DESCRIPTION OF THE COURSE

Name of the course **Computer Vision**	Code: **MpCSTS01**	Semester:**1**
Type of training: Lectures (L) Laboratory work (LW)	Hours per semester: L – 30 hours; LW – 15 hours	Number of credits: **5**

LECTURER (S):

prof. d-r Petya Pavlova (FEA), Dep. CST, tel. 659 705, e-mail: p_pavlova@tu-plovdiv.bg,
as.prof. Veselka Petrova – Dimitrova PhD (FEA), Dep. CST, e-mail: vpetrova@tu-plovdiv.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 Computer systems and technologies, Professional orientation 5.3 General Engineering, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: After passing education the students have to obtain skills in area of achromatic and colour images processing, objects' features obtaining and systems for identification. During the labs each student must develop personal software for basic processing of the images

DESCRIPTION OF THE COURSE: Main topics: Methods and techniques for computer images derivation; different types of images and their features; Preliminary image processing – convolution and filtering, linear and non-linear filters, spatial filters, restrictions of applications. Mathematical morphology; Image segmentation; Object's features obtaining and normalizing; Dynamic images processing.

PREREQUISITES: Program languages, Digital signal processing

TEACHING METHODS: Lectures. Labs with programming using Visual Studio, OpenCV and initial shell of a software product, helpful for the personal product development

METHOD OF ASSESSMENT: Two tests on theory and some particular tasks solving. The final estimation is based on the tests results – 70% and laboratory work – 30%.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:
1 Павлова П., Н. Шакев, Компютърно зрение, ТУ София филиал Пловдив, 2018 2.R. Gonzalez, R. Woods, Digital Image Processing, 3rd Ed., Prentice Hall, 2007. 3. У. Претт, Цифровая обработка изображений (пр. от англ.), т.1 и т.2, Москва, Мир, 1981. 4.Павлова П., Цифрова обработка на изображения (уч. пособие), Фондация физика, инженерство и медицина XXI, Пловдив 2005. 5.Ed. Al Bovik, Handbook of Image & Video Processing, sec. ed., Elsevier, 2005 6.Holst G., T. Lomheim, CMOS/CCD sensors and cameras systems. Sec. ed. SPIE PRESS, 2011 7. Tekalp A., Digital Video Processing, Prentice Hall, 1995 8. Daugherty Geoff, Pattern Recognition and Identification, an introduction. Springer, 2013 g. 9.Farid H., Fundamentals of Image Processing**,** 2010 – e-book. 10. Ahad, Computer Vision and Action Recognition, A Guide for Image Processing and Computer Vision Community for Action Understanding, Atlantis Press, 2011.

DESCRIPTION OF THE COURSE

Name of the course: **Natural language interfaces**	Code: **MpCST02**	Semester: **1**
Type of teaching: Lectures (L) Laboratory work (LW)	Hours per semester: L – **30 hours** LW - **15** hours	Number of credits: **5**

LECTURER(S):

assoc. prof. eng. Dilyana Budakova PhD (FEA), e-mail: dilyana_budakova@tu-plovdiv.bg
Technical University of Sofia – Plovdiv Branch

COURSE STATUS IN THE CURRICULUM: Compulsory subject for the master's degree course in „Computer systems and technologies "in the Faculty of Electronics and Automation at the Technical University of Sofia, Plovdiv Branch.

AIMS AND OBJECTIVES OF THE COURSE: The goal is for students to acquire knowledge about informal problem-solving methods, knowledge representation models, and inference methods for different models; about intelligent virtual agents, large language models, chatbots, which in recent years have been developing as a new realistic, emotional, computer interface in natural language, as well as for implementing their intelligent agent, chatbot; to become familiar with the basic and hybrid techniques for speech synthesis and synthesis of expressive, emotional speech. Algorithms for morphological and syntactic analysis of natural language, speech recognition, and mathematical models for natural language representation are considered.

DESCRIPTION OF THE COURSE: Some main topics are: Knowledge representation models and inference methods for different models (logical, network, production, frame). Deep neural networks; Transformer models; Large language models; Generative artificial intelligence; Artificial intelligence systems; Expert systems; Logic programming Visual Prolog 7.0; SSML and TTS Processors for speech synthesis. Natural language dialogue systems with CSLU Natural Language Toolkit; Windows Desktop Speech Technology; Visual Studio.NET and C#; synthesized Bulgarian voices.

PREREQUISITES: Basic programming languages.

TEACHING METHODS: Lectures delivered using multimedia tools, presentations provided on the Moodle electronic platform, and laboratory exercises on the main lecture topics.

METHOD OF ASSESSMENT: Assessment of the exam and student work during laboratory exercises and tests.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:

1.Russell S., Norvig P., Artificial Intelligence A Modern Approach, Prentice Hall, Third Edition, 2010. 2. Kevin Murphy, ML Machine Learning - A Probabilistic Perspective, 2012, MIT Press, Cambridge; 3. Zhiyuan Liu, Yankai Lin, Maosong Sun, Representation Learning and NLP, Springer, 2020, 2023; 4. What are Transformer models and how do they work, https://www.youtube.com/watch?v=qaWMOYf4ri8 5. The Stanford Natural Language Processing Group http://nlp.stanford.edu/research.shtml; 6. Център за разпознаване на говорима реч (CSLU). http://cslu.cse.ogi.edu/tutordemos/; 7. Visual Prolog - www.visual-prolog.com .

