DESCRIPTION OF THE COURSE

Course title**: Measuring instruments and systems**	Code: **MpEE01**	Semester: **1**
Type of teaching: Lectures laboratory exercises	Hours per week: L - 30 hours; LE - 30 hours.	number of credits: 5

LECTURER: Assoc. Prof. Eng **Margarita Angelova Deneva** PhD**,** pfone 032 659 759, email: deneva@tu-plovdiv.bg

Ass.prof. Eng. Nikolai Paunkov PhD, pfone 032 659 687. nick123@abv.bg

Department "Electrical engineering", Technical University of Sofia, Branch Plovdiv

COURSE STATUS IN THE CURRICULUM: The course is mandatory for the students of specialty "*Electrical engineering* " on FEA TU-Sofia, Plovdiv Branch for the academic degree "Master."

PURPOSE OF THE COURSE: The purpose of the course is for students to learn and be able to apply the approaches, methods and technical means to analyze, model, ensure and improve the accuracy and reliability of measurement systems and, in accordance with their needs and interests, to acquire new knowledge and capabilities in this subject area.

COURSE DESCRIPTION: The course covers different types of measurement systems, general principles for their construction, as well as methods for noise reduction and noise effects. Modern specialized measurement systems for the measurement of wave and energy characteristics of electromagnetic radiation in radio and optical range are also considered. A large percentage is also the examination of modern measurement systems realized through virtual measurement tools. The laboratory exercises aim to familiarize students with the practical application of different types of measurement systems, as well as the use of specialized equipment for measuring quantities of contemporary problems.

BACKGROUND: Previous knowledge in Physics, Mathematics, Theoretical Electrical Engineering, Materials Science, Semiconductor components, Computer systems, Electrical measurements.

TEACHING METHODS: Lectures, laboratory reports with a written report and individual protection.

METHODS OF ASSESSMENT: Written ongoing assessment at the end of semester (80%), laboratories assignments (20%).

LANGUAGE: Bulgarian

RECOMMENDED BOOKS

1. Lecture notes.
2. John Bentley. Principles of Measurement Systems. Longman Scientific @ Technical. 1992.
3. *https://forums.ni.com/t5/Community-Documents/Introduction-to-LabVIEW-and-Computer-Based-Measurements-Full-Day/ta-p/3526527?profile.language=en*
4. http://zone.ni.com/
5. Krastev G, Tsc. Georgiev. Automation tools of the scientific research, Ruse, 2002
6. M. Deneva, M. Nenchev, „Laser radiation in presentation for engineers and applicators”, Technical University of Sofia – branch Plovdiv, 2015

DESCRIPTION OF THE COURSE

Name of the course: **Numerical methods and circuits modeling**	Code: **MpEE02**	Semester: 1
Type of teaching: Lectures (L) Laboratory work (LW)	Hours per semester: L – 30 hours LW – 30 hours	Number of credits: **5**

LECTURER(S):
Assoc. Prof. Eng. Ivan Hadzhiev, PhD (FEA), tel.: 032 659-686,
e-mail: hadzhiev@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 Electrical Engineering, Professional orientation 5.2 Electrical Engineering, Electronics and Automation, Field 5. Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: To introduce students to the finite element method with nodal elements for modeling of electromagnetic fields and electrical circuits. Application of the finite element method to the analysis of two-dimensional, axis-symmetric and three-dimensional electromagnetic fields excited by current sources, voltage sources or permanent magnets. Coupling of the electric circuits equations with the equations of the electromagnetic field and movement. Demonstration of the practical application of the finite element method to modelling of electrical devices fed by current source or voltage source of arbitrary shape and frequency, at presence or absence of movement. Application of the finite element method to numerical modeling of devices of complex geometry of the magnetic circuits and coils, and non-linear characteristics of materials.

DESCRIPTION OF THE COURSE: Basic topics: Equations and problems for the analysis of electrical, magnetic and thermal fields. The finite element method – nature, main characteristics, element types and interpolation polynomials. Steps in the finite element method. Galerkin formulation. Forming of local and global matrix. Assembling. Example for forming the matrices of two-dimensional magnetic field. Non-linear problems. Two-dimensional analysis of permanent magnets by the finite element method. Solving time-dependent problems by the finite element method. Eddy currents. Skin effect. Coupling the electromagnetic field and electric circuits equations in the two-dimensional analysis of electric machines by the finite element method. Modeling of mixed quasy-stationary electromagnetic and thermal field by the two-dimensional finite element method. Three-dimensional problems fed by current source. Postprocessing the results from the three-dimensional finite element analysis. Modeling of electric circuits in the three-dimensional finite element analysis of electromagnetic devices. Coupling the electromagnetic field and electric circuits equations. Parametric, direct and indirect model for coupling the electromagnetic field and electric circuits equations. Software for two-dimensional and three-dimensional analysis of electromagnetic fields and electric circuits by the finite element method.

PREREQUISITES: Mathematics, Physics, Theoretical Electrical Engineering, Electrical Machines, Electrical Apparatuses, CAD systems in Electrical Engineering.

TEACHING METHODS: Lectures and Laboratory exercises. The lectures are delivered by multimedia. The exercises are provided with a manual and are conducted in a computer room. The students prepare an individual report for each exercise and defend it before the supervising lecturer.

METHOD OF ASSESSMENT: Laboratory exercises (25 %) and written exam (75 %).

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY: 1. Ячев И., И. Маринова. Числени методи и моделиране на вериги и полета - I част. Технически университет - София, 2011, ISBN 978-954-438-652-8; 2. Ячев И., И. Маринова. Ръководство за лабораторни упражнения по числени методи и моделиране на вериги и полета - I част. Технически университет - София, 2007, ISBN 978-954-438-651-1; 3. Соколов Е. Методът на крайните елементи в електротехниката. Юбилейна научна сесия "50 години ТУ – София", секция Електротехника, октомври 1995, 3-16; 4. Александров А. Компютърно проектиране на електрически апарати. Авангард Прима, София, 2004, ISBN 954-323-055-2; 5. Александров А. Специален курс по електрически апарати. София, Техника, 1983; 6. Брандиски К., И. Ячева. CAD системи в електромагнетизма, София, CIELA, 2002; 7. Кулон Ж. Л. САПР в электротехнике. Москва, Мир, 1988; 8. Демирчян К., В. Чечурин. Машинные расчеты электромагнитных полей. Москва, Высшая школа, 1986; 9. Jin J. The finite element method in electromagnetics, John Wiley & Sons, 1993; 10 Hoole S. Computer-aided analysis and design of electromagnetic devices, Elsevier Science Publishing Co., Inc., 1989; 11. Zienkewich O. The finite element method. London, Mc-Graw Hill, 1977.

