Faculty of Electrical Engineering / AUTOMATICS AND INDUSTRIAL ELECTROTECHNICS / Control and regulation of electrical drives

Course:	Control and regulation of electrical drives			
Course ID	**Course status**	**Semester**	**ECTS credits**	**Lessons** (Lessons+Exercises+Laboratory)
12785	Mandatory	2	6	3+2+0
Programs	AUTOMATICS AND INDUSTRIAL ELECTROTECHNICS			
Prerequisites	There are no prerequisites with other subjects.			
Aims	The course is designed to familiarize students with the control and regulation of electric drives: mathematical description, overview of control methods, and specifics of control/regulation.			
Learning outcomes	Upon completion of this course, the student will be able to: - Understands the operation of automatic closed-loop systems in stationary and dynamic regimes, - Perform independent analysis and modeling of an automatic regulated drive, - Select the structure of the automatic regulated drive, - Understand the coupling of elements of automatic regulated electric drives, - Uses advanced methods/techniques to select controller parameters.			
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	Introduction to drive regulation. Overview of typical schemes.			
I week exercises	Overview of typical schemes for drive regulation.			
II week lectures	The quality of the automatic control system of electric drives. Overview of state space methods.			
II week exercises	The quality of the automatic control system of electric drives.			
III week lectures	Parametric synthesis of electric drive regulators.			
III week exercises	Parametric synthesis of electric drive regulators.			
IV week lectures	Automatically regulated drives with DC machines. Mathematical description.			
IV week exercises	Automatically regulated drives with DC machines. Mathematical description.			
V week lectures	Control of DC drives with a thyristor converter. Control of DC drives fed from the chopper.			
V week exercises	Control of DC drives with a thyristor converter. Control of DC drives fed from the chopper.			
VI week lectures	Synthesis of the current loop with the symmetric optimum method.			
VI week exercises	Synthesis of the current loop with the symmetric optimum method.			
VII week lectures	Colloquium			
VII week exercises	Colloquium			
VIII week lectures	Automatically regulated electric drives with asynchronous motor-scalar control.			
VIII week exercises	Automatically regulated electric drives with asynchronous motor-scalar control.			
IX week lectures	Automatically regulated electric drives with asynchronous motor-vector control.			
IX week exercises	Automatically regulated electric drives with asynchronous motor-vector control.			
X week lectures	Frequency control of AC drives. U/F control with compensation.			
X week exercises	Frequency control of AC drives. U/F control with compensation.			
XI week lectures	Direct torque control.			
XI week exercises	Direct torque control.			
XII week lectures	Measurement in automatically regulated electric motor drives. Direct/indirect speed measurement of the regulated electric motor drive.			
XII week exercises	Measurement in automatically regulated electric motor drives. Direct/indirect speed measurement of the regulated electric motor drive.			
XIII week lectures	The use of advanced optimization methods and techniques for the calculation of the parameters of electric drive regulators.			

XIII week exercises	The use of advanced optimization methods and techniques for the calculation of the parameters of electric drive regulators.
XIV week lectures	The use of MATLAB/Simulink in the regulation of electric drives.
XIV week exercises	The use of MATLAB/Simulink in the regulation of electric drives.
XV week lectures	Colloquium
XV week exercises	Colloquium
Student workload	

Per week	**Per semester**
6 credits x 40/30=8 hours and 0 minuts 3 sat(a) theoretical classes 0 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. M. Ćalasan, “Električni pogoni”, Elektrotehnički fakultet Podgorica, skripta, 2019. godine 2. P.C.Krause, et.al.: Analysis of Electric Machinery and Drive Systems, 3rd Edition, Wiley, 2013 3. Barnes M., Practical variable speed drives and power electronics, Elsevier, 2003. 4. Bose B. K., Power electronics and motor drives - advances and trends, Elsevier, 2004. 5. Vladan Vučković: Električni pogoni, Elektrotehnički fakultet, Beograd, 1997. 6. B.Jurković: Elektromotorni pogoni, Školska knjiga, Zagreb, 1978
Examination methods	Laboratory exercises + homework (or seminar) - 20 points. Test I - 40 points, Test II - 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