DESCRIPTION OF THE COURSE

Name of the course **Distributed systems and Computer Communications**	Code: **MpCST03**	Semester: **1**
Type of teaching: Lectures (L) Laboratory work (LW)	Hours per semester: L – 30 hours; LW – 15 hours	Number of credits: **4**

LECTURER:
Assoc. prof. Mitko Shopov, PhD, lecturer in TU-Sofia, Plovdiv branch, Faculty of Electronics and Automatics, Dept. CST – tel.: (032) 659 765 e-mail:mshopov@tu-plovdiv.bg

COURSE STATUS IN THE CURRICULUM: Mandatory course for students in MSc program in Computer systems and technologies.

AIMS AND OBJECTIVES OF THE COURSE: At the end of the course the students are expected to have knowledge about the architectures of distributed systems based on client-server applications, web technologies, SOA, REST, MQTT, Cloud computing. To gain their own experience in the design and implementation of distributed applications.

DESCRIPTION OF THE COURSE: Key topics include: Introduction to distributed systems. Application layer communication protocols. Loosely coupled architectures. Middleware protocols. Names and addressing in distributed systems. Distributed processes: client-server, threads, migration code, software agents. Synchronization of distributed systems. Coordination models and replication methods. Distributed file systems (NFS, Hadoop, VMFS). Virtual computer networks. Software defined networks (SDN). Security in distributed systems – policies and mechanisms. Web based distributed systems - SOA, REST. Cloud Computing - IaaS, PaaS, SaaS. Stream processing - MQTT, Kafka. Big data and the Internet of Things (IoT).

PREREQUISITES: Good fundamental knowledge in computer networking, operating systems, programming languages.

TEACHING METHODS: Lectures with multimedia and web resources, laboratory works in main topics with individual and group tasks.

METHOD OF ASSESSMENT: One assessment test at the end of semester (50%), and laboratory work (50%).

INSTRUCTION LANGUAGE: Bulgarian.

BIBLIOGRAPHY:

1. E-learning course in Moodle (https://fea.tu-plovdiv.bg/moodle);

2. Maarten Van Steen, Andrews S. Tanenbaum. „Distributed Systems“ Third edition, Maarten van Steen, 2017, ISBN: 978-90-815406-2-9;

3. George Coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair „DISTRIBUTED SYSTEMS. Concepts and Design“ Fifth Edition, Addison-Wesley, 2012, ISBN 13: 978- 0-13-214301-1.

4. 4. Dan Marinescu „Cloud Computing. „Theory and practice“, Elsevier, 2013, ISBN: 978-0-12404-627-6.

5. James Kurose, Keith Ross „Computer Networking: A Top-down Approach“, Fifth Edition, Addison-Wesley, 2010, ISBN: 978-0-13607-967-5.

DESCRIPTION OF THE COURSE

Name of the course **GRID technologies**	Code: **MpCST4.1**	Semester: **1**
Type of teaching: Lectures (L), Laboratory work (LW)	Hours per semester: L – 30 hours LW – **15** hours	Number of credits: **5**

LECTURER:

Assoc. Prof. Ph.D. Maria Marinova (FEA), Dept. CST – tel.: 659 728,
Technical University of Sofia, branch Plovdiv,
e-mail: m_marinova@tu-plovdiv.bg

COURSE STATUS IN THE CURRICULUM: Selective course for the students in MSc program in Computer systems and technologies.

AIMS AND OBJECTIVES OF THE COURSE: The aim of the course is to create knowledge about GRID *Architectures*: what is VO, CE and SE. The students will be learned about basic components of OGSA, components of gLite 3.0 middleware, SOA/SOAP и OGSA; WSDL и WSIL, OGSA-DAI.

DESCRIPTION OF THE COURSE: architecture of GRID; main terms like virtual organizations, computing elements and storage elements; encrypting algorithm – X.509, asynchronous and synchronous encrypting, fields of Grid computing; SOA and OGSA, modifying of web services in grid; WSDL и WSIL, OGSA-DAI; grid computing and computing and clouds difference and similarly; types of distributed systems, distributed programming: model client-server, socket, java RMI, DCOM and CORBA; Job Description Language using to start programs on the grid;

PREREQUISITES: Good fundamental knowledge in the courses Parallel Programming and High-Performance Computer Systems.

TEACHING METHODS: Lectures and laboratory work. For laboratory exercises students have grid certificate to access EU Grid Infrastructure. Programming on gLite middleware with JDL.