DESCRIPTION OF THE COURSE

Name of the course: **High Voltage Electrical Machines and Apparatuses**	Code: **MpEE03**	Semester: 1
Type of teaching: Lectures (L) Laboratory work (LW) Course work (CW)	Hours per semester: L – 30 hours LW – 30 hours	Number of credits: **5**

LECTURER(S):

Assoc. Prof. Eng. Ivan Hadzhiev, PhD (FEA), tel.: 032 659-686,
e-mail: hadzhiev@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 Electrical Engineering, 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 general issues of the design, principle of operation, characteristics and testing of high voltage electric machines and apparatuses. Upon completion of the course the students should acquire advanced theoretical knowledge and practical skills in the field of high voltage machines and apparatuses.

DESCRIPTION OF THE COURSE: The High Voltage Electrical Machines module introduces the students to the design, principle of operation, characteristics and testing of turbogenerators and hydrogenerators, high voltage synchronous and induction motors, and high voltage transformers. The cooling methods, excitation systems, winding insulation systems and various modes of operation are discussed. The High Voltage Electrical Apparatuses module studies the design, principle of operation, characteristics, testing, application and operation of circuit breakers, power disconnectors, reclosers, medium and high voltage switchgear, surge arresters, current and voltage transformers and other high voltage devices. The insulation systems and drives of the apparatuses are discussed and attention is paid to the commutation problems.

PREREQUISITES: Theoretical Electrical Engineering, Electrical Machines and Apparatuses and Electrical Measurements courses.

TEACHING METHODS: Lectures and Laboratory exercises. The lectures are delivered by multimedia. The students prepare an individual report for each exercise and defend it before the supervising lecturer.

METHOD OF ASSESSMENT: Laboratory exercises (20 %), written exam (65%) and course work (15 %).

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY: 1. Драгомиров Т., Ячев Ив., Електрически апарати за високо напрежение, ИК "ICON", 1994. 2. Tavner P, Penman J. Condition monitoring of rotating electrical machines. Published by The Institution of Engineering and Technology, London, 2008. 3. Справочник по электрическим апаратом высокого напрежения, под редакцией В. В. Афанасиева, Ленинград, Енергоатомиздат, 1987. 4. Теория и конструкции выключателей, под редакцией Ч. Ф. Фершейна, Ленинград, Енергоатомиздат, 1982. 5. Кукеров Г., Выключватели переменного тока высокого напрежения, Енергия, 1972. 6. Ангелов А., Д. Димитров, Електрически машини, част първа, София, Техника, 1988. 7. Абрамов А., Иванов А. Проектирование гидрогенераторов и синхронных компенсаторов. Москва,

Высшая школа, 2001. 8. Глебов И., Диагностика турбогенераторов, Наука, 1989. 9. Димитров Д., Ваклиев И., Сотиров Д., Стоянов М., Ръководство за изпитване на електрически машини, София, Техника, 1991. 10. Dasgupta I. Power transformers quality assurance. New Age International Ltd. Publishers, 2009.

DESCRIPTION OF THE COURSE

Name of the course: **Protection of power equipment**	Code: **MpEE04.1**	Semester: **1**
Type of teaching: Lectures (L) Laboratory work (LW)/Seminars (S) Course work (CW)	Hours per semester: L – 30 hours S – 0 hours LW – 30 hours	Number of credits: 5

LECTURER(S):
Assoc. Prof. Eng. Misho Matsankov, PhD (FEA), tel.: 032 659 686 e-mail: mishel@tu-plovdiv.bg
Assoc. Prof. Eng. Georgi Ganev, PhD (FEA), тел.: 032 659 560, email: gganev@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Mandatory elective course for full-time students majoring in "Electrical Engineering" at the FEA of TU-Sofia Plovdiv Branch for the Master's degree in the professional field 5.2 Electrical Engineering, Electronics and Automation, field 5. Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: The discipline introduces students to the principles of operation, characteristics and settings of the relay protections of the main devices and equipment used in the power industry - networks, transformers, generators, buses, motors.

DESCRIPTION OF THE COURSE: The course examines the main types of protection - maximum current, directional current, distance and differential protection and their application in distribution and transmission networks. The protections of generators, transformers, electrical machines and busbars are considered against their typical emergency modes. In the lectures, along with the use of protection relays and electromechanical relay protections, emphasis is placed on digital protection devices - structure, mathematical algorithms, etc. During the laboratory exercises, students acquire knowledge and skills to test and adjust digital relay protections.

PREREQUISITES: The discipline is based on knowledge acquired in the courses in Theoretical Electrical Engineering, Electrical Machines, Electrical Apparatus, Electric Power Engineering and Electrical Networks and Systems.

TEACHING METHODS: Lectures are conducted using multimedia. Laboratory exercises are conducted in accordance with the exercise manual. Exercise minutes are checked and defended to the exercise leader. All necessary materials are provided to students in advance.

METHOD OF ASSESSMENT: Written exam at the end of the semester. The assessment is complex, from the defense of protocols from laboratory exercises (20%) and from the exam (80%).

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:

1. Вичев С. Записки по релейна защита (CD);
2. Аврамов Н. Основи на релейната защита. С., Техника, 1984;
3. Horowitz S,, A.Phadke. Power System Relaying, J.Wiley&Sons, Ltd, 2008;
4. Networks protection and automation guide, Areva, 2005.
5. Неделчев Н., Цифрови релейни защити и автоматизация в интелигентните електрически мрежи, ТУ-София 2012г.

COURSE DESCRIPTION

Course Title: **Vector control of electric motors**	Code: **MpEE05.1**	Semester: **1**
Type of teaching: Lectures and Laboratory Work Course Project - Yes	Hours per Semester: L - 30 hours, LW – 30 hours,	Credits: **5**

LECTURERS:

1. Assoc. Prof. Ph.D. Ivan Kostov (FEA) – tel.: +35932659526, e-mail: ijk@tu-plovdiv.bg , Technical University - branch Plovdiv; 2. Assist. Prof. Ph.D. Vasil Drambalov, e-mail: v_drambalov@tu-plovdiv.bg

COURSE STATUS IN THE CURRICULUM: Elective subject for full-time students of the specialty "Electrical engineering" of the Faculty of Electronic and Automation of the Technical University of Sofia – branch Plovdiv, for educational and qualification master's degree.

AIMS AND OBJECTIVES OF THE COURSE: At the end of the course the students are expected to be able to apply the principles of adjustable drives with DC and AC motors, to have more knowledge on their structure and performance, to analyze drives behavior and drives parameters, to choose appropriate drive for particular industrial application. To expand students' knowledge of mathematical description, structures, algorithms and modern means of control of alternating current electric drives: asynchronous, synchronous, valve-inductor. The main attention is paid to vector approaches to control of electric drives, which are based on the method of vector representation of variables in the state space. The basic schemes, methods and features of formation of control signals of the power semiconductor converters widely applied in the electric drive of alternating current are considered. In addition to the traditional approach to vector control with direct and indirect orientation in digital implementation, examples of digital relay-vector control, digital adaptive-vector control with and without the use of angular displacement sensor, direct torque control are considered.

