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PRESENTATION OF THE CONTENT OF NEW/INNOVATED CURRICULA – FTS KM/UPKM

STUDY PROGRAM: ELECTRICAL AND COMPUTING ENGINEERING
MODULE: POWER ENGINEERING

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FACULTY OF TECHNICAL SCIENCES KOSOVSKA MITROVICA

UPKM

FTS KM/UPKM

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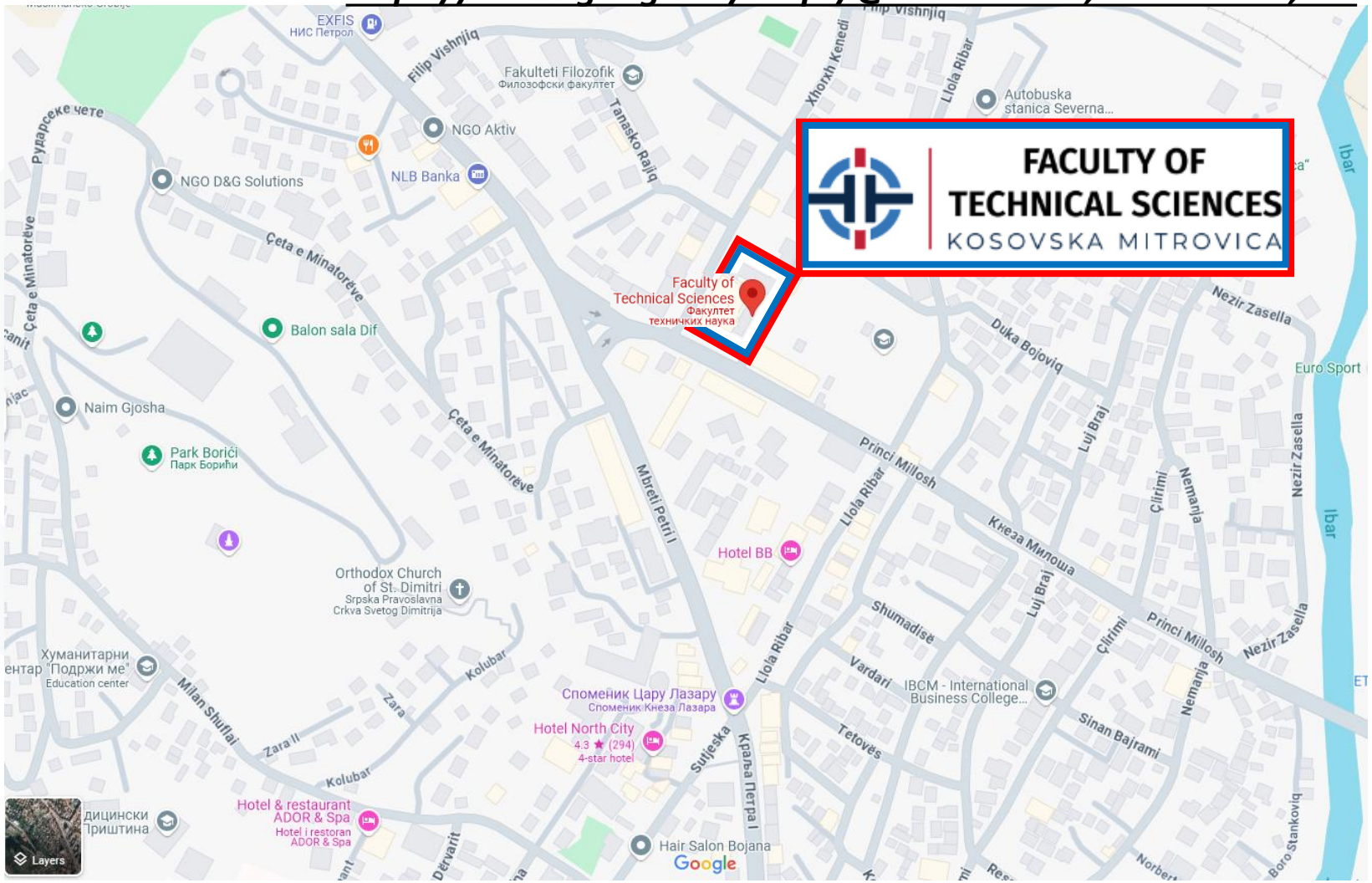