METHOD OF ASSESSMENT: Final mark is form like takes value of mark of test, laboratory work and course project.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY: **C. Prabhu**, *Grid and Cluster Computing*, 2013, **K. Hwang,** *Distributed and Cloud Computing: From Parallel Processing to Internet of Things*, 2014, **F. Berman, G. Fox, A. Hey**, *Grid Computing. Making the Global Infrastructure a Reality*. (ed.). Wiley, 2003, **T. Erl, Z. Mahmood,** *Cloud Computing: Concepts, Technology and Architecture*, 2013, **B.Wilkinson,** *Grid Computing: Techniques and Applications*, 2009, **F.Magoules,** *Fundamentals of Grid Computing: Theory, Algorithms and Technologies*,2009, **Culler D., Singh J.,** *Parallel Computer Architecture: A Hardware/Software Approach*. Elsevier, 2009, **A. Kshemkalyani, M. Singhal,** *Distributed Computing: Principles, Algorithms, and Systems*, 2011

WWW addresses:

Global Grid Forum http://www.gridforum.org/
European Grid Infrastructure: http://www.egi.eu/

The Grid Computing Information Centre: http://www.gridcomputing.com
IITC-BAS, Грид Технологии и Приложения: http://gta.grid.bas.bg/index.php/bg/
LEGION: http://www.cs.virginia.edu/~legion/
http://www.cs.kent.edu/~farrell/grid06/reference/index.html
http://www.electro.fisica.unlp.edu.ar/eela/docs/gLite-3-UserGuide.pdf

DESCRIPTION OF THE COURSE

Name of the course: **Programming of modern heterogeneous architectures**	Code: **MpCST4.2**	Semester: **1**
Type of teaching: Lectures (L) laboratory work (LW), course work	Hours per semester: **L – 30;** **LW – 15**	Number of credits: **5**

LECTURER (S):
Assoc. Prof. PhD Maria Pl. Marinova, (FEA), tel.: 659728, e-mail: m_marinova@tu-plovdiv.bg,
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Selective for students speciality Computer Systems and Technologies MEng programme of the Faculty of Electronics and Automation

AIMS AND OBJECTIVES OF THE COURSE: At the end of the course the students are expected to know the parallel languages as CUDA C, OpenCL and have knowledge to programming onto MIC processors.

DESCRIPTION OF THE COURSE:
Main topics: Parallel programming of heterogeneous computer architectures. Programming of the multi-GPU. Programming on Xeon Phi accelerators. Using of *warp* execution – warps-thread blocks, warp divergence, distribution of the resources, warp latency and synchronization.

PREREQUISITES: Parallel Programming, Operating Systems, Computer Architectures.

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

METHOD OF ASSESSMENT: One test assessment at the end of the semester (50%), and defence of course work implemented during the laboratory exercises (50%).

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:
Lecture slides
Han J., Bharatkumar S., Learn CUDA Programming: A beginner's guide to GPU programming and parallel computing with CUDA 10.x and C/C++, 1st edition, 2020
Soyata T., GPU Parallel Program Development Using CUDA. 2020
Kirt D., Wen-mei W., Programming Massively Parallel Processors. A hands-on Approach. Third edition, 2018.
Reinders J., Jeffers J., High Performance Parallelism Pearls. Multicore and Many-core Programming Approaches Volume II – 2015.
Jeffers J., Reinders J., Sodani A., Intel Xeon Phi Processor High Performance Programming, 2016
CUDA Programming. A Developer's Guide to Parallel Computing with GPUs. Shane Cook. 2020

DESCRIPTION OF THE COURSE

Course title: **UML object-oriented design**	Code: **MpCST5.1**	Semester: **1**
Classes: Lectures (L), Laboratory work (LW)	Hours per week: L – **30 hours** LW – **15 hours**	Credits: **5**

LECTURERS:
Assoc. Prof. PhD Ivaylo Atanassov (FEA) – tel.: (032) 659 729, email: ivo_atan@tu-plovdiv.bg ,
Assist. Prof. Dobrinka Petrova, PhD (FEA) – tel .: (032) 659 727, email: dpetrova@tu-plovdiv.bg
Technical University – Sofia

COURSE STATUS IN THE CURRICULUM: Selective discipline for "Computer systems and technologies", faculty of "Electronics and automatics", Technical University – Sofia, branch Plovdiv, master degree.

AIMS AND OBJECTIVES OF THE COURSE: The "UML object-oriented design" course aims to give students knowledge and skills for object-oriented design and solving problems with the corresponding tools.

DESCRIPTION OF THE COURSE: Main topics: Object-oriented design – principles and basic terms. Class design. Inheritance and abstract classes. Elements, relationships, diagrams. Requirements modeling. Conceptual modeling. Class diagrams. Object diagrams. Behavior modeling. Sequence diagrams and states diagrams. Packages, components, components diagrams. Nodes and components, deployment diagrams..

PREREQUISITES: Platform-independent programming languages, Object-oriented programming, Component programming.

TEACHING METHODS: Lectures, exercises on the main topics, solving assignments related to the system programming.