DESCRIPTION OF THE COURSE: In the course the following subject are studied: Introduction to high performance electric drives, mathematical and simulation models of DC and AC machines (ACM: IM, SMPM and SRM), power converters with different PWM and spatial vector SVPWM modulations, vector control of AC machines - direct/indirect control and sensor/sensorless control, parametric and coordinate observers and estimators, direct torque control (DTC) of AC machines.

PREREQUISITES: Necessary knowledge of Mathematics, Physics, Electrical Engineering, Electronics.

TEACHING METHODS: Classical lectures with visual aids and demos. Laboratory works with individual laboratory reports. Project with defense prepared in standard form – theoretical and experimental (solutions and results) part.

METHOD OF ASSESTMENT: Final assessment is formed by written final examination, laboratory reports defense and students' activity during seminars with equal weights. The project has separate assessment.

ISTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:

1. Bolton W., Mechatronics. Electronic Control Systems In Mechanical And Electrical Engineering, Sixth Edition, Pearson Education, 2015, p.663, ISBN 978-1-292-08159-5. 2. Liuping Wang, Shan Chai, Dae Yoo, Lu Gan and Ki Ng, PID and Predictive Control of Electrical Drives and Power Converters using MATLAB®/Simulink®, First Edition, 2015, John Wiley & Sons Singapore, ISBN: 9781118339442, Pages: 344. 3. Chiasson J, Modelling and High-Performance Control of Electric Machines, John Wiley & Sons Inc., 2005, ISBN 0-471-68449-X (cloth), p.709. 4. John J. Craig, Introduction to Robotics: Mechanics and Control, Pearson Education Limited, 2014, Third Edition, p.369. 5. Steven A. Frank, Control Theory Tutorial, Basic Concepts Illustrated by Software Examples, SpringerBriefs in Applied Sciences and Technology, 2018, ISBN 978-3-319-91706-1, ISBN 978-3-319-91707-8, https://doi.org/10.1007/978-3-319-91707-8, p.112. 6. Rik De Doncker, Duco W.J. Pulle, André Veltman, Advanced Electrical Drives, Analysis, Modeling, Control, Springer, 2011, e-ISBN 978-94-007-0181-6, DOI 10.1007/978-94-007-0181-6, p.475. 7. Костов И., Г. Иванов, Ръководство за лабораторни упражнения по управление на електрозадвижванията, Пловдив, 2014, с.100. 8. Костов И., Г. Иванов, Ръководство за курсово проектиране и семинарни упражнения по управление на електрозадвижванията, Пловдив, 2014, с.140. 9. И. Й. Костов, Електрозадвижвания с постояннотокови, асинхронни и синхронни двигатели, учебно пособие, Пловдив, 2016, ISBN 978-619-90128-0-2.

DESCRIPTION OF THE COURSE

Name of the course: **Computer simulation of processes and electrical systems with switching**	Code: **MpEE05.2**	Semester: **1**
Type of teaching: Lectures (L) Laboratory work (LW) Course project (CP)	Hours per semester: L – 30 hours LW – 30 hours	Number of credits: **5**

LECTURER(S):
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Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Elective course for full-time students, majoring in Electrical Engineering at the Faculty of Electronics and Automation, TU–Sofia, Plovdiv Branch, for receiving the Master of Science degree, professional field 5.2 Electrical Engineering, Electronics and Automation, Area 5. Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: After completion of the course the students students acquire knowledge of computer simulation of transient processes during the switching on and off of electrical circuits under normal and emergency conditions.

DESCRIPTION OF THE COURSE: Main topics: Transient processes in switching devices during connection to electrical networks; Transient processes in switching devices during disconnection from electrical networks; Recovery voltage in single-frequency and dual-frequency networks; Transient processes during the switching of a circuit with a predominantly capacitive load; Recovery voltage during the disconnection of a long transmission line under no-load and short-circuit conditions; Transient processes during the switching of a circuit with a predominantly inductive load; Processes during the switching on and off of a transformer under no-load conditions; Transient processes under normal and emergency conditions in networks with a directly grounded star point; Transient processes under normal and emergency conditions in networks with an isolated star point.

PREREQUISITES: Mathematics, Physics, Theoretical Electrical Engineering, Electrical materials and Application and use of computers.

TEACHING METHODS: Lectures and Laboratory exercises. Lectures, prepared for multimedia presentation and laboratory exercises conducted on a computer.

METHOD OF ASSESSMENT: Laboratory work (25%) and written examination (75%).

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY: 1. Notov P., Transient processes in electric power systems – Part I, Technique, Sofia, 1992; 2. Alexandrov A., Electrical apparatus, Sofia, 2004; 3. Maslarov I., Electrical apparatus, Sofia, Avant-garde prima, 2013; 4. Dragomirov T., I. Yatchev, High voltage electrical apparatus, IK "ICON", 1994; 5. Genov L., Theoretical foundations of electrical engineering, Technique, Sofia, 1991; 6. Robert Morel, Low –Voltage Cirquit Breaker: Breaking Techiquee, Technical Publication (ect 154), Schnieder Electric, June, 2000.

COURSE DESCRIPTION

Course Title: Electrical supplying and Electrical equipment	Cod: **MEE05.3**	Semester: **1**
Type of teaching: Lectures, Laboratory work, Course project.	Hours per semester: L - 30 hours; LW - 30 hours; Optionaly.	Credits: **5**

LECTURER:
Assoc. prof. PhD. Stanimir Stefanov, (FEA), tel: +35932659512, e-mail: glasst@tu-plovdiv.bg,
Technical University – Sofia, branch Plovdiv

COURSE STATUS IN THE CURRICULUM: Eligible subject for the major Electrical Engineering of the Faculty of Electrical Engineering and Automation, Mster of Science.

AIMS AND OBJECTIVES OF THE COURSE: **The subject aims at introducing students to new theoretical knowledge and practical skills in field Electrical supplying and Electrical equipment, choice of electrical motors and their joint work with working machinery, electrical equipment of lifting, pumping and ventilation systems.**

DESCRIPTION OF THE COURSE: Development of electrical power energy, energetic resources, structure of electrical power energy; Electrical loads and diagrams, quality of electrical power; Determination of basic computing loads, consumption of electrical power and compensate power; Electrical transmission network; Distributing outfit, machines and apparatuses for high voltage, transformers, switches , circuit breaker, measurement transformers; Choice of electromotors by rated performances and power; Elements of systems for control and conduct of electrical equipment, choice of apparatuses for control and defence, Schemes of second commutation; Electrical equipment of cranes; Electrical equipment of elevators; Electrical equipment of ventilators and pumps.