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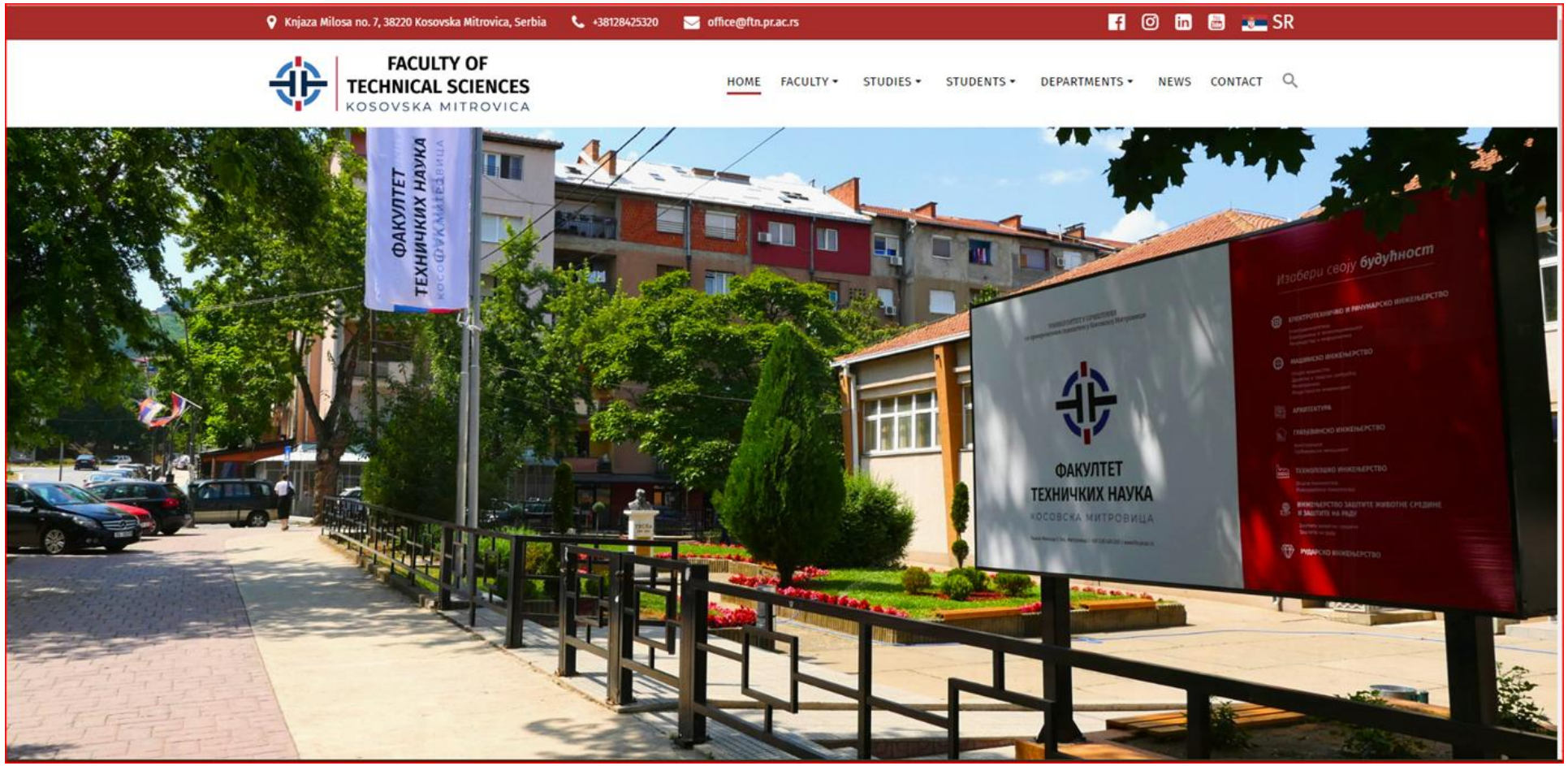

ANALYSIS OF EXISTING CURRICULA – FTS KM/UPKM
STUDY PROGRAM „ELECTRICAL AND COMPUTING ENGINEERING" WITH ELECTION AREA - MODULES

