical modelling tools.

TEACHING METHODS: Lectures, visually illustrated; laboratory exercises with preparation of laboratory reports/protocols.

METHOD OF ASSESSMENT: Written final examination, including solving problems (80%); laboratory reports defence (20%).

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY: 1. Иванов И. Е. и О. Маринов, Микропроцесорна техника, ч. I, ТУ София, 2007; 2. Yiu, Joseph, The Definitive Guide to the ARM Cortex-M3, Newnes, USA, 2007; 3. Г. Спасов, М. Шопов, В. Спасова, Н. Каканаков "Ръководство за лабораторни упражнения по Микропроцесорни системи", ТУ София, 2013, ISBN: 978-619-167-021-5; 4. J. Ganssle, Embedded Systems. World Class Designs, Newnes Press, 2007, ISBN-13: 978- 0750686259.

DESCRIPTION OF THE COURSE

Name of the course: **Measurement of Non-electrical Quantities**	Code: **BpAICE05**	Semester: **5**
Type of teaching: Lectures (L) Laboratory work (LW)/Seminars (S) Course work (CW)	Hours per semester: L – 30 hours S – 0 hours LW – 19 hours	Number of credits: **4**

LECTURER(S):
Assoc. Prof. Eng. Nikola Georgiev PhD (FEA), tel.:659581, e-mail:nikola.georgiev@tu-plovdiv.bg
Assoc. Prof. Eng. Misho Macankov (ФЕА), tel.:659685, e-mail: mishel@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Compulsory course for the students of specialty "Automation, Information and Control Engineering" of the Faculty of Electronics and Automation Engineering of TU-Sofia, Branch Plovdiv for the Bachelor of Science degree.

AIMS AND OBJECTIVES OF THE COURSE: Theoretical Electrical Engineering – part 1 is a fundamental subject and introduces the basic laws and phenomena of electromagnetism and the approaches applied to describe the processes in linear and nonlinear electric and magnetic circuits and with the methods of analysis on these processes in constant, stationary and unfixed modes..

DESCRIPTION OF THE COURSE: The most frequently used principles and constructive circuits of measurement transducers, grouped by the physical principle of transducing are viewed. The features of the static and dynamic characteristics as well as the methods for analysis and experimental determination of the transfer functions and the specific errors of the transducers and their application areas are studied. Recommendations are given for adjustment of the measurement transducers to the following sections of the structural circuit of the measurement units.

PREREQUISITES: A basic knowledge is necessary from courses "Physics", "Electrical Engineering" and "Electrical Measurements Engineering".

TEACHING METHODS: Lectures, using slides, case studies, laboratory and course work, work in teams, protocols.

METHOD OF ASSESSMENT: Exam with three questions.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY: 1. Ставракев, Ж., В. Туренков, Електрически измервателни преобразуватели, уреди и устройства, Техника, С., 1984, 2. Русев, Д., Д. Пенкова, Електрически измервания на неелектрически величини, Техника, С., 1989, 3. Йорданов, Р., Преобразуватели в прецизната техника, ТУ-София, 2003, 4. Тодоров, Д., Преобразуватели в уредостроенето, Техника, С., 1992, 5. Евтихиев, Н., (ред.) Измерение электрических и неэлектрических величин, Энергоатомиздат, М., 1990, 6. Asch, G., P. Andre, J. Beaufront, Les capteurs en instrumentation industrialle, Dunod, Paris, 1991, 7. Щерев, Г., Ръководство за лабораторни упражнения по измерване на неелектрически величини, ТУ-София, филиал Пловдив, 2006.

DESCRIPTION OF THE COURSE

Course title: **Economics and Management**	Code: **BpAICE06**	Semester: **5**
Type of teaching: Lectures (L) Seminars(SE) Laboratory practicals (LP) Extracurricular activities (ECA)	Hours per semester: L – 18 hours S – 0 hours LP – 0 hours ECA – 42 hours	Number of credits: **2**

LECTURER:
Prof. Toni Mihova PhD (FME), tel: 0888 42 45 70, e-mail: mihova@tu-plovdiv.bg,
Technical University of Sofia, Plovdiv Branch

COURSE STATUS IN THE CURRICULUM: Compulsory course in the Bachelor degree curriculum of 'Automation, Information and Control Engineering' in 5.2 'Electrical Engineering, Electronics, Automation' Professional field of study, 5. STE (Science, Technology, Engineering) Higher Education Area of study

AIMS AND OBJECTIVES OF THE COURSE: The course intends to provide students with a thorough grounding and understanding of the basic terms and concepts of Economics and Management, the nature of communications, management decisions and styles, conflicts in industrial enterprises and the changes in business activities as well as in the nature and characteristics of economic and management processes.