PREREQUISITES: The course is conducted on the basis of knowledge from the bachelor courses - BpEE01, BpEE02, BpEE03, BpEE08, BpEE09, BpEE15 and BpEE21.1.

TEACHING METHODS: Lectures. Labs are conducted in accordance whit the lab books and reports prepared by the students and checked by the supervisor. Individual students' project made through design manual and specialized PC programs for calculation and data processing; Project defence.

METHOD OF ASSESSMENT: Written exam at the end of the semester (70%), laboratories (10%) and individual cours projekt (20%). Individual course project 15th weeks with assessment.

INSTRUKTION LANGUAGE: Bulgarian.

BIBLIOGRAPHY:

1. Кирчев В., К. Янев и М. Георгиев, Електрически мрежи средно и високо напрежение, Летера, 2006.
2. Платиканов Ст., Електроснабдяване на промишлени предприятия - записки. ТУ – Габрово.
3. Стоянов Ст. и Ц. Цанев, Електрообзавеждане на производствени агрегати, София Техника, 1990.
4. Василев Н. и С. Сидеров, Ръководство за проектиране на електроснабдителни системи на промишлени предприятия, София, Техника, 1991.
5. Андреев Х., Електрически мрежи и системи – ръководство за курсово проектиране, Русе, РУ „Ангел Кънчев", 2000.

DESCRIPTION OF THE COURSE

Name of the course: **Engineering Methods for Optimization**	Code: **MpEE05.4**	Semester: **1**
Type of teaching: Lectures (L) Laboratory work (LW)/Seminars (S) Cours project (CP)	Hours per semester: L – 30 hours S – 0 hours LW – 30 hours CP - Optionali	Number of credits: **5**

LECTURER(S):
Assoc. Prof. Eng. Stanimir Stefanov, PhD (FEA), tel.: 032659512, e-mail: glasst@tu-plovdiv.bg
Assoc. Prof., PhD. Eng. Misho Matzankov (FEA), tel.: 03659685, e-mail: mishel@tu-plovdiv.bg
Technical University of Sofia, branch Plovdiv

COURSE STATUS IN THE CURRICULUM: Compulsory elective subject from the curriculum for training of students to obtain Magister's degree, specialty Electrical Engineering, 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 familiarize students, through lectures and practical exercises, with methods for solving optimization problems in the field of electrical power engineering and to equip them with the necessary knowledge for independent application in various practical situations.

DESCRIPTION OF THE COURSE: The course covers topics related to the application of mathematical methods and software packages for solving problems in the field of electrical power engineering and power systems. It includes the application of graph theory and the calculation of operating modes in complex closed electrical networks through matrix computations, harmonic analysis in power systems, linear and nonlinear optimization, mathematical statistics, game theory, and experimental design theory. Additionally, the course explores the mathematical theory of reliability and forecasting methods in electrical power engineering.

PREREQUISITES: The lectures and practical exercises are based on students' knowledge of Mathematics, Electrical power engineering, and Electrical networks and systems.

TEACHING METHODS: Multimedia presentations are used during the lectures. Students are provided with access to the presentations in advance and can supplement them with the lecturer's explanations. The laboratory exercises include solving specific tasks using computers and data processing software.

METHOD OF ASSESSMENT: Written control at the end of the semester whit a duration of 2 hours (70%), laboratory work (20%) end the pparticipation in lectures (10%) .

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:
1. Нотов П.Н., С.И. Неделчева, Основни математични подходи в електроенергетиката, ISSN 1312-3920, 1, 2018.; 2. Нотов П. Н., С. И. Неделчева, Математични методи за инженерни изследвания в електроенергетиката, ISSN 1312-3920, 2, 2018.; 3. Неделчева С. И., М. Мацанков, И. Лазаров. Приложение на теорията на вероятностите и математическата статистика в електроенергетиката, ISSN 1312-3920, 6, 2018.; 4. Неделчева С. И. Ръководство за решаване на задачи по електрически мрежи и системи. ISBN 978-619-167-243-1. София, Изд. на ТУ-София, 2016.; 5. Мацанков М., Краткосрочно прогнозиране на електрическите товари, Изд. на ТУ-София 2019 г.; 6. Вучков, И., С. Стоянов. Математическо моделиране и оптимизация на технологични обекти. Техника, София, 1980, 1986.

DESCRIPTION OF THE COURSE

Name of the course: **Special Electrical Machines and Apparatus**	Code: **MpEE06.1**	Semester: **1**
Type of teaching: Lectures (L) Laboratory work (LW)	Hours per semester: L – 30 hours LW – 30 hours	Number of credits: **5**

LECTURER(S):
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Assist. Prof. Eng. Vasil Drambalov, PhD (FEA), tel.: 032 659-687, e-mail: v_drambalov@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Elective course for full-time students, majoring in Electrical Engineering at the Faculty of Electronics and Automation, TU–Sofia, Plovdiv Branch, for receiving the Master of Science degree, professional field 5.2 Electrical Engineering, Electronics and Automation, Area 5. Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: The aim of the course is for the students to acquire advanced basic theoretical knowledge and practical skills in construction, principle of operation and types of special electrical machines and apparatus.

DESCRIPTION OF THE COURSE: Module "Special Electrical Machines" – Basic topics: Transformers for converting the number of phases, Transformers for frequency conversion. Transformers for arc welding. Transformers for insulation testing of machines and equipment. "Peak" transformers (rotating transformers), Phase regulator, Special DC machines: Wheelless for direct current, High torque motors for direct current, Generators with combined excitation, Electromachine amplifiers, Stepper motors, Celsini, Magnetohydrodynamic generators, Electromachine converters. Single-anchor DC-AC converters, DC motor with semiconductor switches, Universal collector motor. Asynchronous tachogenerators, DC tachogenerators, Linear and arc asynchronous motors, Jet synchronous motors. Asynchronous actuators. On the basis of the respective mathematical apparatus the physical essence of the electromagnetic phenomena in the special electric machines is considered. The main dependences on the theory of special electric machines are derived. The lecture material is presented from the point of view of both the theory and the practical application of electric machines in energy, automation and electric drives.

The module "Special Electrical Apparatus" introduces the students to the structure, principle of operation, characteristics and types of special-purpose electrical apparatus. Such electrical apparatus are those working in vehicles, mines, etc. Some of them are exposed to aggressive media: chemical gases (sulphur-based, nitrogen-based and other types of compounds), acids, alkalis and others. Another part are subjected to shocks, vibrations, accelerations, etc. Therefore, these machines must also meet specific requirements such as speed, accuracy, sensitivity, explosion safety, resistance to mechanical impacts, etc. Different types of electrical and electromagnetic sensors, devices for protection against residual currents, devices for protection against overvoltages, etc. are considered.