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FACULTY OF TECHNICAL SCIENCES KOSOVSKA MITROVICA

Study program:
Electrical and Computing Engineering
with election area - modules:
Power Engineering (PE),
Electronics and Telecommunications (ET), and
Computer Engineering and Information Theory (CEIT)

COMMON BASIS
MANDATORY MUTUAL COURSES: 10 courses = 50 ECTS;
ELECTIVE MUTUAL COURSES: 5 Courses from 10 =10 ECTS;
All together = 60 ECTS

MODULE 1 - PE
MANDATORY = 22 courses= 131 ECTS
ELECTIVE = 7 courses from 15= 39 ECTS
Internship=3
Study Resasrch=3
Diploma thesis= 4
Summ: 170 + 10=180 ECTS

MODULE 2 - ET

MODULE 3 - CEIT

THE BACHELOR ACADEMIC STUDIES IN ELECTROTECHNICAL AND COMPUTER ENGINEERING - FTS KM/UPKM

The First Year - Common basis				
Num	Code	Name of course	Sem	ECTS
1	20.OE1	Mathematics 1	1	7
2	20.OE2	Fundamentals of Electrical Engineering 1		7
3	20.OE3	Physics		5
4	20.OE4	Programming 1		4
5	20.OE5	Laboratory Exercises in Physics		2
6	Elective Course Group 1 (Students choose 1 of 2 courses)			
	20.OE72	Practicum Matlab Programming	1	3
	20.OE73	Practicum in Computer Applications		3
7	Elective Course Group 2 (Students choose 1 of 2 courses)			
	20.OE74	English Language 1	1	2
	20.OE75	Russian Language 1		2
8	20.OE6	Mathematics 2	2	7
9	20.OE7	Fundamentals of Electrical Engineering 2		7
10	20.OE8	Programming 2		4
11	20.OE9	Fundamentals of Computer Engineering		5
12	20.OE10	Laboratory Exercises In Fundamentals of Electrical Engineering		2
13	Elective Course Group 3 (Students choose 1 of 2 courses)			
	20.OE76	Introduction to Electronics	2	3
	20.OE77	An Introduction to Object-oriented Programming		3
14	Elective Course Group 4 (Students choose 1 of 2 courses)			
	20.OE78	English Language 2	2	2
	20.OE79	Russian Language 2		2
		Summary number of ECTS credits for the First Year		**60**

THE BACHELOR ACADEMIC STUDIES IN ELECTROTECHNICAL AND COMPUTER ENGINEERING - FTS KM/UPKM

FACULTY OF TECHNICAL SCIENCES KOSOVSKA MITROVICA

The Second Year - Module: Power Engineering				
Num	Code	Name of course	Sem	ECTS
1	20.OE11	Electric Circuit Theory	3	7
2	20.OE12	Electrical Measurements 1		7
3	20.OE13	Materials in Electrical Engineering		7
4	Elective Course Group 5 (Students choose 1 of 3 courses)			
	20.OE80	Elements of Electronics	3	7
	20.OE24	Object-oriented Programming 1		7
	20.OE23	Numerical Analysis and Discrete Mathematics		7
5	Elective Course Group 6 (Students choose 1 of 2 courses)			
	20.OE81	English Language 3	3	2
	20.OE82	Russian Language 3		2
6	20.OE14	Electromagnetics	4	6
7	20.OE15	Thermal Processes in Power Engineering		6
8	20.OE16	Electrical Measurements 2		6
9	20.OE17	Electric Machines 1		7
10	Elective Course Group 7 (Students choose 1 of 2 courses)			
	20.OE83	Mechanics	4	5
	20.OE84	Introduction to Management		5
Summary number of ECTS credits for the **Second** Year				60

Modernization

THE BACHELOR ACADEMIC STUDIES IN ELECTROTECHNICAL AND COMPUTER ENGINEERING - FTS KM/UPKM

The Third year - Module: Power Engineering					
Num	Code	Name of course	Sem	ECTS	
11	20.OE29	Low Voltage Electrical Installations	5	6	Modernization
12	20.OE30	Electric Machines 2		6	
13	20.OE31	Automatic Control Systems		6	
14	20.OE32	Elements of Power Systems		6	
15	20.OE33	Power Converters		6	
16	20.OE34	High Voltage Technique 1	6	6	
17	20.OE35	Distribution and Industrial Power Networks		6	
18	20.OE36	Computer-aided design in the Power Engineering		6	
19	20.OE37	Electric Machines 3		7	Modernization
20	Elective Course Group 8 (Students choose 1 of 2 courses)				
	20.OE87	Practicum - elements of power systems	6	5	
	20.OE88	Telecommunications in Power Engineering		5	
Summary number of ECTS credits for the Third Year				**60**	