DESCRIPTION OF THE COURSE: The course comprises the following main topics – Introduction to Enterprise Economics, Business Environment of the Industrial Enterprise, Enterprise Equity and Assets, Costs and Costing, Pricing, Communications in Management, Management Decisions, Management Styles and Conflict Management.

PREREQUISITES: Basic knowledge of Arts, Maths, Management as well as economic, engineering, technology and technical subjects

TEACHING METHODS: Lectures aided by multimedia tools; active teaching methods continuously engaging students

ASSESSMENT METHOD: Continuous assessment based on 3 marks signifying students' score on: a mid-term test covering 6 topics – 30%, a presentation on a topic previously selected by students – 30% and an end-of-term test – 40%

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:

1. D.R. Kiran, Principles of Economics and Management for Manufacturing Engineering, eBook ISBN: 9780323998635, 2022; 2. N.Agarwal, S. Singh, Sucheta Sardar, The Handbook of Management and Business Economics, Bloomsbury Publishing, 2022; 3. I. Fraser, Niall M., Engineering economy. Pearson Education, Inc. , 2012; 4. Alan Griffiths, Stuart Wall, Economics for Business and Management, Pearson Education Canada, 2011; 5. Димитър Дончев, Цонка Лалева, Даниела Манчева, Икономика на предприятието Мартилен, София, 2020; 6. Димитър Дончев, Мениджмънт на предприятието. Оперативен мениджмънт, Мартилен, 2015; 7. Георгиев Ив. И др. Икономика на предприятието, Университетско издателство "Стопанство", София, 2008; 8. Иван Илиев, Димитър Дончев, Младен Велев, Икономика и мениджмънт, Мартилен, 2008; 9. Михова Т., Икономика и управление на индустриалните предприятия", Изд. "Имеон", Пловдив, 2023

DESCRIPTION OF THE COURSE

Name of the course: **Engineering Laboratory Practice**	Code: **BpAICE07**	Semester: **5**
Type of teaching: Lectures (L) Seminars (S) Laboratory work (LW)	Hours per semester: L – 0 hours S – 0 hours LW – 0 hours	Number of credits: 2

LECTURER(S):
Assist. Prof. Vasil Popov, PhD (FEA), tel.: 359 896282030, e-mail: vasil_popov@tu-sofia.bg
Technical University of Sofia, branch Plovdiv

COURSE STATUS IN THE CURRICULUM: Compulsory facultative subject from the curriculum for training of students to obtain Bachelor's degree, specialty Automation, Information and Control Systems, Professional orientation 5.2 Electrical Engineering, Electronic and Automation, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: At the end of the course the students are expected to have basic practical engineering skills in the field of automation and control systems. Have practical knowledge and skills in working with passive elements, discrete semiconductor elements, analog integrated circuits, operational amplifiers, comparators, stabilizers, timers, etc. Be able to investigate and synthesize passive and active filters with RLC elements and analogue integrated circuits. Be able to implement and investigate typical circuits of P, PI, PID controllers based on analog integrated circuits.

DESCRIPTION OF THE COURSE: The main topics concern: Passive elements - resistors, capacitors, inductors, etc. Types, parameters, design features. Designations, codes, usage; Discrete semiconductor elements - diodes, transistors, basic parameters. Circuit solutions; Analog integrated circuits - operational amplifiers, comparators, stabilizers, timers, etc. Basic parameters. Typical circuits; Synthesis and study of filters - synthesis and study of passive filters with RLC elements. Synthesis and study of active filters with analog integrated circuits; Implementation of P, PI, PID controllers with analog integrated circuits - circuit types, basic parameters and tuning.

PREREQUISITES: Control Theory, Electrical Engineering, Electronics.

TEACHING METHODS: Lectures, using slides, case studies, laboratory and course work, work in teams, protocols and course work description preparation and defence.

METHOD OF ASSESSMENT: Continuous assessment 100%.