PREREQUISITES: Physics, Theoretical Electrical Engineering, Electronics, Electric machines, Electrical apparatus, Switching equipment.

TEACHING METHODS: Lectures, prepared for multimedia presentation and laboratory exercises, during which experiments, related to the topics of the lectures are conducted.

METHOD OF ASSESSMENT: The final grade is formed by two tests during the semester (75%), and the performance during the laboratory exercises (25%).

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY: Module "Special Electrical Machines": 1. Дончев Д.,Стафунски Ю.Специални електрически машини, Техника София 1990; 2. Ангелов А., Д. Димитров. Електрически машини, част първа, София, Техника, 1988; 3. Волдек А. Електрически машини, София, Техника, 1978.; 4. Бонев С., Малки силови и специални трансформатори, Техника София 1963; 5. Кононенко Е.В.»Сипайлов Г.А.Дорьков К.А. Электрические машины (спецкурс) /Учебн.пособ. для вузов. Высшая школа, М., -1975,- 279 с.; 6. 274. Фонера С. , Шварц Б. Сверхпроводящие машины и устройства. Перевод с англ. д-ра физ.-мат. наук Е.Ю. Клименко, Мир,М., 1977, - 763 с. ; 7. Соколов Е. Изследване и изпитване на електрически машини, София, Техника, 1977.; 8 Дончев Д., Митев Е., Божилов Г. Ръководство за семинарни упражнения по електрически машини, София, Техника, 1976. 6. Димитров Д., Ваклиев И., Сотиров Д., Стоянов М. Ръководство за изпитване на електрически машини, София, Техника, 1991.

Module "Special Electrical Apparatus": 1. BDS 10880:1983 - Electric mining equipment. Residual current protection devices for networks with voltage up to 1200 V with insulated star center. Technical requirements and test methods (in Bulgarian); 2. BDS 17119:1990 - Devices for protection against switching overvoltages of the underground electric networks in the coal mines (in Bulgarian); 3. Hinov K., I. Maslarov, Electrical apparatus of automation, Avangard Prima, Sofia, 2014, ISBN 978-619-160-428-9 (in Bulgarian); 4. Maslarov I., Electrical apparatus, Avangard Prima, Sofia, 2015, ISBN 978-619-160-482-1 (in Bulgarian); 5. Alexandrov A., Electrical apparatus, Sofia, 1999, ISBN 954-438-236-4 (in Bulgarian); 6. Long M., Experimental Study on Connecting and Breaking Capacity of Low Voltage Mine Electrical Apparatus, Journal of Physics: Conference Series, Vol. 1549, Issue 5, 29 June 2020, DOI:10.1088/1742-6596/1549/5/052018; 7. Okamoto I., Vibration control apparatus for vehicles, The Journal of the Acoustical Society of America 85(4), April 1989, DOI: 10.1121/1.397901; 8. Specialized literature of the companies ABB, Schneider Electric, Merlin-Gerin, Siemens, Telemecanique and others.; 9. Taev, I. S., Electrical apparatus of automation and control, Higher school, M., 1975 (in Russian).

COURSE DESCRIPTION

Course Title: **Electronic devices in transport**	Code: **MpEE06.2**	Semester: **1**
Type of teaching: Lectures and laboratory work	Hours per Semester: L - 30 hours, LW – 30 hour,	Credits: **5**

LECTURER:
Assoc. Prof. Ph.D. Nikola P. Georgiev, tel.: 659592 e-mail: nikola.georgiev@tu-plovdiv.bg,, Faculty of Electronic and Automation, dept. of Electrical engineering – Technical University of Sofia – branch Plovdiv
Principal Assistant Eng. Николай Паунков (ФЕА), tel.:659687, e-mail: nick123@tu-plovdiv.bg

COURSE STATUS IN THE CURRICULUM:
Elective subject for full-time students of the specialty "Electrical engineering" of the Faculty of Electronic and Automation of the Technical University of Sofia – branch Plovdiv, for educational and qualification degree "master".

AIMS AND OBJECTIVES OF THE COURSE:
The main aim of this course in "Electrical engineering" should be to develop in the students knowledge in general principles of work of Electronic devices in transport.

DESCRIPTION OF THE COURSE:
In the course the following subject are studied: regulator of voltage, systems for starting the engine, electronic ignition systems, measurement systems and electronic systems for management.

PREREQUISITES:
Necessary knowledge of Electronics and Electrical engineering.

TEACHING METHODS:
Lectures lead with the help of virtual models and slides, laboratory workshops is accompany to making reports and defending.

METHOD OF ASSESTMENT:
Current assessment at the end of the 1st semester.

ISTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:

1. Iliev L., B. Traikov. Electrical installation of the automobiles, Technics-Sofia, 1990.
2. Traikov. B. Electronics in the automobiles, Technics-Sofia, 1997.
3. Ю.П. Чижков, Электрооборудование автомобилей, Машиностроене, Новосибиркс 2002.
4. Тошков Г. П., 'Електроника', ТУ- Варна, 2005.
5. Erickson R, D. Maksimovic, 'Fundamentals of Power Electronics'KAP, Massachusetts, USA, 2001.

DESCRIPTION OF THE COURSE

Name of the course: **Special construction and electrical materials**	Code: M**pEE06.3**	Semester: **1**
Type of teaching: Lectures (L) Laboratory work (LW)/Seminars (S)	Hours per semester: L – 30 hours S – 0 hours LW – 30 hours	Number of credits: **5**

LECTURER(S):
Assoc. Prof. Eng. Stanimir Stefanov, PhD (FEA), tel.: 032659512, e-mail: glasst@tu-plovdiv.bg
Assoc. Prof., PhD. Eng. Marin Genchev, tel.: 032659512, email: marin2g@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Compulsory elective subject from the curriculum for training of students to obtain Magister's degree, specialty Electrical Engineering, 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 efficient and sustainable utilization of specialized construction materials for electrical machines and equipment. These materials are characterized by a set of specific properties when subjected to electromagnetic fields and installed in devices, taking into account the requirements of the Bulgarian State Standards (BDS) and the relevant international standards.

DESCRIPTION OF THE COURSE: The course "Special Construction and Electrotechnical Materials" covers the non-electrical properties of passive and active dielectrics, conductors, semiconductors, magnetic materials, optoelectronic elements, fiber-optic systems, and fuel cells. Their parameters, manufacturing technologies, quality control methods, and reliability are thoroughly examined..

PREREQUISITES: The lectures and practical sessions in the course are based on the students' knowledge in Mathematics, Physics, Chemistry, Electrotechnical Materials, Electrical Machines, Electrical Apparatus, and Technologies in Electrical Engineering and Electronics.