METHOD OF ASSESSMENT: The final mark is composed from the examination test.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:
1. HORSTMANN, C., Object-Oriented Design and Patterns, John Wiley & Sons, Inc., 2006
2. OJO, A., E. Esteves, Object-Oriented Analysis and Design with UML - Training Course, e-Macao Report 19, 2005
3. SHALLOWAY, A., J. Trott, Design patterns explained – a new perspective on object-oriented design, Addison Wesley professional, 2004
4. PRIESTLEY, M., Practical object-oriented design with UML, McGrow Hill, 2003

DESCRIPTION OF THE COURSE

Name of the course **Internet Programming**	Code: **MpCST5.2**	Semester: **1**
Type of teaching: Lectures (L) Laboratory work (LW) Course work	Hours per semester: L – 30 hours; LW – 15 hours	Number of credits: **5**

LECTURER:
Assist. Prof. Ph.D. Dobrinka Petrova (FEA) – tel.: (032) 659 727,email: dpetrova@tu-plovdiv.bg
Technical University of Sofia, Plovdiv Branch

COURSE STATUS IN THE CURRICULUM: Elective course for students in the MSc program in Computer Systems and Technologies.

AIMS AND OBJECTIVES OF THE COURSE: At the end of the course the students are expected to have knowledge about the main principles of creating Web and Internet applications, client-side and server-side scripting, and database access technologies.

DESCRIPTION OF THE COURSE: The main topics concern: Client-server architecture; HTML5 and CSS; JavaScript programming, Asynchronous JavaScript, Document Object Model (DOM); Model-View-Controller (MVC); Server-side programming – JSP, ASP.NET Core, and PHP; Database connectivity; Regular expressions; Web 2.0 and 3.0 – wiki, blog, RSS, Web Services, Semantic Web.

PREREQUISITES: Good fundamental knowledge in Programming Languages, Programming Environments, XML Technologies, Computer Networks, and Database Management Systems.

TEACHING METHODS: Lectures, using slides, laboratory work on main topics with individual and group tasks, course project preparation, and defense.

METHOD OF ASSESSMENT: Composite evaluation: continuous assessment (40%), essay or presentation on the theory (10%), and course project (50%).

INSTRUCTION LANGUAGE: Bulgarian.

BIBLIOGRAPHY:

1. J. Duckett, "Web Design with HTML, CSS, JavaScript and jQuery Set",Wiley, 2014, 1st Edition, ISBN: 9781118907443;
2. A. Lock. ASP.NET Core in Action, Manning Publications, 2018, 1st Edition, ISBN: 9781617294617;
3. R. Nixon, "Learning PHP, MySQL & JavaScript", O'Reilly Media; 5th edition, 2018, ISBN: 978-1491978917;
4. M. Fitzgerald, "Introducing Regular Expressions," "O'Reilly Media, Inc.", 2012, ISBN:9781449392680;
5. E. Elliott, "Programming JavaScript Applications," O'Reilly Media Formats: Safari Books Online, Early Release Ebook, March 2014;
6. M.P. MATHA, "JSP and SERVLETS: A Comprehensive Study," PHI Learning Pvt. Ltd., 2013, ISBN: 9788120347458;
7. N. Gray, "Web Server Programming," Wiley, 2003, ISBN: 0470850973.

DESCRIPTION OF THE COURSE

Name of the course: **Systems for remote monitoring and control of space crafts**	Code: **MpCST6.1**	Semester: **1**
Type of teaching: Lectures (L), Laboratory work (LW)	Hours per semester: L – 30 hours LW – 15 hours	Number of credits: **4**

LECTURER:

Assoc. prof. Mitko Shopov, PhD, lecturer in TU-Sofia, Plovdiv branch, Faculty of Electronics and Automatics, Dept. CST – tel.: (032) 659 765 e-mail: mshopov@tu-plovdiv.bg.

Hristo Indzhov, PhD, CEO, Space Cube, Germany, e-mail: h.indzhov@space-cube.de.

COURSE STATUS IN THE CURRICULUM: Electable course for students in the MSc program in Computer systems and technologies.

AIMS AND OBJECTIVES OF THE COURSE: At the end of the course the students are expected to have knowledge about the architecture and organization of monitoring and control systems (MCS), their main information flows, and the components that represent them. They will have beginner experience in the development of components/modules for MCS based on the educational environment of Simple MCS.

DESCRIPTION OF THE COURSE: The discipline is an introduction to monitoring and control systems (MCS) and their application in the space sector and space missions. The content of the course is based on an educational MCS (Simple MCS) developed with the help of Java and Spring Framework. Simple MCS introduces the telemetry chain, the telecommand chain and the components that build them. The main goal of the exercises is to implement missing functionalities in said components e.g. work with specific file formats (YAML), bitwise manipulations and object conversions, encoding and decoding of binary streams, synchronization in multi-threaded environment, storage and retrieval of data.

PREREQUISITES: Good fundamental knowledge in programming languages (including multithreading), programming environments, Computer networks, Database management systems.

TEACHING METHODS: Lectures with multimedia and web resources, laboratory works in main topics with individual and group tasks.

METHOD OF ASSESSMENT: One assessment test at the end of semester (70%), and laboratory work (30%).

