

Study program: Electrical and Computing Engineering – Module: Industrial Power Engineering			
Type and level of studies: Undergraduate Academic studies (first degree academic studies)			
Course unit: Electrical Drives			
Course lecturer: Marko M. Rosić			
Language of instruction: English			
ECTS: 6			
Prerequisites: Passed exams: Electrical Machines			
Semester: Winter			
Course unit objective The course is designed to provide a necessary level of knowledge for understanding and dealing with different issues in the area of electrical drives with DC and AC machines. The course objective is to introduce students to electric drive structure, mechanics, load types, working point and stability of the electric drive. When it comes to DC electrical drives the aim of the course is to make students familiar with mathematical models, static characteristics of the machine with separate and series excitation as well as with principles of electrical braking. AC electric drives field deals with mechanical characteristics of induction and synchronous machines, regulation methods and principles of electrical braking.			
Learning outcomes of Course unit After completing the course students should be able to: <ul style="list-style-type: none"> • Understand the principles of work and reproduce static models of DC and AC drives • Analyse impact of voltage, resistance and excitation on static characteristic of DC drive • Understand adaptation and regulation of the characteristics by changing supply voltage, adding resistance in armature circuit, variation of frequency etc. • Understand and apply regenerative, dynamic and reverse circuit braking in DC and AC electric drives. 			
Course unit contents Theoretical classes Static. Equations describing dynamics in stationary regime. Four-Quadrant operation. Active and passive load. Working point and stability. Mathematical model of DC drive. Static characteristic of DC machine with separate excitation. Static characteristic of DC machine with series excitation. DC machine electrical braking. Regenerative braking. Dynamic braking. Reverse circuit braking. AC drives. Induction motor equivalent circuit. Power flow. Mechanical characteristic during constant flux, constant voltage, variable frequency with respect of magnetizing current. Unbalanced power supply. Single phase supply. Current supply. Electrical braking: Regenerative braking, reverse circuit braking, braking with DC current. Drives with synchronous machines. Fundamental drive characteristics. Standard synchronous machines. Synchronous reluctance machines. Synchronous machines with permanent magnets. Principles of choosing the motor for electric drive system. IEC standard codes: IC, IP, IM, IE. Theory of electrical machine heating as the basis for choosing of the electric motor. Types of mechanical loads in electric drives: S1-S10. Environment impact on choosing of electric drive. Multimotor electrical drives. Principles of electric drive protection. Practical classes <ul style="list-style-type: none"> • Laboratory exercises in EMPR laboratory: http://www.empr.ftn.kg.ac.rs/2.html 			
Literature [1] P.C.Krause: "Analysis of Electric Machinery", McGraw-Hill, New York, 1986., P.C.Krause: "Analysis of Electric Machinery", McGraw-Hill, New York, 1986. [2] B. Bose, "Modern Power Electronics and Ac Drives", Prentice-Hall, Inc., 2002. [3] Austin Hughes Bill Drury, "Electric Motors and Drives", IEEE, 2002. [4] Dave Polka, "Motors and Drives: A Practical Technology Guide" [5] Vladan Vučković: Električni pogoni, Elektrotehnički fakultet, Beograd 1997.			
Number of active teaching hours			Other classes
Lectures: 2	Practice: 2	Other forms of classes: 1	Independent work: Case study
Teaching methods: ex cathedra classes, consultations, independent individual home and laboratory work			
Examination methods (maximum 100 points)			
Exam prerequisites	No. of points:	Final exam	No. of points:
Student's activity during lectures	10	oral examination	25
Practical classes	10	written examination	25
Seminars/homework	20	
Project	10		
Grading system			
Grade	No. of points	Description	
10	91-100	Excellent	
9	81-90	Exceptionally good	
8	71-80	Very good	
7	61-70	Good	
6	51-60	Passing grade	
5	less than 50	Failing grade	