TEACHING METHODS: Lectures, using slides, case studies, laboratory work whit protocols and defence.

METHOD OF ASSESSMENT: Current written control in the middle and end of the semester whit a duration of 1 hour (70%), laboratory work (20%) end the pparticipation in lectures (10%) .

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:
1. Генчев М. "Електроматериалознание", учебник, ISBN 978-954-8779-99-9, Дъга принт ООД, Пловдив, 2011; 2. Генчев М. "Ръководство за лабораторни упражнения поелектроматериалознание", ISBN 978-954-8779-98-2, Дъга принт ООД , Пловдив, 2011; 3. Тодорова А.К., Г.Дюстабанов, Електротехнически материали, ПБ на ТУ-София, 1997; 4. .Барудов С., В. Илиев Б. Ников, „Материали и компоненти в електрониката” ТУ-Варна, 2006; 5. Safa O. Kasap, Principles of electrical engineering materials and devices, University of Saskatchewan, ISBN 0256161739, Book No. 96173901, 2007..

DESCRIPTION OF THE COURSE

Name of the course: **Numerical methods and fields modeling**	Code: **MpEE07**	Semester: 2
Type of teaching: Lectures (L) Laboratory work (LW)	Hours per semester: L – 30 hours LW – 30 hours	Number of credits: 4

LECTURER(S):
Assoc. Prof. Eng. Ivan Hadzhiev, PhD (FEA), tel.: 032 659-686,
e-mail: hadzhiev@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 Electrical Engineering, Professional orientation 5.2 Electrical Engineering, Electronics and Automation, Field 5. Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: To introduce students to the following methods for modelling of electromagnetic fields – the three-dimensional finite element method with vector elements and the three-dimensional multigrid method. Introduction to the theory and practice of the vector finite elements which are becoming increasing important. Derivation of three methods for computing electromagnetic force with vector elements – the virtual work method, Maxwell stress tensor method and the nodal force method. Presentation of the geometric multigrid method with vector elements. Introduction to a new accelerated multigrid method for electromagnetic fields analysis, that is manifold faster than the conventional multigrid method and the finite element method.

DESCRIPTION OF THE COURSE: Basic topics: Three-dimensional finite element method with vector elements. Shape functions of first-order vector hexahedra tetrahedra. Galerkin formulation. Coefficients of the set of equations when using vector tetrahedra and feeding by current source. Introducing the exciting current by the electric vector potential. Non-linear problems. Electromagnetic force computation when using vector finite elements. Three-dimensional non-stationary magnetic field with vector finite elements and voltage source supply. Geometric multigrid method - V- cycle, and F-cycle. Mesh generation in the geometric multigrid method. Selection of operators for restriction and prolongation. Multigrid method with symmetric Gauss-Seidel, accelerated by the conjugate gradient method. Comparison of the accelerated multigrid method with the conventional multigrid, using Gauss-Seidel, and with the finite element method.

PREREQUISITES: Mathematics, Physics, Theoretical Electrical Engineering, Electrical Machines, Electrical Apparatuses, CAD systems, Numerical methods and circuits modeling.

TEACHING METHODS: Lectures and Laboratory exercises. The lectures are delivered by multimedia. The exercises are provided with a manual and are conducted in a computer room. The students prepare an individual report for each exercise and defend it before the supervising lecturer.

METHOD OF ASSESSMENT: Laboratory exercises (25 %) and written exam (75 %).

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY: 1. Ячев И., И. Маринова. Числени методи и моделиране на вериги и полета - I част. Технически университет - София, 2011, ISBN 978-954-438-652-8; 2. Ячев И., И. Маринова. Ръководство за лабораторни упражнения по числени методи и моделиране на вериги и полета - I част. Технически университет - София, 2007, ISBN 978-954-438-651-1; 3. Соколов Е., Методът на крайните елементи в електротехниката, Юбилейна научна сесия

“50 години ТУ – София”, секция Електротехника, октомври 1995, 3-16; 4. Александров А. Компютърно проектиране на електрически апарати. Авангард Прима, София, 2004, ISBN 954-323-055-2; 5. Брандиски К., Ячева И., CAD системи в електромагнетизма, София, CIELA, 2002; 6. Ризов П., Изследване на установени режими на асинхронни двигатели с метода на крайните елементи, Дисертация за получаване на научна степен “Доктор”, София, 1998; 7. Кулон Ж., САПР в электротехнике, Москва, Мир, 1988; 8. Силвестер П., Феррари Р., Метод конечных элементов для радиоинженеров и инженеров электриков, М. Мир, 1986; 9. Демирчян К., Чечурин В., Машинные расчеты электромагнитных полей, Москва, Высшая школа, 1986; 10 Salon S., Finite element analysis of electrical machines, Kluwer Academic Publishers, Second printing 1998; 11. Jin J. The finite element method in electromagnetics, John Wiley & Sons, 1993; 12. Hoole S. Computer-aided analysis and design of electromagnetic devices, Elsevier Science Publishing Co., Inc., 1989; 13. Zienkewich O. The finite element method. London, Mc-Graw Hill, 1977.

DESCRIPTION OF THE COURSE

Name of the course **Practice of Informatics**	Code: **MpEE09**	Semester: 2
Type of teaching: Laboratory work	Semester hours: L –0; LW –20 hours	Number of credits: **2**

LECTURER: Assoc. Prof. Ph.D. Albena Taneva (FEA) – tel.: +359 32 659 585, email: altaneva@tu-plovdiv.bg Technical University of Sofia, Branch in Plovdiv

COURSE STATUS IN THE CURRICULUM: Compulsory course for the students of specialty "Electrical Engineering", 'master' degree of qualification of the Faculty of Electronics and Automatics.

AIMS AND OBJECTIVES OF THE COURSE: The purpose of the course is to introduce students to the industrial control systems basics and practice. The main focus is on the hardware and software related to the programmable logic controllers (PLC) and to the Input\Output devices.

DESCRIPTION OF THE COURSE: The course covers the basic information about Theoretical electronic. This is one of the modern trends in engineering practice. The subject is devoted to typical and widely used devices in practice. The various hardware and software are presented. Special attention is focused on configuration and programming of the PLC.

PREREQUISITES: The main prerequisites for the present course are the following courses: Electrical theory and Measurements from the Bachelor of Science plan.

TEACHING METHODS: Laboratory works and exercises. The laboratory work visualizes the practical solution of the control systems with programmable controllers and laboratory sets up. The exercises expand the knowledge and focuses on acquiring practical knowledge and skills.

