Faculty of Electrical Engineering / /

Course:				
Course ID	**Course status**	**Semester**	**ECTS credits**	**Lessons** (Lessons+Exercises+Laboratory)
12772	Mandatory	1	5	3+1+1
Programs				
Prerequisites	There are no prerequisites with other subjects.			
Aims	The course is designed to familiarize students with the basic concepts, principles, and characteristics of high voltage engineering, focusing on the causes, generation, and effects of high-intensity electric fields, various types of overvoltages, as well as methods for overvoltage protection of elements in power systems. Through calculation exercises, students gain a closer understanding of the material presented in lectures by solving practical problems.			
Learning outcomes	Upon completion of this course, the student will be able to: 1. Recognize the role and explain and analyze general concepts related to the issues associated with high voltage actions on the surrounding environment. 2. Explain and analyze the electric field in the vicinity of different electrode shapes and differentiate methods for its calculation. 3. Interpret and classify the properties and characteristics of various types of dielectrics applied in electrical power systems. 4. Identify and explain discharge mechanisms in different dielectrics and methods for sizing insulation. 5. Explain the origin, nature, impacts, and effects of various types of overvoltages that may occur in electrical power systems. 6. Recognize different methods and perform necessary calculations for various transient processes. 7. Explain the types and application of overvoltage protective devices, compare their characteristics and capabilities, and make their selection. 8. List and explain the basic principles and methods of insulation coordination.			
Lecturer / Teaching assistant	Vladan Radulović, PhD, full professor, Snežana Vujošević, PhD, assistant professor.			
Methodology	Lectures, computational exercises.			
Plan and program of work				
Preparing week	Preparation and registration of the semester			
I week lectures	General concepts related to issues in HV engineering. Accurate and approximate methods for calculating electric fields.			
I week exercises	Calculation of electric field for simpler geometric shapes of electrodes.			
II week lectures	Experimental and approximate determination of the shape and strength of the electric field.			
II week exercises	Calculation of electric field in the case of arbitrary electrode shapes.			
III week lectures	Dielectrics. Classification, properties, basic electrical characteristics of dielectrics.			
III week exercises	Calculation of the effects of the electric field on dielectrics.			
IV week lectures	Discharge mechanism in gaseous dielectrics.			
IV week exercises	Determination of the breakdown voltage of a dielectric.			
V week lectures	Discharge mechanism in liquid and solid dielectrics.			
V week exercises	Calculation of conditions at the interface of two dielectrics.			
VI week lectures	General concepts about the occurrence and nature of overvoltages. Types, characteristics, impacts, and effects of overvoltages.			
VI week exercises	Determination of withstand voltages of insulation with respect to overvoltages.			
VII week lectures	Atmospheric overvoltages. Propagation of overvoltage waves.			
VII week exercises	Calculation of the characteristics of overvoltage wave propagation.			
VIII week lectures	Methods for calculating overvoltages. Petersons rule.			
VIII week exercises	Calculation of overvoltages using Petersons rule.			
IX week lectures	Lattice diagram method.			
IX week exercises	Calculation of overvoltages using the lattice diagram method.			
X week lectures	Bergerons method.			
X week exercises	Calculation of overvoltages using Bergerons method.			
XI week lectures	Switching overvoltages in power systems.			

XI week exercises	Determination of switching overvoltage values using Laplace transformation.
XII week lectures	Temporary overvoltages in power systems.
XII week exercises	Calculation of temporary overvoltages.
XIII week lectures	Types, methods, and principles of overvoltage protection. Protective devices.
XIII week exercises	Selection of appropriate overvoltage protection.
XIV week lectures	Surge arresters, types, classifications, and selection methods.
XIV week exercises	Selection of surge arresters in the power system.
XV week lectures	Overvoltage protection of ground-based facilities.
XV week exercises	Calculation of the protective zone for the lightning protection systems air termination network.
Student workload	

Per week	**Per semester**
5 credits x 40/30=6 hours and 40 minuts 3 sat(a) theoretical classes 1 sat(a) practical classes 1 excercises **1 hour(s) i 40 minuts** of independent work, including consultations	Classes and final exam: **6 hour(s) i 40 minuts x 16 =106 hour(s) i 40 minuts** Necessary preparation before the beginning of the semester (administration, registration, certification): **6 hour(s) i 40 minuts x 2 =13 hour(s) i 20 minuts** Total workload for the subject: **5 x 30=150 hour(s)** Additional work for exam preparation in the preparing exam period, including taking the remedial exam from 0 to 30 hours (remaining time from the first two items to the total load for the item) **30 hour(s) i 0 minuts** Workload structure: **106 hour(s) i 40 minuts (cources), 13 hour(s) i 20 minuts (preparation), 30 hour(s) i 0 minuts (additional work)**
Student obligations	Students are required to attend lectures, exercises, as well as colloquiums.
Consultations	Every working day.
Literature	1. Milanković Lj.: Tehnika visokog napona, ETF, Beograd, 1981. 2. Škuletić S.: Tehnika visokog napona , UCG UR, Titograd, 1989. 3. Škuletić S. Vujošević S. Radulović V.:Praktikum za laboratorijske vježbe iz TVN, ETF, Podgorica, 2004
Examination methods	Two colloquiums, each worth 25 points (total 50 points). Final exam is worth 50 points.
Special remarks	No.
Comment	If necessary, classes can also be conducted in English.

Grade:	F	E	D	C	B	A
Number of points	less than 50 points	greater than or equal to 50 points and less than 60 points	greater than or equal to 60 points and less than 70 points	greater than or equal to 70 points and less than 80 points	greater than or equal to 80 points and less than 90 points	greater than or equal to 90 points