INSTRUCTION LANGUAGE: in Bulgarian

BIBLIOGRAPHY: 1. Chen, C-T., Analog & Digital Control System Design, Oxford University Press, 1993; 2. Ленк Дж., - Наръчник по операционни усилватели, Техника, 1991; 3. Gottlieb I., Power Supplies, Switching Regulators, Inverters and Converters, TAB Books, 1994, ISBN 5-901095-05-7, 4. Вълков С., Аналогова електроника, Техника, 2002; 5. Соклоф С., Приложения на аналогови интегрални схеми, Техника, 1990.

DESCRIPTION OF THE COURSE

Name of the course: **Electromechanical Systems**	Code: **BpAICE08t**	Semester: **5**
Type of teaching: Lectures (L) Laboratory work (LW) Course Work (CW)	Hours per semester: L – 30 hours S – 0 LW – 19 hours	Number of credits: **5**

LECTURER(S):
Assoc. Prof. Eng. Radoslav Hrischev, (FEA) tel.: 032 659527, e-mail: hrischev@tu-plovdiv.bg Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: The subject is compulsory for students regular course specialty "Automatics, Information and Control Engineering" for educational- qualification level "bachelor"..

AIMS AND OBJECTIVES OF THE COURSE: The aim of the course is to give students practice in making project and operation with electric drive systems which requires knowledge in particularity and characteristics of electric motors as an object of the control.

DESCRIPTION OF THE COURSE: Main topics concern: Mathematical description on the process of the electromechanical transformation of energy in the generalized electric machine. Electro mechanical coupling and its characteristics. Structure and characteristics of linear electro mechanical transformer. Regime of working and restrictions, imposed on its elapse. Equations of movement of electromechanical systems. Types of resistance and moments of productions mechanisms Basic indicators for regulation on the speed of the electric drive. Mathematic description of the process of transforming energy in the engine for constant current. Mathematic description of the process of transforming energy into induction motor.

PREREQUISITES: Control Theory, Electrical Engineering, Electronics..

TEACHING METHODS: Lectures, using slides, case studies, laboratory, work in teams, protocols preparation and defence.

METHOD OF ASSESSMENT: Written assessment in the end of fifth semester (70%), course work 20%, laboratories (10%)

INSTRUCTION LANGUAGE: in Bulgarian

BIBLIOGRAPHY:
Ключев В. И., Теория на електрозадвижването, "Техника", София, 1989, с. 545. 2. Даскалов Г., И. Костов, К. Кутрянски, Електрозадвижване, ръководство за лабораторни упражнения, Технически университет - Пловдив, 2002, с. 136, ISBN 954-8779-36-6.

Чиликин М. Г. и колл., Основû автоматизированного электропривода, "Энергия", Москва, 1979, с. 616. 5. Елисеев В. А. и колл., Справочник по автоматизированному электроприводу, "Энергоатомиздат", Москва, 1983, с. 616..

DESCRIPTION OF THE COURSE

Name of the course: **System Identification**	Code: **BpAICE09**	Semester: **6**
Type of teaching: Lectures (L) Laboratory work (LW)	Hours per semester: L – 33 hours S – 0 LW – 19 hours	Number of credits: **5**

LECTURER(S):
Assoc. Prof. Nikola Shakev, PhD (FEA), tel.: 032 659 528, e-mail: shakev@tu-plovdiv.bg
Assoc. Prof. Tanya Titova-Kosturkova (FEA), tel.: 032 659 526, e-mail: t.titova@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Compulsory for training of students to obtain Bachelor's degree, specialties of "Automation, Information and Control Engineering", Professional orientation 5.2 Electrical Engineering, Electronics and Automation, Field 5 Technical Sciences

AIMS AND OBJECTIVES OF THE COURSE: When the process is complex, or the information about many process variables is missing it is difficult to derive its appropriate dynamic model using only analytical modeling. In such conditions the only feasible way for building it is based on conducted experiments: the input and output signals of the system under consideration are measured and appropriately processed in order to obtain the model describing their transformation. This approach is known as system identification. At the end of the course students will be able to apply successfully different engineering techniques in order to obtain the mathematical models of the dynamics of different continuous and discrete systems.

DESCRIPTION OF THE COURSE: The fundamental and widely used methods for identification of mainly linear dynamic systems are studied. Different non-recursive and recursive techniques for plant parameter estimation in open and closed loop are discussed. Attention is paid to the quality of the obtained estimates (they have to be non-shifted, consistent etc.) and to the approaches for estimation that can guarantee these properties. The problems of choosing appropriate structure of the model and good conditions for conducting the experiments are also considered, the existing criteria for model validation are described. The theoretical preconditions for linking the parameter estimation task with the task for state estimation using Kalman filters are given. The place of system identification (and of the recursive estimators in particular) in adaptive control schemes with self-tuning regulators is given..