METHOD OF ASSESSMENT: Ongoing evaluation at the end of the second semester.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:

1. Ганчев И., М.Петров, Промишлени приложения на микропроцесорите, "Учебни записки", Технически Университет-София, Филиал Пловдив, 1999;
2. Michel C., Programmable Logic Controllers, 1990;
3. Berger H., Automating with SIMATIC S5 115U, Siemens AG;
4. Clarence T Jones, STEP 7 Programming Made Easy in LAD, FBD, and STL: A Practical Guide to Programming S7300/S7-400 Programmable Logic Controllers, 2013
5.OMRON, "Operation Manual – Ethernet Units Construction of Applications for CJ Series", 2003;
6. OMRON, "Operation Manual – Ethernet Units for CJ Series", 2003;
7. OMRON, "Programming Manual – Programmable controllers for CS/CJ Series", 2003;
8. OMRON, "CX-Programmer Introduction Manual". 2003; OMRON, "CX-Programmer 6.1 Operation Manual", 2005

COURSE DESCRIPTION

Course Title: **Transitional processes in electrical grid and electrical power systems**	Code: **MEE10.1**	Semester: **2**
Type of Teaching: Lectures; Laboratory work.	Hours per semester: L – 20 hours; LW – 20 hours.	Credits: **3**

LECTURER:

Assoc. Prof. PhD. Stanimir Stefanov (FEA) - tel: +35932659512, e-mail: glasst@tu-plovdiv.bg,
Technical University – Sofia, branch Plovdiv

COURSE STATUS IN THE CURRICULUM: Eligible subject for the major Electrical Engineering of the Faculty of Electrical Engineering and Automation, Master of Science.

AIMS AND OBJECTIVES OF THE COURSE: The subject aims at introducing students to new theoretical knowledge and practical skills in field Transitional processes in electrical grid and electrical power systems.

DESCRIPTION OF THE COURSE: Electromagnetic transitional processes - equations, substitute schemes and parameters of the electric power equipment and grid, calculation currents and voltages at the a short circuit and complex damages in electrical grid; High-frequency transitional process – 0, α, β-consist on currents and voltages, 0, α, β - equations on transitional process, methods and computer programs for studing atmospheric, commutation and lasting over-voltage in electrical grids; Electromechanics transitional processes – criterions for static and dynamic of systems, methods for studying by little and grand disturbance, methods and means for improving the stability on electrical systems.

PREREQUISITES: The course is conducted on the basis of knowledge from the bachelor courses - PHY02, EEA03, EAA07, BpEE01, BpEE02, BpEE03, BpEE08, BpEE09, BpEE15 и BpEE21.1.

TEACHING METHODS: Lectures. Computer models for investigation of transitional processes in electrical grid and electrical power systems are empfasized at laboratories.

METHOD OF ASSESSMENT Written exam at the end of the semester (70%), laboratories (20%) and participation in lectures (10%)**.**

INSTRUKTION LANGUAGE: Bulgarian.

BIBLIOGRAPHY:

1. Генов Л., Електроенергетика, София, ДИ "Техника", 1985.
2. Генов Л., Техника на високите напрежения в електроенергийните системи, София, ДИ "Техника", 1979.
3. Нотов П., Преходни процеси в електроенергийните системи, София, ДИ "Техника", 1985.
4. Нанчев Н. и М. Георгиев, Техника на високите напрежения, София, ДИ "Техника", 1967.

DESCRIPTION OF THE COURSE

Name of the course: **Design of converters**	Code: **MpEE10.2**	Semester: **2**
Type of teaching: Lectures(L) Tutorials (T) Laboratory work (LW)	Hours per semester: L – 20hours LW – 20 hours	Number of credits: **3**

LECTURER:
Prof. Eng. Tsvetana Grigorova, PhD (FEA), tel.: 032 659 711, e-mail: c_gr@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Elective course from the curriculum for Master's degree in Electrical Engineering, professional field 5.2. Electrical Engineering, Electronics and Automation, field 5. Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: The objective of the course, entitled "Design of Converters," is to provide students of electrical engineering with a comprehensive understanding of the fundamental circuits of electronic power converters based on power semiconductors, their control systems, and their areas of application. The course delves into the specific characteristics of computer modeling and the methodologies employed for the analysis and design of power conversion circuits with different industrial applications.

DESCRIPTION OF THE COURSE: The primary subjects of study include: Static uninterruptible power systems, including structural circuits and construction methodologies; Basic technical data for uninterruptible power supply systems; ways to power "sensitive" consumers; Dynamic uninterruptible power supply systems; Elements and blocks for building uninterruptible power supply systems; Inverter topologies for photovoltaic systems; Surge protection for photovoltaic installations; Remote monitoring systems; Energy storage elements; Matrix converters

PREREQUISITES: Required knowledge in disciplines: Electrical engineering, Electronic circuits theory, Digital electronics, Electrical converters and energy efficiency.

TEACHING METHODS: Lectures using slides; specialized laboratory in “Industrial Electronics” for lab sessions.

METHOD OF ASSESSMENT: The course grade is formed by considering the grade of the written exam (80%) and the defense of the laboratory exercise protocols (20%). The examination consists of written answers to 3 to 5 set problems, case studies, or assignments that productively test the student's knowledge and skills.

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY: 1. Анчев, М., М. Минчев, Системи за непрекъсваемо електрическо захранване, София, Авангард прима, 2005; 2. Анчев, М., Енергийна ефективност на силови електронни устройства, С., ТУ-София, 2010; 3. Анчев, М., Силови електронни устройства, С., ТУ-София, 2019; 4. Williams, B. Power Electronics - Devices, Drivers, Applications, and Passive Components, McGraw-Hill, 2002; 5. Muhammad Rashid, Power Electronics Handbook, Copyright, 2007, Elsevier Inc.

DESCRIPTION OF THE COURSE

Name of the course: **Equipment for building automation**	Code: **MpEE10.3**	Semester: **2**
Type of teaching: Lectures (L) Laboratory work (LW)	Hours per semester: L – 20 hours LW – 20 hours	Number of credits: **3**

LECTURER(S):
Assoc. Prof. Eng. Ivan Hadzhiev, PhD (FEA), tel.: 032 659-686,
e-mail: hadzhiev@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Elective course for full-time students, majoring in Electrical Engineering at the Faculty of Electronics and Automation, TU–Sofia, Plovdiv Branch, for receiving the Master of Science degree, professional field 5.2 Electrical Engineering, Electronics and Automation, Area 5. Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: The aim of the course is to allow the students to acquire extensive basic theoretical knowledge and practical skills for working with equipment for design and exploitation of modern integrated systems for building automation.