THE BACHELOR ACADEMIC STUDIES IN ELECTROTECHNICAL AND COMPUTER ENGINEERING - FTS KM/UPKM

The Fourth year - Module: Power Engineering				
Num	Code	Name of course	Sem	ECTS
21	20.OE52	Power Plants	7	5
22	20.OE53	Renewable Energy Sources	7	5
23	20.OE54	Electric Drives	7	5
24	20.OE55	Power System Analysis 1	7	5
25	Elective Course Group 9 (Students choose 1 of 2 courses)			
	20.OE97	Technical Automatic Control System iin Power Engineering	7	5
	20.OE98	High voltage Equipment	7	5
26	Elective Course Group 10 (Students choose 1 of 2 courses)			
	20.OE99	Cable Technology	7	5
	20.OE100	Thermal Processes in Renewable Energy Sources	7	5
27	20.OE56	Relay Protection	8	5
28	20.OE57	Distribution Plants	8	5
29	Elective Course Group 11 (Students choose 1 of 2 courses)			
	20.OE101	Power System Analysis 2	8	5
	20.OE102	Power Engineering Optimization Methods	8	5
30	Elective Course Group 12 (Students choose 1 of 2 courses)			
	20.OE103	Regulation of Electric Drives	8	5
	20.OE104	Specialized Software Applications for Design Renewable Energy Sources	8	5
31	20.OE58	Internship	8	3
32	20.OE59	Study Research Work on Theoretical the Basis of the Thesis	8	3
33	20.OE60	Diploma Thesis	8	4
		Summary number of ECTS credits for the Fourth Year		**60**

Modernization

Modernization

LIST OF COURSES THAT ARE PLANNED FOR MODERNIZATION ON POWER ENGINEERING MODULE - BACHELOR ACADEMIC STUDIES – FTS KM/UPKM

Courses that are planned for modernization			
Num	Code	Name of course	ECTS
1	20.OE16	Electrical Measurements 2	6
2	20.OE29	Low Voltage Electrical Installations	6
3	20.OE37	Electric Machines 3	7
4	20.OE52	Power Plants	5
5	20.OE57	Distribution Plants	5
		Summary number of ECTS credits	**29**

TABLE 5.2 COURSE SPECIFICATION

Study program: Electrical and Computing Engineering			
Name of the subject: Electrical Measurements 2			
Teacher(s): Alenka Milovanović			
Status of the subject: Compulsory			
Number of ECTS credits: 6			
Conditions: Electrical Measurements 1			
Subject goal Acquisition of theoretical knowledge and practical skills on measuring electric and magnetic quantities. Acquaintance of students with methods of measuring electrical quantities in three-phase alternating current systems and magnetic quantities and characteristics of magnetic materials.			
Outcome of the subject Mastering the knowledge required for the application of various measurement methods in three-phase alternating current systems and for practical work with classic and modern electrical measuring devices			
Subject content *Theory* AC bridges. Galvanometry. Measurements of magnetic quantities. Oscillography. Measuring transformers. Measurement of power and energy in low and high voltage three-phase systems. Measurements on earthing systems. Locating faults on electrical lines. Smart meters of electricity. Connection of smart electricity meters to mobile devices and Internet applications. *Practical learning* Application of alternating current bridges. Application of electronic oscilloscope for measuring frequency, impedance and phase angle. Determination of the hysteresis cycle using an oscilloscope. Verification of measuring transformers. Application of measuring methods and instruments for measuring power, power factor and energy in three-phase alternating current systems. Measurement of grounding resistance and specific soil resistance. Determining the location of the fault on the electric lines. Programmable digital three-phase electricity meter. Smart electric meters for simultaneous measurement of electricity consumption in several different circuits. Microprocessor development cards for measuring electrical and non-electrical quantities.			
Literature 1. Authorized extracts from the subject teacher's lectures. 2. F. Petrović, : Electrical Measurements *1*, Naučna knjiga, Beograd, 1986. 3. F. Petrović, : Electrical Measurements *2*, Naučna knjiga, Beograd, 1992. 4. M. Đekić, A. Milovanović, S. Vardić, A collection of problems from electrical measurements., FTN Čačak, 2016. 5. R.Malarić, *Instrumentation and measurement in electrical engineering*, BrownWalker Press, 2011. **6.** VIjay K. Sood, Monalisa Biswal, Saumendra Sarangi, Smart Metering, Hassan Haes Alhelou - Infrastructure, Methodologies, Applications, and Challenges, Elsevier, 2024, eBook ISBN: 9780443155864			
Number of active teaching classes	**Theoretical teaching:**	**Practical teaching:**	
Method of carrying out the teaching Theoretical lectures, consultations and practical exercises in the laboratory.			
Evaluation of knowledge (maximum number of points 100)			
Pre-exam obligations	points	**Final exam**	points
Activity during lectures	5	Written exam	35
Practical teaching	20	Oral exam	
colloquium	40	.....	
Seminar(s)			
The methods of testing the knowledge can be different. The table below lists only some options: (written exams, oral exams, project presentation, seminars, etc.....)			
*maximum length 2 A4 pages			