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:

1. E-learning course in Moodle (https://fea.tu-plovdiv.bg/moodle);
2. European Cooperation for Space Standardization http://ecss.nl/
3. European Space Agency https://www.esa.int/ESA
4. European Ground Systems Common Core http://www.egscc.esa.int/
5. Cubesat http://www.cubesat.org/

6. Java https://docs.oracle.com/javase/tutorial/
7. Spring Framework https://spring.io/
8. Maven https://maven.apache.org/
9. GIT https://git-scm.com/

DESCRIPTION OF THE COURSE

Name of the course **Methods and devices for digital signal processing**	Code: **MpCST6.2**	Semester: **1**
Type of teaching: Lectures (L), Laboratory work (LW)	Hours per semester: L – 30 hours; LW – 15 hours	Number of credits: **4**

LECTURER:

Assoc. Prof. D-r Boyko Petrov, tel: 659760 e-mail: abpetrov@persecteam.com
TU-Sofia, branch Plovdiv

COURSE STATUS IN THE CURRICULUM: Selective subject for the student's specialty "Computer Systems and Technologies" master's degree program of the Faculty of Electronics and Automatics, Technical University of Sofia, branch Plovdiv.

AIMS AND OBJECTIVES OF THE COURSE: The goal of the course is giving theoretical and practical knowledge in the areas of analysis and syntheses of computer systems for digital processing of one-dimensional and multi-dimensional signals The main theoretical topics are related to development and realization of devices and systems for digital signal processing.

DESCRIPTION OF THE COURSE:. Main topics**:** development of linear digital filters, methods for spectral and correlative analyses of the signals, specialized techniques for signal processing, methods for one multidimensional signals compressing, architecture of specialized processors for digital signal processing. Practical topics: program realization of digital filters, using of computer libraries for spectral and correlative signal analyses of digital signal processors.

PREREQUISITES: Good programming skills with the C computer language. Good knowledge on mathematics.

TEACHING METHODS: Lectures, using slides and multimedia presentations, laboratory work with some particular tasks solving, course work.

METHOD OF ASSESSMENT: The final estimation is based on the exam results – 80% and laboratory work – 20%.

INSTRUCTION LANGUAGE: Bulgarian.

BIBLIOGRAPHY:

1. Макс, Ж., Методы и техника обработки сигналов при физических измерениях, М.: Мир, 1983, първа и втора част.
2. Ташев, Ив., Методи,устройства и системи за събиране и преобразуване на информация, Учебник за дистанционно обучение при ТУ София.
3. Прэтт У.: Цифровая обработка изображений, том 1 и 2, Москва,"Мир", 1982г.
4. Беноа Ерве, Цифрова телевизия – MPEG-1, MPEG-2. Принципи на системата DVB, София,2001г, "ЛИК"
5. http://www.analog.com/processors/sharc/
6. http://www.analog.com/processors/blackfin/index.html
7. http://www.cs.sfu.ca/CC/820/mark/material/refs.html

DESCRIPTION OF THE COURSE

Name of the course **Project**	Code: **MpCST07**	Semester: **1**
Type of teaching: Course project	Hours per semester: Self work	Number of credits: **2**

Student must select one of the subjects from the current semester and develop course project.

DESCRIPTION OF THE COURSE

Name of the course: **Distributed embedded systems**	Code: **MpCST08**	Semester: **2**
Type of teaching: Lectures (L), Laboratory Work (LW), course work	Hours per semester: **L – 30;** **LW – 15**	Number of credits: **5**

LECTURERS:

Assoc. Prof. PhD Nikolay R. Kakanakov (FEA), tel.: 659765, e-mail: kakanak@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Compulsory for student's specialty Computer Systems and Technologies MEng programme of the Faculty of Electronics and Automation

AIMS AND OBJECTIVES OF THE COURSE: At the end of the course the students are expected to know the techniques for design and implementation of application and systems programs for distributed embedded systems as well as communication protocols and architecture for data exchange in distributed embedded systems.

DESCRIPTION OF THE COURSE:

Main topics: Embedded systems programming. Development platforms and tools for DES. Designing DES. Application of Web technologies in DES. Real-time Operating Systems. Ethernet in real-time communication. Sensor networks. Distributed Embedded Systems security. Internet of Things and BigData. Analytical estimation of delays in controller networks.

PREREQUISITES: Microcontroller technologies, Microprocessors, Computer Periphery, Operating Systems, Programming, Computer Networks.

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

METHOD OF ASSESSMENT: One test assessment at the end of the semester (50%), and defense of course work implemented during the laboratory exercises (50%).

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:

1. J. Axelson "Embedded Ethernet and Internet Complete", Lakeview Research LLC, 2003, ISBN:1-931448-000;
2. Qing Li and Carolyn Yao, "Real-Time Concepts for Embedded Systems, " CMP Books, 2003.
3. Topp, U., P. Müller, "Web based service for embedded devices", Lecture Notes in Computer Science, Volume 2593 / 2003, pp. 141 – 153, ISSN: 0302-9743;
4. M. Barr, A. Massa, "Programming Embedded Systems," O'Reilly, 2006.;
5. G. Spasov, M. Shopov. V. Spasova, N. Kakanakov, "Tutorial for laboratory work in microprocessor systems", Technical University of Sofia, 2013.
6. G. Spasov, N. Kakanakov, M. Shopov, "Tutorial for laboratory work in computer networks", Technical University of Sofia, 2009.