PREREQUISITES: Linear Control Systems, Nonlinear Control Systems.

TEACHING METHODS: Lectures, laboratory exercises with written reports.

METHOD OF ASSESSMENT: Written exam at the end of the semester (82%) and course work defence (18%).

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:
1. E. Garipov, Identification of systems, part1 and part2, TU Sofia, 2007 (in Bulgarian). 2. I. Vuchkov, Identification, IK IUrapel, 1996 (in Bulgarian). 3. V. Tsochev, Handbook of laboratory exercises on identification, Artform, 1996 (in Bulgarian). 4. L. Ljung, System Identification: Theory for the User, 2nd ed., NJ: Prentice Hall PTR, 1999. 5. T. Petkov, Identification of controlled plants, Technika, 1982 (in Bulgarian).

DESCRIPTION OF THE COURSE

Name of the course: **Process Control**	Code: **BpAICE10** **CP – BpAICE11**	Semester: **6**
Type of teaching: Lectures (L) Laboratory work (LW) Course project (CP)	Hours per semester: L – 33 hours S – 0 LW – 19 hours	Number of credits: **4** **CP - 1**

LECTURER(S):
Assoc. Prof. Sevil Ahmed-Shieva, Ph.D. (FEA) tel.: 032 659 583, e-mail: sevil.ahmed@tu-plovdiv.bg

Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Compulsory for the B.Eng level students, speciality AICE of the Faculty of Electronics and Automation

AIMS AND OBJECTIVES OF THE COURSE: After studying this course the students should be able to apply methods for investigation and analysis of industrial plants, to choose the appropriate structure of the control system and provide optimal tuning of the controllers.

DESCRIPTION OF THE COURSE: The main topics concern: Plant Models in Process Control, Analysis of Systems with different Controllers, Methods for optimal tuning of Controllers, Cascade control Systems, Time Delay Systems, Multiple-Input Multiple-Output Systems, Applied aspects of Process Control, Automatic tuning of controllers , etc.

PREREQUISITES: Linear Control Systems, Nonlinear Control Systems, Multivariable control systems, System identification, Technical devices for automation.

TEACHING METHODS: Lectures, using slides, case studies, laboratory and course project, work in teams, protocols and course project description preparation and defence.

METHOD OF ASSESSMENT: Written exam in the end of fifth semester (80%), laboratories (20%). The course project has a separate assessment.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY: **1**. Dragotinov I., I. Ganchev, Process Control, *Third edition*, University of Food Technologies, Plovdiv, 2013. **2**. Dragotinov I., I.Ganchev, Process Control, University of Food Technologies, Plovdiv, 2003. **3**. Hinov H., K. Naplatarov, Process Control, Technika, Sofia, 1987. **4**. Hadjiiski M., Process Control in Metallurgy and Chemistry, Technika, Sofia, 1992. **5**. Hadjiiski M., K.Velev, G.Sotirov, I.Kalaykov, Process Control - Methods and Algorithms, Technika, Sofia, 1992, **6**. Astrom K-J, T. Hagglund, PID Controllers: Theory, Design, and Tuning, Instrument Society of America, Research Triangle Park, 1995. **7**. Golten J., A.Verwer, Control System Design and Simulation, McGraw-Hill, 1991, **8**. Luyben W., M.Luyben, Essentials of Process Control, McGraw-Hill, 1997

DESCRIPTION OF THE COURSE

Name of the course: **Control of Electromechanical Systems**	Code: **BpAICE12**	Semester: **6**
Type of teaching: Lectures (L) Laboratory work (LW)/Seminars (S) Course Work (CW)	Hours per semester: L – 33 hours S – 0 hours LW – 19 hours	Number of credits: **5**

LECTURER(S):
Assoc. Prof. Ivan Kostov, PhD, (FEA), Phone: 032 659 526, e-mail: ijk@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Mandatory subject for full-time students of the Automation, Information and Control Engineering specialty at FEA TU-Sofia, Plovdiv Branch, Bachelor's degree, Professional orientation 5.2 Electrical Engineering, Electronics and Automation, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: The training objective is to prepare students for the processes of design and operation for electric drive systems requiring knowledge of the specifics and characteristics of electric motors as objects of control.