TABLE 5.2 COURSE SPECIFICATION

Study program: Electrical and Computing Engineering
Name of the subject: Low Voltage Electrical Installations
Teacher(s): Saša Štatkić
Status of the subject: Compulsory
Number of ECTS credits: 6
Conditions: None
Subject goal Acquaintance with the basic knowledge of the technique of design and exploitation of low voltage power installations.
Outcome of the subject Students will acquire basic knowledge for designing low-voltage power installations and learn the skills of reading and understanding technical project documentation from this area.
Subject content *Theory* Types of electrical installations. Electrotechnical regulation. Characteristics of the basic components. Linear and non-linear consumers. Energy efficiency classes of consumers in electrical installations. Basic calculations of elements in electrical installations. Selection of installation components. Technical and economic criteria. Standards and regulations in design. Creation of project documentation. Connections to the low-voltage network and electrical installations in buildings. Grounding technique and protection against excessive contact voltage in electrical installations. Working and protective grounding. Protection against atmospheric discharges. Calculations of lightning protection installation. Components of lightning protection installations. Overvoltage protection of low-voltage installations. Calculations` of internal and external lighting. Smart lighting with IoT technology. Public lighting installations and facilities. Electrical installation design using free software tools. New energy, communication and computer technologies in power installations. Concept of electrical installation of smart house and smart building. Installing IoT devices and sensors that can monitor and measure energy consumption. Integration of IoT cameras, motion sensors and alarm systems in electrical installations. Integration of WiFi technology in electrical installations. Fast electronic relays (Solid state - relays). Electrical installations of small solar power plants. Electrical installations of energy converters for battery power in electric vehicles. *Practical learning* Development of projects (2) in the form of seminar papers using free software tools for designing electrical power installations, and projects (2) for indoor and outdoor lighting installations.
Literature 1. M. Kostić, " The theory and practice of electrical installation design ", 2014. 2. G. Dotlić, Electrical energy through standards, laws, regulations and technical recommendationse, 2013. 3. Gunter G. Seip, Electrical Installation Handbook, John Wiley and Sons, MCD Verlag, 2000. 4. Westerman- Electrical engineering manual, Građevinskaknjiga, 2003. 5. ABB Electrical Installation Handbook.pdf, Summaries for Electrical Engineering,2019. 6. Siemens AG, Planning of Electric Power Distribution- Technical Principles, © 2015 Siemens AG. 7. The Electrical Installation Guide, Schneider Electric Industries, 2016. 8. ABB e-Designesoftware for electrical system dimensioning. 9. Electrical Planning Software – SIMARIS, Siemens. 10. Ecodial Advanced Calculation 4 software for electrical installation calculation, Schneider Electric 11. Dialux - software for planning, calculation and visualization of indoor and outdoor lighting.

