[MGF101] ELECTRICAL MACHINES DESIGN

GENERAL INFORMATION

Studies	UNIVERSTIY MASTER IN ENERGY AND POWER ELECTRONICS			**Subject**	ELECTRICAL MACHINERY DESIGN, MODELLING AND ANALYSIS
Semester	1	**Course**	1	**Mention / Field of specialisation**	
Character	COMPULSORY				
Plan	2015	**Modality**	Adapted Face-to-face	**Language**	ENGLISH
Credits	6	**Hours/week**	4.28	**Total hours**	77 class hours + 73 non-class hours = **150 total hours**

PROFESSORS

(No professor appointed)

REQUIRED PREVIOUS KNOWLEDGE

Subjects	Knowledge
(No specific previous subjects required)	*(No previous knowledge required)*

SKILLS

VERIFICA SKILLS

SPECIFIC

MGC06 - Developing machine designs that are adjusted to the specific requirements of each application, with optimal electromagnetic and thermal performance.

MGC07 - Acquiring knowledge of new electric machine design and manufacturing trends in terms of manufacturing processes, high-performance materials, and design tools.

MGC08 - Acquiring knowledge and skills for the use of design tools and the analysis of electric machines.

MGC09 - Acquiring knowledge of electric machine design methods.

CROSS

MGTR10 - To share knowledge, reasoning and conclusions with specialist and non-specialist audiences in clear, unambiguous ways.

MGTR11 - To lead work teams effectively and efficiently in order to achieve common goals.

MGTR12 - To analyse complex information and situations in the field of study, considering several solutions for each problem and making the right decision in a given context, taking social and ethical implications into account.

MGTR13 - To identify product or business development opportunities, managing the human and material resources adequately.

BASIC

M_CB9 - To share knowledge, conclusions and their rationale with specialised and lay audiences in a clear, unambiguous manner

LEARNING RESULTS

RMG127 Analyze and size the different elements optimizing the resources (number of windings, magnetic materials, dimensions...)

LEARNING ACTIVITIES	CH	NCH	TH
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	30 h.		30 h.
Carrying out exercises and solving problems individually and/or in teams		34 h.	34 h.

EVALUATION SYSTEM	W
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	20%
Individual written and/or oral tests or individual coding/programming tests	80%

MAKE-UP MECHANISMS

Individual written and/or oral tests or individual coding/programming tests

CH - Class hours: 30 h.
NCH - Non-class hours: 34 h.
TH - Total hours: 64 h.

RMG128 Optimize electromagnetically the machine design with finite elements, including the simulation in the design loop in coherent way

LEARNING ACTIVITIES	CH	NCH	TH
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	20 h.		20 h.
Carrying out exercises and solving problems individually and/or in teams		28 h.	28 h.

EVALUATION SYSTEM	W	MAKE-UP MECHANISMS
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	80%	Individual written and/or oral tests or individual coding/programming tests
Individual written and/or oral tests or individual coding/programming tests	20%	

CH - Class hours: 20 h.
NCH - Non-class hours: 28 h.
TH - Total hours: 48 h.

RMG129 Apply electrical machine skills in real or simulated environment with POPBL methodology

LEARNING ACTIVITIES	CH	NCH	TH
Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams	27 h.	11 h.	38 h.

EVALUATION SYSTEM	W	MAKE-UP MECHANISMS
Observation (technical capacity, attitude and participation)	100%	Observation (technical capacity, attitude and participation)

CH - Class hours: 27 h.
NCH - Non-class hours: 11 h.
TH - Total hours: 38 h.

CONTENTS

0.- FUNDAMENTAL OF ELECTRICAL MACHINES

0.1.- Electromagnetism Laws for Magnetic Circuit Resolution

0.2.- Electro-Mechanical Energy Conversion Principles

0.3.- Brushless AC Motor Fundamentals

0.4.- Analysis of Brushless AC Motors

1.- DESIGN OF MAGNETIC CIRCUITS

1.1.- Air Gap Magnetic Field

1.2.- Air Gap Magnetic Flux

1.3.- Design of Rotor and Stator Magnetic Circuits

Coursework 1: Analytical and FEM Computation of Magnetic Field in PMSM

2.- DESIGN OF WINDINGS

2.1.- Three Phase Integral Slot Stator Windings

2.2.- Computation of the Winding Factor

2.3.- Computation of Electrical Parameters. Coil Resistance and Coil Inductances

Coursework 2. Definition of a three phase winding and computation of electrical parameters

3.- MATERIALS FOR ELECTRICAL MACHINE CONSTRUCTION

3.1.- Permanent Magnets

3.2.- Silicon Steels

3.3.- Soft Magnetic Composites

3.4.- Materials for electrical Insulation

4.- FEM ANALYSIS OF BRUSHLESS AC MACHINES

4.1.- Fundamentals of Finite Element Method

4.2.- Open Circuit Analysis and Load Analysis

4.2.- Characterization of AC Brushless Machines

Coursework 3. Characterization of AC Brushless machines

5.- THERMAL EVALUATION OF ELECTRICAL MACHINES

LEARNING RESOURCES AND BIBLIOGRAPHY

Learning resources	Bibliography
Class presentations	Transducteurs électromécaniques / Marcel Jufer, Presses polytechniques et universitaires romandes ,1985,ISBN: 2880740495 Design of Brushless Permanent Magnet Motors : Monographs in Electrical and Electronic Engineering J.R. Hendershot, TJE Miller A Oxford University Press 1995 ISBN: 9780198593898 (papel)