DESCRIPTION OF THE COURSE: Topics covered include: Rectifier control of DC motors (two-quadrant and four-quadrant systems); Chopper control of DC motors (one-quadrant, two-quadrant and four-quadrant systems); Control of induction motors by AC voltage controllers; Frequency-controlled induction motor drives (systems with cycloconverters, voltage source inverters and current source inverters); Slip-power controlled wound-rotor induction motor drives; Control of synchronous motor electromechanical systems; Brushless DC and AC motor drives; Control of stepping motor electromechanical systems.

PREREQUISITES: Electromechanical Systems, Digital Circuitry, Control Theory, Mechanics and Electrical Machines.

TEACHING METHODS: Lectures, visually illustrated; laboratory exercises with preparation of protocols; course work with presentation and defense.

METHOD OF ASSESSMENT: Written exam/test during the examinations session following the semester.

INSTRUCTION LANGUAGE: in Bulgarian.

BIBLIOGRAPHY: 1. Mikhov, M.R., Control of electromechanical systems, part I, Technical University - Sofia, Sofia, 2011; 2. Mikhov, M.R., Control of Electromechanical Systems, Part II, Technical University - Sofia, Sofia, 2011; 3. Mikhov, M.R., Manual for course work on control of electromechanical systems, Technical University - Sofia, Sofia, 2011; 4. Kutryanski K., I. Kostov, G. Daskalov, Control of electromechanical systems - a guide for laboratory exercises, Technical University, Plovdiv branch, Plovdiv, 2001. http://dox.bg/files/dw?a=de9581a1a66.

DESCRIPTION OF THE COURSE

Name of the course: **Communication and information systems**	Code: BpAICE13	Semester: 6
Type of teaching: Lectures (L) Laboratory work (LW)	Hours per semester: L – 33 hours LW – 19 hours	Number of credits: 5

LECTURER(S):
Assoc. Prof. Eng. Albena Taneva, PhD (FEA), tel.: 032 659 585, e-mail: altaneva@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Mandatory for all students in the Automation Information and Control Engineering BEng program of the Faculty of Electronics and Automation at the Technical University of Sofia, branch Plovdiv. Professional orientation 5.2 Electrical engineering, electronics and automation, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: The aim of the course is to introduce students to the basic concepts, modern methods, tools and structures for industrial networks. Students acquire knowledge of a solution applying in networked control system. The subject of the course are industrial devices with ability to data exchange in the network. At the end of the course the students are expected to be able apply the modern concepts for networking. Current and widespread company solutions for building industrial and information systems are set in the course. Students should be familiar with the concepts of connecting intelligent terminals, and be able to solve tasks, both in construction and maintenance.

DESCRIPTION OF THE COURSE: The subject of the course are information and industrial networked systems. Some of the main topics are: Communication model. Protocols and architectures. Standards. Mediums for data transmission. Analog and Digital communication. Wired and wireless data communication. Coding. Analog and digital data. Communication interfaces. Synchronous and asynchronous communication. Data-link control. Multiplexing. Chanel switching and packet switching. Application in distributed systems. At the end of the course the students are expected to be able to use and apply modern company strategies for communication. The basement of the course are solutions for industrial and information systems.

PREREQUISITES: Industrial elements of automation, Data and signal processing, Programming of industrial controllers.

TEACHING METHODS: Lectures, using slides, case studies, laboratory work.

METHOD OF ASSESSMENT: Exam (70%), laboratories (30%).

INSTRUCTION LANGUAGE: in Bulgarian

BIBLIOGRAPHY:
1.Джиев, Ст., (2003), Индустриални мрежи за комуникация и управление., Изд. ТУ, С., 2003.2. Сапунджиев, Г., (1993), Интегрирани системи за управление на производството. Изд. ТУ,С., 1993. 3. Христов Х., Мирчев С., Неделчев Н., (2001), Основи на телекомуникациите мрежи, Нови Знания, София, 2001, ISBN 954-97-40-35-8. 4. W. Stallings, (2006), Data and computer Communications; Prentice Hall Inc., New Jersey, 2006, ISBN 0 132 4331 09. 5.KNAPP, ERIC D. Industrial Network Security - Securing Critical Infrastructure Networks for Smart Grid, SCADA, and Other Industrial Vontrol Systems, издател SYNGRESS MEDIA,U.S. 2011, ISBN 978-1-59749-645-2 (pbk.) 2011 Elsevier Inc. 6.David P. Buse, Q.H. Wu, IP Network-based Multi-agent Systems for Industrial Automation: Information Management, Condition Monitoring and Control of Power Systems (Hardcover) ISBN 978-1-84996-635-1, Springer-Verlag London Limited 2010.