DESCRIPTION OF THE COURSE

Name of the course **VLSI design**	Code: **MpCST09**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW)	Hours per semester: L – 30 hours; LW – 15 hours	Number of credits: **5**

LECTURER (S):

Assoc. Prof. PhD Atanas Kostadinov, Computer systems and Technologies Department,
Technical University – Sofia, branch Plovdiv, Phone: + 359 32 659 726,
email: kostadat@tu-plovdiv.bg.

COURSE STATUS IN THE CURRICULUM: A compulsory subject for the Computer Systems and Technologies students admitted to the master program. The Computer Systems and Technologies Department belongs to the Electronics and Automation Faculty (EAF). EAF is a part of the Technical University – Sofia, Plovdiv branch.

AIMS AND OBJECTIVES OF THE COURSE: The main goal of the above-mentioned subject is the receiving or refreshing of basic knowledge for CPLDs (Complex Programmable Logic Devices), FPGAs (Field Programmable Gate Arrays), and VHDL (Very high-speed integrated circuit Hardware Description Language). The main topics are connected to the CPLD, FPGA, and VHDL. The acquired knowledge will open to the students the possibilities of using reconfigurable integrated circuits and VHDL in the digital and microprocessor devices and systems design. The objectives of this course are:

- Understand or refresh the concept of reconfigurable logic;

- Know and remember how different processor architectures are designed;

- Learn or refresh your knowledge of how to use the VHDL in the simulation and synthesis of a microprocessor and a simple computer;

- Be able to use CAD tools to design and simulate digital circuits.

DESCRIPTION OF THE COURSE: The main topics covered in this subject are: The basic terms used in VLSI (Very Large–Scale Integration) design. CMOS (Complementary Metal Oxide Semiconductor) logic gates. Behavioral, Structural, and Dataflow descriptions of digital devices using VHDL; Simulation of the designed digital circuits using ModelSim. Work with Quartus II Web Edition/Quartus Prime Lite Edition and Vivado HL System Edition; Cyclone II FPGA Starter Development Board, DE2 (Development and education board) and Nexys4 DDR FPGA boards – basic electronic components and parameters; Fundamentals of different microprocessor architectures; Microprocessors datapath – design and test of simple datapath unit. Microprocessor control unit – implementing basic arithmetic and logic instructions; Verification of the designed computer system consisting of microprocessor and RAM (Random Access Memory) using SignalTap II embedded logic analysis; Optimization of implemented processor architecture using Quartus II Advisors; Different IP (Intellectual Property) microprocessor architectures described by HDLs (Hardware Description Languages); Synchronization and signal propagation in VLSI circuits; Multiple cores microprocessor architectures – short information; Multiprocessor systems – types, advantages and disadvantages.

PREREQUISITES: The prerequisite subject is BpCST17.1 Reconfigurable logic.

TEACHING METHODS: The lectures presented the above material using slides and a multimedia projector. In the laboratory exercises are applied CAD tools to design and simulate digital circuits described in VHDL as well as FPGA boards for their implementation.

METHOD OF ASSESSMENT: The written exam is in the form of a test. The final mark consists of written exam (80%), midterm exam (10%) and laboratory work (lab report grading - 10%).

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:

1. W. Dally, R. Harting, T. Aamodt, Digital Design Using VHDL: A Systems Approach, 1st Edition, Cambridge University Press, 2016.

2. C. Unsalan and B. Tar, Digital system design with FPGA: Implementation using Verilog and VHDL, 1st Edition, McGraw-Hill Education, 2017.

3. Modern digital design with EDA, VHDL and FPGA, 1st Edition, Terasic Inc., 2015.

4. https://cst.tu-plovdiv.bg/edu/msc/login/index.php

5. https://www.ee.ryerson.ca/~courses/coe328

6. https://www.intel.com/content/www/us/en/products/programmable.html

7. https://www.xilinx.com

DESCRIPTION OF THE COURSE

Name of the course **Bioinformatics**	Code: Mp**CST10.1**	Semester: 2
Type of teaching: Lectures (L) Laborathory work (LW)	Hours per semester: L – 30 hours; LW – 15 hours	Number of credits: **5**

LECTURER (S):
Assoc. Prof. PhD Ivaylo Atanassov (FEA) – tel.: 659 729, email: ivo_atan@tu-plovdiv.bg ,
Technical Technical university of Sofia

COURSE STATUS IN THE CURRICULUM: Optional course for first-year students in Computer Systems and Technologies, M.Sc. program of the Faculty of Electronics and Automatics, Technical University of Sofia, branch Plovdiv.

AIMS AND OBJECTIVES OF THE COURSE: After course completion, students should: know the goals of bioinformatics; biological motivation concepts; a set of methods and algorithms used in bioinformatics and a set of bioinformatics databanks.

DESCRIPTION OF THE COURSE: Main topics: Molecular biology reminder. Sequence comparison algorithms. Markov models. Databases in bioinformatics. Gene detection. Genome mapping. Protein analysis.

PREREQUISITES: Discrete mathematics. Data structures. Synthesis and analysis of algorithms. Combinatorial algorithms.

