Faculty of Electrical Engineering / POWER SYSTEMS AND AUTOMATIC CONTROL /

Course:				
Course ID	**Course status**	**Semester**	**ECTS credits**	**Lessons** (Lessons+Exercises+Laboratory)
992	Mandatory	6	6	2+2+1
Programs	POWER SYSTEMS AND AUTOMATIC CONTROL			
Prerequisites	There are no prerequisites with other subjects.			
Aims	Through this course, students are introduced to the basics of electromechanical conversion in DC and AC machines. Special attention is devoted to familiarizing students with the principles of operation, construction, equivalent circuits, and efficiency, as well as the possibilities of application of basic electrical machines.			
Learning outcomes	Upon completion of this course, the student will be able to: - Explain electromechanical conversion and the basic concept of the mechanical equation of electrical machines - Explain motor and generator modes of operation, - Recognize the structural elements of electrical machines, - Independently perform basic tests on DC, AM, and SM.			
Lecturer / Teaching assistant	Assistant prof. Martin Ćalasan, MSc Mihailo Micev			
Methodology	Lectures, calculation exercises, demonstrative examples, laboratory exercises. Consultations.			
Plan and program of work				
Preparing week	Preparation and registration of the semester			
I week lectures	Types of electrical machines. DC machines. Construction of DC machines. The working principle of DC machines. Commutation.			
I week exercises	The working principle of DC machines.			
II week lectures	Field of excitation. Armature reaction. Moment. Moment equation. Voltage equation. Motor and generator mode of operation. Losses.			
II week exercises	Moment. Moment equation. Voltage equation. Motor and generator mode of operation. Losses.			
III week lectures	No-load operation and short circuit. Characteristics of DC motors and generators. Types of DC machines.			
III week exercises	No-load operation and short circuit. Types of DC machines.			
IV week lectures	Starting DC machines. Speed regulation of DC machines. Transient processes. Mathematical description of DC machines. Equivalent diagram of a DC machine.			
IV week exercises	Starting DC machines. Speed regulation of DC machines. Transient processes.			
V week lectures	First colloquium. Introduction to synchronous machines. Construction. Work principles. EMF.			
V week exercises	First colloquium.			
VI week lectures	Hydro and turbo generators. Load. Armature reaction. Vector diagram of hydro and turbo generators.			
VI week exercises	Hydro and turbo generators. Load. Armature reaction. Vector diagram of hydro and turbo generators.			
VII week lectures	SM voltage change. Parallel operation of SM. Operation of SM online and in island mode. Automatic voltage regulation. Regulators. Characteristics of SM.			
VII week exercises	SM voltage change. Parallel operation of SM. Operation of SM online and in island mode.			
VIII week lectures	Synchronous motor. Vector diagram. Principle of operation.			
VIII week exercises	Synchronous motor. Vector diagram. Principle of operation.			
IX week lectures	Second colloquium.			
IX week exercises	Second colloquium.			
X week lectures	Induction machines. Construction. Principle of operation. Slip.			
X week exercises	Induction machines. Construction. Principle of operation. Slip.			
XI week lectures	No load operation. Short circuit. Moment. Stability of operation. Klos expression.			
XI week exercises	No load operation. Short circuit. Moment. Stability of operation. Klos expression.			
XII week lectures	Equivalent circuit. Characteristics of IM. Stator and rotor current change.			
XII week exercises	Equivalent circuit. Characteristics of IM. Stator and rotor current change.			

XIII week lectures	Induction machine starting process. Regulation of speed. Braking.
XIII week exercises	Induction machine starting process. Regulation of speed. Braking.
XIV week lectures	Induction generator. Double-fed induction generator. Mathematical model of IM.
XIV week exercises	Induction generator.
XV week lectures	Third colloquium.
XV week exercises	Third colloquium.
Student workload	

Per week	**Per semester**
6 credits x 40/30=8 hours and 0 minuts 2 sat(a) theoretical classes 1 sat(a) practical classes 2 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	
Consultations	
Literature	1. G. Joksimovic, Masine jednosmjerne struje, Sinhrone mašine, asinhrone masine - skripte, ETF Podgorica. 2. M. Calasan, Masine jednosmjerne struje, Naucna knjiga, Beograd 3. Stephen J. Chapman, Electric Machinery Fundamentals, McGraw-Hill Higher Education; 5 edition, 2011. 4. Slobodan N. Vukosavic, Electrical Machines, Springer 2012. 5. Sergey E. Lyshevski, Electromechanical Systems, Electric Machines and Applied Mechatronics, CRC Press, 2000.
Examination methods	Test I (DC machines) - 30 points, Test II (SM) - 30 points, and Test III (AM) - 40 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