DESCRIPTION OF THE COURSE

Name of the course: **Artificial Intelligence and Robotics**	Code: **BpAICE14**	Semester: **6**
Type of teaching: Lectures (L) Laboratory work (LW))	Hours per semester: L – 33 hours LW – 19 hours	Number of credits: **5**

LECTURER(S):
Assoc. Prof. Eng. Nikola Shakev, PhD (FEA), tel.: 032/659 528, e-mail: shakev@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Compulsory subject from the curriculum for training of students to obtain Bachelor's degree, specialty "Automation, Information and Control Systems", Professional orientation 5.2. Electrical Engineering, Electronics and Automation, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: The aim of the course is to acquaint students with the basic terminology, principles, formalisms and methods of both AI and Robotics. To provide students with a practical opportunity to reinforce basic algorithms through examples, engineering-oriented applications and applied problem-solving.

DESCRIPTION OF THE COURSE: The course is introductory to the fields of artificial intelligence and robotics. The issues are presented from the standpoint of the agent-oriented approach to AI. From this point of view, the connection between Robotics and AI is considered, which is expressed in the construction of program architectures and mechanisms for integration between reasoning, perception and actions of agents capable of solving specific problems in real physical environments. The main topics concern: Concept and terminology of AI; Methods for presentation and automated knowledge processing; Search methods; Planning; Machine learning and self-learning; Basic architectures of intelligent agents, robots and areas of their application.

PREREQUISITES: Programming, Mathematics, Programming and mathematical modeling tools.

TEACHING METHODS: Lectures, using slides, case studies and laboratory, work in teams,.

METHOD OF ASSESSMENT: Two assessments at mid and end of semester (70%), laboratories (30%),

INSTRUCTION LANGUAGE: in Bulgarian

BIBLIOGRAPHY:
1. Д. Димитров. Системи с интелигентно поведение. ТУ-София, 2005, ISBN 954-438-457-X.

2. Д. Димитров, Д. Никовски. Изкуствен интелект. Второ преработено издание. ISBN 954-438-252-6. Изд. ТУ-София, 1999.

3. S. Russel., P. Norvig. Artificial Intelelgence. A Modern Approach. Prentice Hall, 2010.

4. R. Siegwart, I. Nourbakhsh. Introduction to Autonomous Mobile Robots. Massachusetts Institute of Technology, 2004..

DESCRIPTION OF THE COURSE

Name of the course: **Quality Management and Control**	Code: BpAICE15	Semester: 6
Type of teaching: Lectures (L) Laboratory work (LW)	Hours per semester: L – 33 hours LW – 19 hours	Number of credits: 5

LECTURER(S):
Assoc. Prof. Eng. Albena Taneva, PhD (FEA), tel.: 032 659 585, e-mail: altaneva@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Mandatory for all students in the Automation Information and Control Engineering BEng program of the Faculty of Electronics and Automation at the Technical University of Sofia, branch Plovdiv. Professional orientation 5.2 Electrical engineering, electronics and automation, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: The subject of the course are the management systems and the engineering methods, tools and approaches to the quality control of production and services, as well as the actions related with improving of the organization of the production in all its aspects. The students will be fluently orientated in the national and international systems and societies of quality management and control; they will manage the optimal engineering approaches for sustainable achieving of high quality; they will be able to define criteria values, to manage the respective conformity assessment processes and to take the respective decisions in quality improvement aspect.

DESCRIPTION OF THE COURSE: The subject of the course are the management systems and the engineering methods, tools and approaches to the quality control of production and services, as well as the actions related with improving of the organization of the production in all its aspects. The students will be fluently orientated in the national and international systems and societies of quality management and control; they will manage the optimal engineering approaches for sustainable achieving of high quality; they will be able to define criteria values, to manage the respective conformity assessment processes and to take the respective decisions in quality improvement aspect.

PREREQUISITES: Mathematics, Physics, Electrical Measurements, Measurement of Non-Electrical Values.