TEACHING METHODS: Lectures with multimedia presentations. Tutorials using demo software.

METHOD OF ASSESSMENT: Written tests on the theory.

INSTRUCTION LANGUAGE: Bulgarian.

BIBLIOGRAPHY: 1. Shamir R., Algorithms in molecular biology, 2002; 2. Online Courses in Bioinformatics and Molecular Biology, MIT ; 3. Tomova Sn., Biology digest (in Bulgarian), Sofia, Modula 1994; 4. Stoichev S., J.Genoff, Lecture scripts in bioinformatics, Plovdiv, 2004.

DESCRIPTION OF THE COURSE

Name of the course **Combinatorial Algorithms**	Code: **MpCST10.2**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW)	Hours per semester: L – 30 hours LW – 15 hours	Number of credits: **5**

LECTURER (S):
Assist. Prof. Ph.D. Dobrinka Petrova (FEA) – tel.: (032) 659 727, email: dpetrova@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Elective course for students in the MSc program in Computer Systems and Technologies.

AIMS AND OBJECTIVES OF THE COURSE: The aim of the course is to provide knowledge about the mathematics and basic methods and algorithms, used in Combinatorics and Graph Theory. Students gain skills to apply them for solving problems in different areas of Computer Science.

DESCRIPTION OF THE COURSE: The main topics concern: Permutations; Variations; Combinations; Sets, Partitioning; Graph – basics and representation; Graph Search; Extremal path algorithms; Euler Path and Cycle; Hamiltonian Path and Cycle; Topological Sorting; Planarity; Colorings; Matching; Isomorphism and Automorphism.

PREREQUISITES: Good fundamental knowledge in Synthesis and Analysis of Algorithms, Discrete Mathematics, Mathematics and Programming.

TEACHING METHODS: Lectures, using slides, laboratory work on main topics with individual and group tasks.

METHOD OF ASSESSMENT: Composite evaluation: assessment test at the end of semester (60%) and laboratory work (40%).

INSTRUCTION LANGUAGE: Bulgarian.

BIBLIOGRAPHY:

1. Наков Пр., П. Добриков. Програмиране = ++ Алгоритми; София, 2005.
2. Harris J. M., J. L. Hirst, M. Mossinghoff. Combinatorics and Graph Theory, Second edition, Springer, 2008.
3. M. Bona. A Walk Through Combinatorics: An Introduction to Enumeration and Graph Theory, Third Edition, World Scientific Publishing Co, 2011.
4. R. J. Wilson, Introduction to Graph Theory, 5th edition, Prentice Hall, 2010.
5. B. Bollobás, Modern Graph Theory, Graduate Texts in Mathematics 184, Springer-Verlag, 1998.
6. Kreher D. L. and Stinson D. G. Combinatorial Algorithms, CRC Press, 1998.

DESCRIPTION OF THE COURSE

Name of the course **Learning and self-learning in programming**	Code: **MpCST10.3**	Semester: **2**
Type of training: Lectures (L) Laboratory work (LW)	Hours per semester: L – **30 hours** LW – **15 hours**	Number of credits: **5**

LECTURER (S):

Assoc. Prof. Eng. Dilyana Budakova PhD, tel.: 0878 28 1616, e-mail:
dilyana_budakova@tu-plovdiv.bg, dilyana_budakova@yahoo.com
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Elective subject for the Master of Science degree course in „Computer Systems and Technologies “

AIMS AND OBJECTIVES OF THE COURSE: The subject aims to introduce the students to the theory and practice of learning and self-learning in computer systems. At the end of their training, the students are expected to be able to design systems, capable of learning and self-learning by their experience, and be capable of deriving the correct model of a notion or a situation; able to predict whether an event is going to happen or not as well as to give instructions how the event could be avoided; the systems will be capable of finding out the most important characteristics while considering an unfamiliar process or event, as well as of explaining the cause and result relationships. Building systems of this kind will be economically beneficial for society.

DESCRIPTION OF THE COURSE: Some of the main topics to be discussed are: learning by analyzing differences; Learning by explaining experience, Learning by correcting mistakes; Learning by recording cases; Learning by managing multiple models; Learning by building identification trees; Learning by training neural nets, Deep learning; Fine-tuning transformer models; learning by simulating evolution; Conditional probability, Bayesian networks, Probabilistic Graphical Models, Markov models, Hidden Markov Models, Reinforcement learning, Q-learning, Imitation learning.

PREREQUISITES: Basic programming languages.

TEACHING METHODS: Lectures were delivered using multimedia tools, presentations were provided on the Moodle electronic platform, and laboratory exercises were conducted on the main lecture topics.

