UNIVERSITAT POLITÈCNICA DE CATALUNYA

ESCOLA UNIVERSITÀRIA D'ENGINYERIA TÈCNICA INDUSTRIAL DE BARCELONA

Degree in ENGINEERING (All degrees)

Escola Universitària d'Enginyeria Tècnica Industrial de Barcelona
Consorci Escola Industrial de Barcelona
UNIVERSITAT POLITÈCNICA DE CATALUNYA

Guide of the course (English)

Subject:	**Actuators and Sensors for Mechatronics**		
Acronym:	**ASM**	**Type:**	**Optional**
Code:		**Semester:**	**Spring**
Year:	**2011**	**Level:**	

Credits:				
	Total Credits ECTS:	**6**	**Total hours:**	**4**
	In Classroom Credits (Theory):	0.75	In Classroom hours (Theory):	0.5
	In Classroom Credits (Problems):	0.75	In Classroom hours (Problems):	0.5
	Laboratory credits:	3	Laboratory hours:	2
	Guided activities :	1.5	Guided activities:	1
	Out of the Classroom credits:	0	Out of the Classroom hours:	0

Coordinator:	Ramon Bargalló Perpiñà
Teaching staff:	Ramon Bargalló Perpiñà, Altres
Consulting timetable:	UR1- BA17, usually I am on my room on mornings.
Prerequisites:	Some knowledge of: - Physical concepts: electromagmetism, mechanics..... - Electrical circuits: DC, AC and transient analysis (Electrical systems) - Matlab (not compulsory, but recommended)
Co-requisites:	
General objectives:	Electromagnetism theory applied to actuators design.
Specific objectives by topic:	
Cross competences:	1. Design of electromechanical devices 2. To use mathematical tools to solve complex problems 3. Autonomy 4. Group work 5. English

Topics of the course:

1. Electromagnetism principles.

2. Magnetic materials, Permanent magnets, Conductors.

3. Magnetic circuit approach.

4. Finite elements approach.

5. Electromechanical conversion principles.

6. Permanent magnet actuators. Characteristics. Applications.

7. Losses and Cooling of electromagnetic devices.

8. Actuators design. Restrictions. Limits. Initial sizing. Optimization.

Laboratory:

They are based on FE analysis of electromagnetic devices.

1. Magnetostatic Inductor analysis. (4h)
2. Automatic analysis of transformer. Link between FEMM and OCTAVE. (4h)
3. Linear actuator analysis. Making animations (4h)
4. Voice-coil design and optimization. Link between FEMM anb OptiY (4h).
5. Thermal analysis of devices (4h).
6. Simultaneuos, thermal and electromagnetic analysis of devices (4h)

Guided activities:

Student's weekly work expressed in hours:

Activity type / Weekly	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total
Theory	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5						7,5
Practice [1]				2	2	2	2	2	2	2	2	2	2	2	2						24
Problems	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5						7,5
Out of classroom [2]	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6						90
Practice report delivery [3]																					18
Oral/Written tests																	3				3
Other activities																					
TOTAL	7	7	7	9	9	9	9	9	9	9	9	9	9	9	9	3	3	0	0	0	150

[1] The laboratory sessions are two hours biweekly, starting the first week. The odd groups attend the 7 sessions on weeks 3, 5, 7, 9, 11 and 13, while even groups attend to them on weeks 6, 8, 10, 12 and 14.

[2] This includes the individual out of the classroom activity (learning time)

[3] The practice reports entail the work of reduced groups during the whole semester. Each report delivery requires three hours of work (previous preparation of the practice and of the report afterwards)

Teaching/Learning method:

Theory sessions to show fundamental principles, Problem sessions to show how apply theory concepts to basic and advanced calculation, Practical sessions to train the student to use and postprocessing FE software to design electromechanical actuators and sensors. Every student must solve a set of homework exercises and design a sensor or actuator using these FE tools.

Main bibliographic resources:

Brauer. Magnetic Actuators and Sensors. John Wiley&Sons. 2005

Bargallo. Finite elements for electrical engineering. EUETIB-UPC- 2008

Complementary bibliographic resources:

A.J. Pawlak. Sensors and Actuators in Mechatronics. CRC Press.2006

Hi-Dong Chai. Electromechanical Motion Devices. Prentice Hall. 1998.

Assessment and qualification:

- Homework exercises: 20 %
- Project Design: 40%
- Laboratory sessions: 20%
- Final test: 20%