TEACHING METHODS: Lectures, using slides, laboratory works with implementation of specialized software with final reports, made by the students and revised by the teacher; Tasks and tests for current control.

METHOD OF ASSESSMENT: Current control rating at the end of the semester includes: current theory tests - 2 separate tasks by 35%, 70% totally, Laboratory tasks assessment 30%

INSTRUCTION LANGUAGE: in Bulgarian

BIBLIOGRAPHY:
1.**Дюкенджиев Г., Р. Йорданов,** Контрол и управление на качеството. Софтрейд, София, 2012. 2.**Станчева В. Й., К. Я. Киров, Н. П. Стефанов,** Управление на качеството. QM, Варна, 1995. 3. **Besterfield, D.,** Quality Control, Prentice Hall, 1986. 4. **Crosby, P.,** Quality is Free, McGraw-Hill Book Company, 1984. 5.**Doming, W.,** Quality, Productivity, and Competitive Position, MIT, 1982. 6. **Juran, J.,** Quality Control Handbook, MeGraw-Hill Book Company, 1974. 7.**Hoyle, D.,** ISO - 9000 Quality Systems Handbook, Butterworth-Heinemann Ltd., 1994.

DESCRIPTION OF THE COURSE

Name of the course: **Sport**	Code: **SPR05**	Semester: 5
Type of teaching: Lectures (L) Laboratory work (LW)/Seminars (S) Self-Study (SS)	Hours per semester: L – 0 hours S – 0 hours SS – 30 hours	Number of credits: 1

LECTURER(S):
Sen. Lect. Daniel Vladimdirov, PhD (FEA), tel.: 032 659 646, e-mail: danielv@tu-plovdiv.bg
Sen. Lect. Petar Doganov, PhD (FEA), tel.: 032 659 648, e-mail: pdoganov@tu-plovdiv.bg
Sen. Lect. Boris Spasov, PhD (FEA), tel.: 032 659 647, e-mail: boris_spassov@tu-plovdiv.bg
Technical University of Sofia-Branch Plovdiv
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Facultative subject from the curriculum for training of students to obtain Bachelor's degree, specialty "Automation, Information and Control Systems", "Electrical Engineering", "Electronics" Professional orientation 5.2 Electrical Engineering, Electronics and Automation, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: Targeted at further developing of students' physical activities, skills and hygiene habits through effective methods of physical education, improving their mental and physical performance.

DESCRIPTION OF THE COURSE: The knowledge and skills in Physical Education and Sports develop a wide range of motor skills and habits, help the hardening of the body and contribute to the moral development of students. The enhancement of physical skills is carried out through:

1. General Physical Preparedness (GPP) – in these seminars the students develop a wide range of motor skill and habits; work to improve strength, speed, endurance, flexibility, structure and skill; increase resistance to unfavourable environmental factors; develop their physical qualities and experience.

2. Sports-Specific Physical Preparedness (SPP) – students improve their sport skills and habits in a specific sport and gain experience through participation in competitions; work to improve strength, speed, endurance, flexibility, structure and skill; increase resistance to unfavourable environmental factors; develop their physical qualities and experience.

PREREQUISITES: The curricula presume the minimum of knowledge and skills acquired at secondary school.

TEACHING METHODS: Seminars in accordance with the curriculum in PE and Sport.

METHOD OF ASSESSMENT: Evaluation is based on functional tests at the end of semester. Lecturer's signature is required at the end of semester.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY: 1. Владимиров В. Туризъм и ориентиране. Методическо ръководство за студентите от ТУ София, филиал Пловдив. Издателство на ТУ - София. 2010.

DESCRIPTION OF THE COURSE

Name of the course: **Fundamentals of programmable controllers**	Code: **FaBpAICE2.2**	Semester: 5
Type of teaching: Lectures (L) Laboratory work (LW)	Hours per semester: L – 15 hours LW – 45 hours	Number of credits: 4

LECTURER(S):
Assoc. Prof. Eng. Albena Taneva, PhD (FEA), tel.: 032 659 585, e-mail: altaneva@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Optional course for students in the Automation Information and Control Engineering, BEng program of the Faculty of Electronics and Automation at the Technical University of Sofia, branch Plovdiv. Professional orientation 5.2 Electrical engineering, electronics and automation, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: The aim of the course to familiarize students with fundamentals and knowledge in programmable logic controller applications. Both programming trainee and input-output device equipment in the frame of control system, are included. At the end of the course the students will be able to understand, to develop user programs for programmable logic controllers, wired to the separate laboratory set up.