METHODS OF ASSESSMENT: Assessment of the exam and student work during laboratory exercises and tests.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY: 1.Kevin Murphy, ML Machine Learning - A Probabilistic Perspective, 2012, MIT Press, Cambridge; **2.**Sutton S. Richard, Barto A. Andrew, Reinforcement Learning: An Introduction, Second Edition, (2017), The MIT Press, Cambridge. 3.Russell S., Norvig P., Artificial Intelligence A Modern Approach, Prentice Hall, Third Edition, (2010), 4. Teahan W. J., Artificial Intelligence – Agent Behaviour I, (2010) William John Teahan & Ventus Publishing ApS, 5. Michael Nielsen, http://neuralnetworksanddeeplearning.com/chap6.html; 6. Machine Learning – Stanford **Uni** https://www.youtube.com/playlist?list=PLLssT5z_DsK-h9vYZkQkYNWcItqhlRJLN;

DESCRIPTION OF THE COURSE

Name of the course **Mathematical methods for digital signal processing**	Code:: **FaMpEE03;** **FaMpCST02;** **FaMpAICE202**	Semester: **II**
Type of teaching: Lectures (L) Laboratoty work (LW)	Semester hours: L – 20 hours, LW – 20 hour	Number of credits: **3**

LECTURER:

Assoc. Prof. PhD B. K. Pachedjieva (FEA) – tel.: 659 708; e-mail: pachedjieva@tu-plovdiv.bg

Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Optional course for the students in Master's programs in "Electrical Engineering", "Computer Systems and Technologies" and "Automatics, Information and Control Engineering"

AIMS AND OBJECTIVES OF THE COURSE: The aim of the course is to provide theoretical knowledge and practical skills using mathematical methods for digital processing and in particular Probabilistic and statistic methods at solving most important theoretical and practical problems in electronics – in particular statistical treatment of experimental data.

DESCRIPTION OF THE COURSE: The main topics concern: Probabilities; Random variables; System from random variables; Deterministic connections between Random variables; Statistical treatment experimental date; Random Processes; Stationary Random Processes; Markov Random Processes; Elements of the theory telegraphic systems; Transforming random processes in electronics units.

PREREQUISITES:. Good fundamental knowledge in the courses: Higher mathematics, Theoretical electrical engineering, Signals and systems.

TEACHING METHODS: Lectures, and laboratory work.

METHOD OF ASSESSMENT: Two two-hour assessments at mid and end of semester.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY: 1. Vencel E. S., L. A. Ovcharov. The theory of probability and its engineering applications. Moscow, Science press, 1988. 2. Gmurman V. E. The theory of probabilities and mathematical statistics. Moscow, Higher school press, 2002. 3. Gmurman V. E. Manual to the decision of tasks on the theory of probabilities and mathematical statistics Moscow, Higher school press, 2003. 4. Srinath M. D. Introduction to statistical signal processing with applications. Prentice-Hall, New Jersey, 1996. 5. Alberto Leon-Garcia. Probability and Random Processing for Electrical Engineering, Addison–Wesley, 1994. 6. Ferdinandov E. S., B. K. Pachedjieva. Probabilistic and statistic methods in communications. Sofia, Siela, 2005.

DESCRIPTION OF THE COURSE

Name of the course **Time series forecasting**	Code: FaMpEE01	Semester: 1
Type of teaching: Lectures (L), Laboratory work (LW)	Lessons: L– 20 hours LW– 20 hours	Number of credits: **3**

LECTURER (S): eng. Alexander Angelov, e-mail: aangelov82@abv.bg;
ESO EAD, RDS-South, Plovdiv

COURSE STATUS IN THE CURRICULUM: Facultative course for the student's specialty "Electrical Engineering", "Automatics, Information and Control Engineering" and "Computer Systems and technologies" at the Faculty of Electronics and Automation in TU-Sofia, Plovdiv Branch, Master's degree.

AIMS AND OBJECTIVES OF THE COURSE: After the successful completion of the course students must know the basic methods for forecasting the time series and be able to apply them in data analysis.

DESCRIPTION OF THE COURSE: In the learning process, students are introduced to different methods for predicting time series - conventional (regression and autocorrelation methods, smoothing methods, etc.) and modern, based on artificial intelligence (neural networks, etc.). Algorithms for analysis of the initial data, selection of a suitable mathematical model, and methods for determining the parameters of the model are considered. The course deals with applied examples and tasks, focused mainly on engineering applications for modeling and making forecasts based on the compiled models. Algorithms for quantitative assessment of the accuracy of the applied models are studied.

PREREQUISITES: Knowledge of the basics of mathematics is required.

TEACHING METHODS: Multimedia presentations are used in the lectures. Students have pre-accessed the presentations and can supplement them with explanations from the teacher. Laboratory exercises include specific tasks using computers and data processing software..

METHOD OF ASSESSMENT: Two examines during the semester (80%) and laboratory work (20%).

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:
1.Вучков, И., С. Стоянов. Математическо моделиране и оптимизация на технологични обекти. Техника, София, 1980, 1986

2. Цочев, В., Д. Дамгалиев, Н. Козарев, Н. Манолов. Ръководство по методи за експериментални изследвания и оптимизация. МАРТИЛЕН, София, 1994.

3. Вучков, И., С. Стоянов, Н.Козарев, В.Цочев. Ръководство за лабораторни упражнения по статистически методи.Издателство "Нови знания", София, 2002

4. R.H. Shumway, D. S. Stoffer. Time Series Analysis and Its Applications, Springer Texts in Statistics, 3rd ed.