

## 820127 - ME1EE - Electrical Machines I

Coordinating unit:	295 - EEBE - Barcelona East School of Engineering
Teaching unit:	709 - EE - Department of Electrical Engineering
Academic year:	2017
Degree:	BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory) BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
ECTS credits:	6
Teaching languages:	Catalan

### Teaching staff

Coordinator:	Ramon Bargalló Perpiñà
Others:	Ramon Bargalló Perpiñà, Altres

### Prior skills

Differential and Integral calculus  
Matrix calculus  
ODE  
Complex number algebra  
Electromagnetics  
DC and AC circuit analysis  
Scientific calculator use (HP 50G and CFX-9950)

### Requirements

Electricas Systems course

### Degree competences to which the subject contributes

Specific:

1. Carry out calculations for the design of electrical machines.

Transversal:

3. TEAMWORK - Level 3. Managing and making work groups effective. Resolving possible conflicts, valuing working with others, assessing the effectiveness of a team and presenting the final results.

### Teaching methodology

Expositive methodology for theory classes.  
PBL for exercises classes.  
Normalized test on laboratory classes.

### Learning objectives of the subject

Electromagnetic laws application to electromechanical conversion and coupled circuit analysis applied to industrial power transformer and rotating electrical machines.



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### Study load

Total learning time: 150h	Hours large group:	45h	30.00%
	Hours medium group:	0h	0.00%
	Hours small group:	15h	10.00%
	Guided activities:	0h	0.00%
	Self study:	90h	60.00%

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### Content

<p>Power Transformer introduction</p>	<p>Learning time: 14h Theory classes: 5h Laboratory classes: 2h Self study : 7h</p>
<p>Description: Electrical circuit. Dielectric system. Magnetic system. Thermal system. Rated values and definition for voltage, current and power.</p> <p>Related activities: Heating test for a transformer</p>	
<p>Three phase transformers</p>	<p>Learning time: 23h Theory classes: 7h Laboratory classes: 5h Guided activities: 11h</p>
<p>Description: Three phase transformer construction. three limbs transformers. Rotation of phases.</p> <p>Related activities: Normalized test of single phase transformer. Tests on three phase transformers. Rotation angle determination</p>	
<p>Special Transformers</p>	<p>Learning time: 8h Theory classes: 3h Self study : 5h</p>
<p>Description: Autotransformers. Three coils transformer. Measurement transformers.</p>	
<p>Electromechanical energy conversion.</p>	<p>Learning time: 10h Theory classes: 4h Self study : 6h</p>
<p>Description: Electromagnetic field as a optimum for electromechanical conversion. Elemental actuator. EMF. Torque. Mechanical port. Losses.</p>	

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<p>AC machines: fundamentals.</p>	<p>Learning time: 25h Theory classes: 7h Self study : 18h</p>
<p>Description: ELemental Alternating Current generator. Windings. EMF. distribution, short pitching and winding factor. Harmonic effects. Magnetic field on airgap. Rotating field theory.</p>	
<p>Asynchronous machine: motor</p>	<p>Learning time: 42h Theory classes: 13h Laboratory classes: 4h Self study : 25h</p>
<p>Description: Three phase asynchronous motor. Fundamentals. Slip. MAGnetic field on airgap. Torque. Equivalent circuit. Power decomposition. Circle's diagram. Steady-State characteristics. Load variations and point of equilibrium. Voltage and frequency modifications.</p> <p>Related activities: Normalized test for losses segregation. Equivalent circuit determination. Normalized test for mechanical characteristic determination.</p>	
<p>Asynchronous machine: special applications.</p>	<p>Learning time: 28h Theory classes: 6h Laboratory classes: 4h Self study : 18h</p>
<p>Description: Asynchronous generator. Double Fed Induction machine: application to eolic generation. Single phase machine. Torque. Equivalent circuit. Start. Mechanical characteristic.</p> <p>Related activities: Single phase motor: start up. MEchanical characteristic determination. Asynchronous generator: Autonomous work. Infinite bus work.</p>	

### Qualification system

Final test: 20%  
Laboratory: 20%  
Homework exercicis+classe exercises: 20%  
middle term exam: 20+20%

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### Regulations for carrying out activities

Scientific calculator

1 sheet with expressions.

Continuous evaluation, no final reexam.

### Bibliography

Basic:

Zorbas, Dino. Electric machines : principles, applications and control schematics. 2nd ed. Montreal: McGill University, 2015. ISBN 9781133628514.

Fraile Mora, Jesús. Máquinas eléctricas. 7a ed. Madrid [etc.]: Garceta, 2015. ISBN 8416228132.

Boldea, I.; Tutelea, Lucian. Electric machines : steady state, transients and design with MATLAB. Boca Raton [etc.]: CRC Press / Taylor & Francis Group, cop. 2010. ISBN 9781420055726.

Complementary:

Gross, Charles A. Electric machines. Boca Raton: Taylor & Francis, 2007. ISBN 0849385814.