DESCRIPTION OF THE COURSE:

The subject of the course are different software environments and hardware of the programmable logic controllers. The main topics concern: Discrete (relay) control. Logical Functions. Functional fully systems. Logical elements and devices in the control systems. History of the Programmable Logic Controllers (PLCs). Applications of PLCs. Structure and principles of operation. Connection of PLCs – supply, sensors, actuators. Programming for PLCs, structure of the programme, methods of representation. Design of small control systems. Practical work with Programmable Logic Controllers.

PREREQUISITES: Industrial elements of automation, Data and signal processing, Programming of industrial controllers.

TEACHING METHODS: Lectures, using slides, case studies, laboratory work with reports. Practical exercises with laboratory set up with programmable logic controllers of OMRON, SIEMENS, Schneider, Mitsubishi and Panasonic..

METHOD OF ASSESSMENT: Temporary evaluation at the end of the semester (70%), laboratories (30%).

INSTRUCTION LANGUAGE: in Bulgarian

BIBLIOGRAPHY: 1.Petruzella F., Programmable Logic Controllers, Fifth Edition, Publisher: McGraw-Hill Education, 2017, 2.Тодоров А., С. Йорданова, С. Джиев, В. Сгурев. Логическо управление на процеси. С.,Технически Университет, 2001, 3. UnityPro, Ръководство за програмиране на Schneider, 2012, 4. FPWIN Pro, Ръководство за програмиране на Panasonic, 2012, 5. SIMATIC S7-300 CPU 31xC: Specifications Manual, Technical data of the integrated I/O, 2010, 6. SIMATIC Programming with STEP 7, (Manual), Siemens, 2010. 7.Melsec FX Family, Programmable Logic Controllers, Beginner's Manual, Mitsubishi Electric, Art.no.:166388, Version B, 2007.

DESCRIPTION OF THE COURSE

Name of the course: **Sport**	Code: **SPR06**	Semester: 6
Type of teaching: Lectures (L) Laboratory work (LW)/Seminars (S) Self-Study (SS)	Hours per semester: L – 0 hours S – 0 hours SS – 30 hours	Number of credits: 1

LECTURER(S):
Sen. Lect. Daniel Vladimdirov, PhD (FEA), tel.: 032 659 646, e-mail: danielv@tu-plovdiv.bg
Sen. Lect. Petar Doganov, PhD (FEA), tel.: 032 659 648, e-mail: pdoganov@tu-plovdiv.bg
Sen. Lect. Boris Spasov, PhD (FEA), tel.: 032 659 647, e-mail: boris_spassov@tu-plovdiv.bg
Technical University of Sofia-Branch Plovdiv
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Facultative subject from the curriculum for training of students to obtain Bachelor's degree, specialty "Automation, Information and Control Engineering", "Electrical Engineering", "Electronics" Professional orientation 5.2 Electrical Engineering, Electronics and Automation, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: Targeted at further developing of students' physical activities, skills and hygiene habits through effective methods of physical education, improving their mental and physical performance.

DESCRIPTION OF THE COURSE: The knowledge and skills in Physical Education and Sports develop a wide range of motor skills and habits, help the hardening of the body and contribute to the moral development of students. The enhancement of physical skills is carried out through:

1. General Physical Preparedness (GPP) – in these seminars the students develop a wide range of motor skill and habits; work to improve strength, speed, endurance, flexibility, structure and skill; increase resistance to unfavourable environmental factors; develop their physical qualities and experience.

2. Sports-Specific Physical Preparedness (SPP) – students improve their sport skills and habits in a specific sport and gain experience through participation in competitions; work to improve strength, speed, endurance, flexibility, structure and skill; increase resistance to unfavourable environmental factors; develop their physical qualities and experience.

PREREQUISITES: The curricula presume the minimum of knowledge and skills acquired at secondary school.

TEACHING METHODS: Seminars in accordance with the curriculum in PE and Sport.

METHOD OF ASSESSMENT: Evaluation is based on functional tests at the end of semester. Lecturer's signature is required at the end of semester.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY: 1. Владимиров В. Туризъм и ориентиране. Методическо ръководство за студентите от ТУ София, филиал Пловдив. Издателство на ТУ - София. 2010.