Faculty of Electrical Engineering / POWER SYSTEMS AND AUTOMATIC CONTROL / HIGH-VOLTAGE SUBSTATIONS

Course:	HIGH-VOLTAGE SUBSTATIONS			
Course ID	**Course status**	**Semester**	**ECTS credits**	**Lessons** (Lessons+Exercises+Laboratory)
127	Mandatory	6	6	3+1+1
Programs	POWER SYSTEMS AND AUTOMATIC CONTROL			
Prerequisites	No prerequisites required.			
Aims	Through this course, students are introduced with the position and function of substations in power systems, stresses to which high-voltage equipment is exposed to, elements of high voltage substations, their basic characteristics, selection methods and necessary calculations, basic and auxiliary schemes, grounding and protection against electric shock, the reliability of the substations, measurement, control and signal circuits, as well as influences of substations on the environment.			
Learning outcomes	Upon successful completion of the course students will be able to: • Recognize the importance, location and role of high voltage substations in the power system. • Classify and explain the different current and voltage stresses of high voltage equipment. • Explain and analyze the place, role and characteristics of individual elements of high voltage substations. • Execute selection and verification of individual elements of high-voltage substations. • Explain the types, role and importance and create different types of schemes of main and auxiliary circuits that are used in the design of high voltage substations. • Explain and analyze the significance and reliability calculation in high voltage substations. • Explain the significance, methods and application of relay protection and grounding in high voltage substations. • Correctly interpret the significance and role of measurement, control, automation, protection and signal circuits. • Describe the impact of high voltage substations on the environment.			
Lecturer / Teaching assistant	Prof. dr Vladan Radulović - professor			
Methodology	Lectures, exercises, video presentations, visits to substations, consultations.			
Plan and program of work				
Preparing week	Preparation and registration of the semester			
I week lectures	The place and role of substation in the power system. Stresses on equipment.			
I week exercises	Voltage stresses.			
II week lectures	High voltage substations equipment.			
II week exercises	Current stresses (1 part)			
III week lectures	Characteristics, selection and calculations of thermal and electro-dynamic stresses of substation elements. Busbars.			
III week exercises	Current stresses (2 part)			
IV week lectures	Insulators. Disconnectors. High voltage fuses.			
IV week exercises	Insulators. Disconnectors. High voltage fuses.			
V week lectures	Breakers. Power disconnectors.			
V week exercises	Breakers. Power disconnectors.			
VI week lectures	Compulsory test I			
VI week exercises				
VII week lectures	Power transformers. Instrument transformers.			
VII week exercises	Power transformers. Instrument transformers.			
VIII week lectures	Cables. Surge arresters.			
VIII week exercises	Cables. Surge arresters.			
IX week lectures	Schemes of main current circuit. The layout of the substations.			
IX week exercises	The layout of the substations.			
X week lectures	Grounding and protection against electric shock.			
X week exercises	Grounding			

XI week lectures	Calculation of reliability.
XI week exercises	Calculation of reliability.
XII week lectures	The auxiliary circuitry.
XII week exercises	-
XIII week lectures	Compulsory test II
XIII week exercises	
XIV week lectures	Measurement, control, protection and signal circuits. Auxiliaries.
XIV week exercises	Measurement, control, protection and signal circuits.
XV week lectures	The impact of substations on the environment.
XV week exercises	-
Student workload	Lectures and final exam (6 hours and 40min) X 16 =106 hours and 40 min. Necessary preparations before the start of semester (administration, enrollment, etc) 2 x (6 hours and 40 min.) = 13 hours and 20 min. Total hours for the course: 5 x 30 = 150 hours Additional hours for the preparation of the correction term(s), including exam: 0 to 30 hours. Structure: 106 hours and 40 min. (Lectures) + 13 hours and 20 min. (Preparation) + 30 hours (additional work)

Per week	**Per semester**
6 credits x 40/30=8 hours and 0 minuts 3 sat(a) theoretical classes 1 sat(a) practical classes 1 excercises **3 hour(s) i 0 minuts** of independent work, including consultations	Classes and final exam: **8 hour(s) i 0 minuts x 16 =128 hour(s) i 0 minuts** Necessary preparation before the beginning of the semester (administration, registration, certification): **8 hour(s) i 0 minuts x 2 =16 hour(s) i 0 minuts** Total workload for the subject: **6 x 30=180 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) **36 hour(s) i 0 minuts** Workload structure: **128 hour(s) i 0 minuts (cources), 16 hour(s) i 0 minuts (preparation), 36 hour(s) i 0 minuts (additional work)**
Student obligations	Students are required to attend classes and to both tests.
Consultations	Every working day from 10 to 12 AM.
Literature	1. Hrvoje Požar: "Visokonaponska rasklopna postrojenja", Tehnička knjiga Zagreb, 1967. 2. Jovan Nahman: "Visokonaponska postrojenja", Beopres, Beograd, 2000. 3. Lj. Geric, P. Djapić: “Razvodna postrojenja“, zbirka zadataka, Univerzitet u Novom Sadu, Nov
Examination methods	- Compulsory tests: (20+30 poena) - Final exam 50 poena.
Special remarks	If necessary, the subject can be delivered in English.
Comment	

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