ABDULLAH GÜL UNIVERSITY
GRADUATE SCHOOL OF ENGINEERING & SCIENCE
ELECTRICAL AND COMPUTER ENGINEERING PROGRAM
COURSE DESCRIPTION AND SYLLABUS

Course Title	Code	Semester	T+L Hours	Credit	ECTS
THEORY of FIELD ORIENTATION CONTROL	ECE-608	SPRING	3 + 0	3	10

Prerequisite Courses	NONE

Type	Selective
Language	English
Coordinator	Prof. Irfan Alan
Instructor	Prof. Irfan Alan
Adjunt	None
Aim	To understand the principles of vector and field orientation control in AC Machines. To investigate the analysis of the machines in different reference frames. To realize the field orientation control of AC machines via computer simulations. To follow the publications related to the subject.
Learning Outcomes	• To be able to come to a level to understand and apply the theory of field orientation control in AC machines in the real control of an ac machine • To learn to simulate the operation and analyze in detail the field oriented controlled AC machines in different reference frames by means of a simulation program • To be able to investigate, prepare and make a presentation about various field orientation techniques applied in literature • To be able to produce original ideas to come up with a better field orientation controller technique by analyzing and making brain storming activity on the various field orientation techniques applied in literature
Course Content	• Vector Control and Field Orientation in Synchronous Machines. • Current and Torque Control via CSI and PWM Drives. • Torque Control via Current Regulated PWM Drive. • Vector Control and Field Orientation in Induction Machines. • Independent Flux and Torque Control. • Induction Machine Flux and Torque Control via CSI, PWM, and CRPWM Drives. • Slip Calculator and Its Errors. • Direct and Indirect Field Orientation. • Dq Model of Induction Machines. • Stator, Rotor, Synchronous and Arbitrary Reference Frames and Induction Machine Models in Various Reference Frames. • Complex Vector Notation. • Complex Vector Models of Induction Machine. • Digital Computer Simulation and Analysis of Induction Machines by means of Developed Models. • Paper Reviews on the Subject. • Evaluation of Selected Studies Carried on Reviewed Papers by means of Software Simulations.

WEEKLY TOPICS AND PRELIMINARY STUDY

Week	Topic	Preliminary Study
1	Paper reviews on the subject	The relevant book chapters and materials from the literature
2	Vector control and field orientation in synchronous machines.	The relevant book chapters and materials from the literature
3	Current and torque control via CSI and PWM drives.	The relevant book chapters and materials from the literature
4	Torque control via current regulated PWM drive.	The relevant book chapters and materials from the literature
5	Vector control and field orientation in induction machines. Independent flux and torque control.	The relevant book chapters and materials from the literature

6	Induction machine flux and torque control via CSI, PWM, and CRPWM drives.	The relevant book chapters and materials from the literature
7	Slip calculator and its errors.	The relevant book chapters and materials from the literature
8	Direct and indirect field orientation.	The relevant book chapters and materials from the literature
9	Stator, rotor, synchronous and arbitrary reference frames and induction machine models in various reference frames.	The relevant book chapters and materials from the literature
10	Complex vector notation. Complex vector models of induction machine.	The relevant book chapters and materials from the literature
11	MIDTERM EXAM	
12	Digital computer simulation and analysis of induction machines by means of developed models.	The relevant book chapters and materials from the literature
13	Evaluation of selected studies carried on reviewed papers by means of software simulations	The relevant book chapters and materials from the literature
14	Student presentations on the reviewed literature and about the simulations made	The relevant book chapters and materials from the literature
15	Student presentations on the reviewed literature and about the simulations made	The relevant book chapters and materials from the literature
16	FINAL EXAM	

SOURCES	
Lecture Notes	Lecture notes and slides
Other Sources	**Course Textbook:** "Vector Control and Dynamics of AC Drives", D.W: Novotny and T.A. Lipo, Clarendon Press, Oxford, 1996. **Additional Materials:** 1. Univeristy of Wisconsin-Madison ECE 411 Ders Notları. 2. Univeristy of Wisconsin-Madison ECE 711 Ders Notları. 3. ACSL Programı ve Programlama Kılavuzu. 4. Konu ile ilgili yayınlar.

COURSE MATERIALS SHARING	
Documents	Lecture notes and slides
Homeworks	Students will be given at least total of 7 analytical or simulation homeworks
Exams	1 Midterm and 1 Final Exam

EVALUATION SYSTEM		
SEMESTER STUDY	**NUMBER**	**CONTRIBUTION**
MIDTERM	1	30
Homework	7	35
FINAL EXAM	1	35
TOTAL		100

Course Category	
Sciences and Mathematics	50%
Engineering	50%
Social Sciences	0%

RELATIONSHIPS BETWEEN LEARNING OUTCOMES AND PROGRAM QUALIFICATIONS		
No	Program Qualifications	Contribution Level

		1	2	3	4	5
1	Skills of using Mathematical, Science and Engineering Knowledge in Advanced Research					**x**
2	Skills of analyzing, designing and/or implementing an original system which will solve an Engineering Problem					**x**
3	Skills of using software, hardware and modern measurement instruments for advanced research in one's field of expertise					**x**
4	Skills of planning, detailing and doing independent research					**x**
5	Skills of following literature, making and/or listening technical presentation, writing academic level article					**x**
6	Skills of finding original ways by means of innovative thinking and questioning					**x**

*Increasing from 1 to 5.

ECTS / WORK LOAD TABLE			
Activities	Number	Duration (Hours)	Total Work Load
Course Length (includes exam weeks: 16x total course hours)	16	3	48
Out-of-class Study Time (Pre-study, practice)	16	5	90
Internet search, library work, literature search	16	3	48
Homework	7	13	91
Midterm	1	15	15
Final Exam	1	20	20
Total Work Load			312
Total Work Load / 30			312/30
Course ECTS Credit			10