Number of active teaching classes	**Theoretical teaching:**	**Practical teaching:**

Method of carrying out the teaching Theoretical lectures, consultations and practical exercises in the laboratory.
Evaluation of knowledge (maximum number of points 100)

Pre-exam obligations	points	**Final exam**	points
Activity during lectures	5	Written exam	30
Practical teaching	5	Oral exam	30
colloquium	10	.....	
Seminar(s)	20		

TABLE 5.2 COURSE SPECIFICATION

Study program: Electrical and Computing Engineering			
Name of the subject: Electric Machines 3			
Teacher(s): Žarko Milkić			
Status of the subject: Compulsory			
Number of ECTS credits:7			
Conditions: None			
Subject goal Acquisition of basic knowledge in the field of synchronous machines. Acquisition of basic knowledge of non-symmetric modes of transformers and electrical machines.			
Outcome of the subject Knowledge of the general theory and construction of synchronous generators, with the aim of application in power plants for the production of electricity and synchronous motors in special conditions. Understanding the essence of non-symmetrical operation of transformers and electrical machines and the transient phenomena in them.			
Subject content *Theory* Introduction. Basic construction elements. Operating principle. Magnetomotive force, flux and stator and rotor induction. . Induced EMF in the stator. Stationary mode, parameters. Scaling sizes. Potier and Blondel diagrams. Equivalent circuit. Characteristics of synchronous machines. Determination and measurement of parameters. Synchronization with the grid. Adjustment of active and reactive power. Angular characteristics. Operational stability. Drive diagrams. Linearization of synchronous machine equations. Excitation systems. Dynamic model of the synchronous machine. Synchronous motor. Symmetrical components. Asymmetrical operation of transformers. Asymmetrical short circuits in transformers. Short circuits in synchronous generators. Transient processes in transformers. Transient processes in synchronous generators. Extension of the d-q theory to asymmetrical operation. Specific requirements for transformers in solar power plants and wind turbines. Rotating electrical machines in renewable energy sources. *Practical learning* Calculation exercises, project assignment, consultations.			
Literature 1. B. Mitraković, Synchronous Machines, Naučna knjiga, Beograd, 1991 2. Đ. Vukić, A. Čukarić, Ž.Milkić, Synchronous Machines - Problem Sets, Academic Mind, Beograd, FTN K. Mitrovica, 2007 **3.** T.A. Lipo, Analysis of Synchronous Machines, 2017, CRC Press			
Number of active teaching classes	**Theoretical teaching:**	**Practical teaching:**	
Method of carrying out the teaching Lectures and exercises on the blackboard, consultations. Implementation of software tools for simulating the operation of synchronous machines and transformers for the purpose of visualizing transition processes and better understanding of the principles of operation. Creation of online materials for easier learning and better understanding of course content.			
Evaluation of knowledge (maximum number of points 100)			
Pre-exam obligations	points	**Final exam**	points
Activity during lectures	5	Written exam	30
Practical teaching	5	Oral exam	30
colloquium	20	.....	
Seminar(s)	10		
The methods of testing the knowledge can be different. The table below lists only some options: (written exams, oral exams, project presentation, seminars, etc.....)			
*maximum length 2 A4 pages			

TABLE 5.2 COURSE SPECIFICATION

Study program: Electrical and Computing Engineering

Name of the subject: Power Plants

Teacher(s): Aleksandar Čukarić

Status of the subject: Compulsory

Number of ECTS credits: 6

Conditions: None

Subject goal

Acquaintance of students with electrical energy production facilities, working method and principles on which energy conversion is carried out.

Outcome of the subject

Students are trained for exploitation and management of power plants.

Subject content

Theory

Hydropower plants. Hydraulic energy of water and power of river flow. Unit work and turbine power. Specific and favorable turbine speed. Types and characteristics of hydraulic turbines. Types of hydroelectric power plants. Reversible and pumped storage hydropower plants. Degree of utilization of hydropower plants. Individual power and number of turbines in a hydroelectric power plant. Single-pole schemes of hydroelectric power plants. Technological scheme, auxiliary equipment and systems in the hydroelectric power plant. Fossil fuel thermal power plants. Thermodynamic cycles of water and water vapor. Elements of the technological scheme. Steam turbines. Types of heat schemes of thermal power plants. Degree of utilization of thermal power plants. Characteristic operating modes of the thermal power plant. Nuclear power plants. Thermal power plants with gas turbines.
Load diagram. The price of electricity at the threshold of the power plant. Synchronous turbo and hydrogen generator. Synchronous generator drive map. Wind power plants. Solar sources of electricity.
The application of digital technologies in power plants can improve operational performance, reduce downtime and increase overall efficiency in the generation and delivery of electricity. Supervisory and data acquisition system (SCADA). Distributed control systems. Internet of Things, IoT. Technology of digital twins (Digital Twins). Artificial intelligence and machine learning. Energy management systems. Data security systems, applications and computer networks in the power plant.