DESCRIPTION OF THE COURSE: Main topics: Basic information, aims, objectives and trends in building automation; Building automation and energy efficiency of buildings; Instrumentation for measurement and control of environmental parameters; Building automation system EIB/KNX - topology, functional structure and parameters of the bus devices and forming control signals; Addressing and organization of the communication between the bus devices in the system EIB/KNX; General information and application of the design software ETS 3; Requirements toward the design and implementation of building automation systems EIB/KNX. Equipment for control and automation of lighting, heating, ventilation, air conditioning, and more in building automation systems EIB/KNX; Characteristics and selection of equipment to protect people and property in buildings against damage from electric current.

PREREQUISITES: Physics, Electronics, Electrical apparatus, Lighting and installation techniques, Energetics, Switching equipment.

TEACHING METHODS: Lectures, prepared for multimedia presentation and laboratory exercises, during which experiments, related to the topics of the lectures are conducted.

METHOD OF ASSESSMENT: Laboratory work (25%) and written examination (75%).

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:
1. Ordinance № 4 of 14 August 2003 for the design, construction and operation of electrical systems in buildings (in Bulgarian).; 2. Homes, residential and special facilities, Schneider Electric - Electrical installation guide 2009 (in Russian); 3. BERCER, Instabus KNX/EIB Technical Manual; 4. ABB i-bus KNX Application Manual Lighting; 5. ABB i-bus KNX Application Manual Shutter Control; 6. ABB i-bus KNX Application Manual Heating/Ventilation/Air Conditioning; 7. Elektronik Handbuch, JUNG, 4 Vollig Neubearbeitete, Auflage, 2003; 8. Dietmar Dietrich, Wolfgang Kastner, Thilo Sauter, EIB-building automation system, Hutigh (in Russian); 9. Project Engineering for EIB, Installations-Basic Principles, 4th (revised) edition.

DESCRIPTION OF THE COURSE

Name of the course: **Time series forecasting**	Code: **FaMpEE01** **FaMpAICE01** **FaMpCST01**	Semester: **1**
Type of teaching: Lectures (L) Laboratory work (LW)/Seminars (S)	Hours per semester: L – 20 hours S – 0 hours LW – 20 hours	Number of credits: **3**

LECTURER(S):
Assoc. Prof. Eng. Stanimir Stefanov, PhD (FEA), tel.: 032659512, e-mail: glasst@tu-plovdiv.bg
Assoc. Prof., PhD. Eng. Georgi Ganev, tel.: 032659512, email: marin2g@tu-plovdiv.bg
PhD Eng. Aleksander Angelov, e-mail: aangelov82@abv.bg, ESO - LTD, TDM "Sout"
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Compulsory elective subject from the curriculum for training of students to obtain Magister's degree, specialty Electrical Engineering, 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 efficient and sustainable utilization of specialized construction materials for electrical machines and equipment. These materials are characterized by a set of specific properties when subjected to electromagnetic fields and installed in devices, taking into account the requirements of the Bulgarian State Standards (BDS) and the relevant international standards.

DESCRIPTION OF THE COURSE: During the course, students are introduced to various methods for time series forecasting, including conventional methods (regression and autocorrelation methods, smoothing techniques, etc.) and modern approaches based on artificial intelligence (e.g., neural networks). The course covers algorithms for analyzing input data, selecting appropriate mathematical models, and methods for determining model parameters. Practical examples and tasks are primarily focused on engineering applications for model development and forecasting based on the constructed models. Additionally, students study algorithms for quantitatively evaluating the accuracy of the applied models.

PREREQUISITES: The lectures and practical sessions in the course are based on the students' knowledge in Mathematics.

TEACHING METHODS: Multimedia presentations are used during the lectures. Students are provided with access to the presentations in advance and can supplement them with the lecturer's explanations. The laboratory exercises include solving specific tasks using computers and data processing software..

METHOD OF ASSESSMENT: Current written control in the middle and end of the semester whit a duration of 1 hour (70%), laboratory work (20%) end the pparticipation in lectures (10%) .

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. 2011..

DESCRIPTION OF THE COURSE

Name of the course: **Power Supplies**	Code: **FaMpEE02**	Semester: 1
Type of teaching: Lectures (L) Laboratory work (LW)	Hours per semester: L – 20 hours LW – 20 hours	Number of credits: 3

LECTURER(S):

Prof. Eng. Tsvetana Grigorova, PhD (FEA), tel.: 032 659 711, e-mail: c_gr@tu-plovdiv.bg
Technical University of Sofia

COURSE STATUS IN THE CURRICULUM: Facultative subject from the curriculum obtain Master's degree, specialty "Electrical engineering" Professional orientation 5.2 Electrical engineering, electronics and automation, Field 5 Technical Sciences.

AIMS AND OBJECTIVES OF THE COURSE: The course "Power supplies" aims to teach students the principles of operation and methods for designing basic circuits of electronic power supplies and power sources. Students gain practical experience in studying rectifiers, continuous voltage and current regulators, switch mode converters, batteries, and other power sources.

DESCRIPTION OF THE COURSE: Parameters and characteristics of basic circuits of power supplies and converters of electrical energy are considered - rectifiers, DC voltage and current regulators with continuous operation, switch mode converters, batteries and other energy sources. Students are also introduced to operating principles and features of uninterruptible power supply systems. The course focuses on acquiring knowledge related to analysis and design methods through simulation programs and models - PSpice for TI and PLECS.

PREREQUISITES Required knowledge in disciplines: Electrical engineering, Semiconductor devices, Electronic circuits theory, Analogue electronics, Digital electronics.

TEACHING METHODS: Lectures using slides, lab exercises with protocols and simulation software tools: PSpice for TI, PLECS with description and defense.

METHOD OF ASSESSMENT: Two one-hour assessments at mid and end of semester (80%), laboratories (20%).

INSTRUCTION LANGUAGE: Bulgarian

BIBLIOGRAPHY:
1. Стефанов Н., "Токозахранващи устройства", Техника, С., 2010.; 2.Арнаудов Д., Ст. Денчев, Г. Гигов, "Ръководство за лабораторни упражнения по ТЗУ" ТУ-София, 2014.; 3. Стефанов Н., Д. Дечев, "Ръководство за лабораторни упражнения по ТЗУ", Печатна база ТУ-София, 1994.; 4. Стефанов Н., "Ръководство за проектиране на ТЗУ", Печатна база ТУ-София, 1994.; 5. Браун М., "Наръчник по токозахранващи устройства", Техника, С., 1998.; 6.Анчев М., М. Минчев "Системи за непрекъсваемо електрическо захранване" С., Авангард, 2006.; 7. Юдов, Д., В. Вълчев, "Токозахранващи устройства", Варна, ТУ Варна и БСУ, 2008. ISBN 978- 954-9370-57-7; 8. www.onsemi.com "Switch Mode Power Supply" — Reference manual 2002.; 9. www.onsemi.com "Power Factor Corection" — Handbook 2004

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) Laboratory work (LW)/Seminars (S)	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, branch Plovdiv

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.