

## Specification for the book of courses

<b>Study program</b>		Electrical Power Engineering		
<b>Module</b>		Electrical Power Engineering		
<b>Type and level of studies</b>		Master studies		
<b>The name of the course</b>		Selected Topics in High Voltage Engineering		
<b>Lecturer (for lectures)</b>		Javor L. Vesna		
<b>Lecturer/associate (for exercises)</b>		Vučković D. Dragan		
<b>Lecturer/associate (for OFE)</b>				
<b>Number of ECTS</b>		5	<b>Course status (obligatory/elective)</b>	Elective
<b>Prerequisites</b>	No			
<b>Course objectives</b>	Study of high voltages, electrostatic discharges and methods for computation of electrostatic fields. Teaching students about protection against unwanted electrostatic discharges and applications of high voltage technique in different fields.			
<b>Course outcomes</b>	Practical knowledge about complex methods for the computation of electromagnetic fields based on simple examples from electrostatics. Theoretical knowledge about processes of electrostatic discharges and practical applications of high voltage technique in various fields. Measures for protection against unwanted electrostatic discharges.			
<b>Course outline</b>				
<b>Theoretical teaching</b>	Generating high voltages (HV), applications of HV and new technologies. Methods for solving electrostatic problems: analytic (Maxwell equations, method of images, direct solving the Laplace and Poisson equations, method of separation of variables) and non-analytic (graphical method, finite difference method (FDM), method of moments (MoM), finite element method (FEM)). Electrostatic discharge (ESD), typical ESD voltages and sensitivity to ESD. Triboelectric series and triboelectric effect. Types of materials. Ohm's and hyperbolic theory. Relaxation time. Applications of HV: filters, xerography, laser printer, painting, varnishing, spraying, separation and transport of materials, testing and defect detection, surface treatment, smoke detector, defibrillator. Van de Graaff's, Marx' and Kelvin's generator. ESD models and currents according to the IEC 61000-4-2. ESD rules for flammable fluids and minimum ignition energy. Corona, brush, branched brush, conical discharge and spark. Measures of protection: grounding, ionization, antistatic preparation, humidity maintenance, increased conductivity, induction and additional measures according to the Rules on technical norms for protection against ESD. Monitoring, control, measurement equipment for ESD testing.			
<b>Practical teaching (exercises, OFE, study and research)</b>	Practical lectures are realized through computational exercises that cover the theoretical knowledge.			
<b>Textbooks/references</b>				
	1	Abdel-Salam M., "High-voltage engineering: theory and practice," Taylor&Francis, CRC Press, 2018.		
	2	Kuffel E., Zaengl W. S., Kuffel J., "High-voltage engineering: fundamentals," Newnes, 2000.		
	3	Arora R., Mosch W., "High-voltage and electrical insulation engineering," Wiley, 2011.		
	4	Ryan H. M., "High-voltage engineering and testing," IET, 2013.		
	5	Veličković D., "Methods for electrostatic fields computation," (in Serbian), Stil, Podvis, Niš, 1982.		
<b>Number of classes of active education per week during semester/trimester/year</b>				
<b>Lectures</b>	<b>Exercises</b>	<b>OFE</b>	<b>Study and research work</b>	<b>Other classes</b>
2	2	0		
<b>Teaching methods</b>	Lectures, exercises and consultations.			
<b>Grade (maximum number of points 100)</b>				
<b>Pre-exam duties</b>	<b>Points</b>	<b>Final exam</b>	<b>Points</b>	
<b>Activity during lectures</b>	10	<b>Written exam</b>	20	
<b>Exercises</b>	10	<b>Oral exam</b>	20	
<b>Colloquia</b>	40			
<b>Projects</b>				