Practical learning

Practical exercises with computational examples. Creation of the project assignment. Visits to power plants.

Literature

1. M. Đurić, A. Čukarić, Ž. Đurišić,“ Power Plants ”, Beopres, Beograd, 2003.
2. M. Đurić, Ž. Đurišić, A. Čukarić, V. Ilić,“ Power Plants ”, Beopres, Beograd, 2010.
3. Zark Bedalov, Practical Power Plant Engineering, 2020, Wiley

Number of active teaching classes	**Theoretical teaching:**	**Practical teaching:**

Method of carrying out the teaching

Lectures, auditory exercises, project, visits to power plants. Implementation of software tools for simulating the operation of power plants in order to visualize technological and transition processes, as well as to better understand the principles of operation. Creation of online materials for easier learning and better understanding of course content.

Evaluation of knowledge (maximum number of points 100)

Pre-exam obligations	points	**Final exam**	points
Activity during lectures	5	Written exam	35
Practical teaching	5	Oral exam	35
colloquium		.....	
Seminar(s)	20		

The methods of testing the knowledge can be different. The table below lists only some options: (written exams, oral exams, project presentation, seminars, etc.....)

*maximum length 2 A4 pages

TABLE 5.2 COURSE SPECIFICATION

Study program: Electrical and Computing Engineering			
Name of the subject: Distribution Plants			
Teacher(s): Aleksandar Čukarić			
Status of the subject: Compulsory			
Number of ECTS credits: 5			
Conditions: None			
Subject goal Acquainting students with the place and role of switchgear in the power system, acquiring knowledge about the elements of the plant, their selection and dimensioning, as well as for creating project documentation.			
Outcome of the subject Students are trained in the exploitation and design of distribution plants.			
Subject content *Theory* Short-circuit currents and characteristic parameters for their calculation. Thermal and electromechanical stress of switchgear elements. Busbars - types of busbars, their selection and checking of terms and mechanical stresses. Insulators - criteria for selection and verification. Switches - role, types, mode of operation, basic characteristics and selection criteria. Disconnectors and disconnect switches - role, types, mode of operation, basic characteristics and selection criteria. High-voltage fuses - role, characteristics and selection method. Current transformers - role, selection and verification. Voltage transformers - role, selection and verification. Energy transformer in the plant. Parallel operation of transformers. Chokes. Overvoltage occurrences in switchgear. Surge arresters. Main and auxiliary schemes of development facilities. Disposition of equipment in switchgear. Armored switchgear. Settlement systems in distribution plants. The application of digital technologies in development facilities in order to improve operational efficiency, improve the reliability of the power system and enable the integration of renewable energy sources and smart distribution technologies.Advanced Measurement Infrastructure (AMI). Intelligent Electronic Devices (IEDs), Switchgear Automation Systems (SAS). SCADA systems. Remote control units (RTU). Reliable network communication. *Practical learning* Practical exercises with computational examples. Creation of the project assignment. Visits to distribution plants.			
Literature 1. Ј. Нахман, В. Мијаиловић, " High voltage plants ", Београд, 2000. 2. М. Ђурић, " High voltage **plants** ",Београд, 2009. 3. John D. McDonald, Electric Power Substations Engineering, 2017, CRC Press			
Number of active teaching classes	**Theoretical teaching:**	**Practical teaching:**	
Method of carrying out the teaching Lectures, auditory exercises, project, visits to power plants. Implementation of software tools for simulating the operation of dDistribution plants in order to visualize technological and transition processes, as well as to better understand the principles of operation. Creation of online materials for easier learning and better understanding of course content.			
Evaluation of knowledge (maximum number of points 100)			
Pre-exam obligations	points	**Final exam**	points
Activity during lectures	5	Written exam	35
Practical teaching	5	Oral exam	35
colloquium		.....	
Seminar(s)	20		
The methods of testing the knowledge can be different. The table below lists only some options: (written exams, oral exams, project presentation, seminars, etc.....)			
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