


Discipline	ELECTRICAL MACHINES, PART 2 code: 38 summer semester	
Specialty	RENEWABLE ENERGY SOURCES	
ECTS credits: 7	Form of assessment: Continuous assessment	
Lecturer	Assoc. prof. PhD Eng. MAIK STREBLAU Room: 702E Phone: +359 52 383 540 E-mail: streblau@tu-varna.bg	
Department	ELECTRICAL ENGINEERING AND ELECTROTECHNOLOGIES	
Faculty	ELECTRICAL ENGINEERING	
<p>Learning objectives:</p> <p>The subject "Electric Machines, part 2" is included in the curriculum for students majoring in "Renewable Energy Sources" and it is studied in the sixth semester.</p> <p>The aim of the subject is to provide fundamental knowledge about the operation principles, constructions, characteristics, operating modes and energy correlations of direct current machines and synchronous machines.</p> <p>Required knowledge from previously studied subjects: "Mathematics, part 1", "Mathematics, part 2", "Physics", "Theoretical Electrical Engineering, part 1", "Theoretical Electrical Engineering, part 2", "Electrical Measurements" and "Electric Machines, part 1".</p> <p>Connections with other subjects: "Electric Micro Machines", "Electric Apparatus, part 2", "Electromechanical Systems", and "Wind Plants and Systems".</p>		

PART 1. DC MACHINES	Hours Lectures	Hours Laboratories	Hours Course Work
Construction and principle of operation of DC machines. Armature winding	3		
DC machine armature windings			8
Exciting of DC machines. EMF and electromagnetic torque	2		
Armature reaction. Commutation	2		
Determine the geometric neutral line in DC machines		2	
DC generator	2		
Separately excited DC generator characteristics		2	
Shunt excited DC generator characteristics		2	
Series excited DC generator characteristics		2	
Compound excited DC generator characteristics		2	
DC motor	2		
Shunt and compound DC motor		2	
Series excited DC motor		2	
PART 2. SYNCHRONOUS MACHINES	Hours Lectures	Hours Laboratories	Hours Course Work
Construction and principle of operation of synchronous machines. Magnetic field and excitation winding parameters	3		
Magnetic field and armature winding parameters. Armature reaction	2		
Determine the synchronous machine parameters		2	
Voltage equations and EMFs phasor diagrams of synchronous machines. Synchronous generators characteristics.	2		
Electrically excited synchronous generator characteristics		2	
Parallel operation of synchronous machines. The angular characteristics of synchronous machines	2		
Steady state operation modes of synchronous machines. Synchronization power and synchronization torque	2		
Parallel mode of synchronous machine with electrical grid		2	

Parallel operation of synchronous generator in an autonomous grid		2	
Study of self-excited synchronous generator		2	
Study of permanent magnet synchronous generator		2	
Synchronous motor. Start of synchronous motor. Synchronous compensator	2		
Synchronous machines exercises			7
Study of electromagnetic excited synchronous motor		2	
Study of synchronous compensator		2	
Exciter system of synchronous machines	2		
Oscillations and dynamic robustness of synchronous machines	2		
Permanent magnet synchronous machine	2		
TOTAL: 75 h	30	30	15