AGU Graduate School of Engineering and Science
Electrical and Computer Engineering Program

COURSE RECORD

Code	**ECE557**
Name	**Introduction to Electric Drive Systems**
Hour per week	3 + 0 (Theory + Practice)
Credit	3
ECTS	7,5
Level/Year	Undergraduate/Graduate
Semester	Fall
Type	Elective
Location	TBD
Prerequisites	EE 308 Electrical Machines and Drives
Special Conditions	N/A
Coordinator(s)	Dr. Burak Tekgün
Webpage	N/A
Content	1. Basic characteristics of DC machines 2. Single phase, three phase, and DC/DC converter drives 3. Closed loop control of DC machines 4. Induction machine drives 5. Stator and rotor voltage control 6. Frequency control 7. Voltage and frequency control 8. Current control 9. Closed loop control of induction machines 10. Synchronous machine drives 11. Cylindrical and salient pole machines 12. Reluctance motors 13. Permanent magnet machines 14. Closed Loop control of synchronous machines
Objectives	1. To gain knowledge for understanding basic requirements placed by mechanical systems on electric drives 2. To provide the basic theory for the analysis of DC and AC electric machines utilizing power electronics circuits with basic control schemes. 3. To provide knowledge for designing torque, speed and position controller of motor drives. 4. To provide knowledge on speed control of various motor drives in an energy efficient manner using power electronics
Learning Outcomes	1. Learning the DC machine basic characteristics 2. Learning power electronic rectifier based single and three phase DC machine drives. 3. Learning power electronic DC/DC controller based DC machine drives. 4. Learning the DC motor control principles 5. Learning the induction machine voltage control, frequency control, and current control schemes. 6. Learning synchronous machine types and their closed loop control structures.
Requirements	Matlab / Simulink, PSIM, PSpice or similar spice software for simulations
Reading List	**Course Textbook**: "Power Electronics, Circuits, Devices, and Applications", M.H. Rashid, 2nd Edition, 1993, Prentice Hall, Inc. **Additional Materials:** 1. "Electric Machines and Drives", Mohan, 2012, Wiley. 2. "First Course on Power Electronics and Drives", Mohan, 2003, MNPERE, Minneapolis. 3. "Advanced Electrical Drives", Doncker, 2011, Springer. 4. "Fundamentals of Electrical Drives", Veltman, 2007, Springer. 5. "Electrical Machinery", Fitzgerald, 5th Edition, 1992, McGraw Hill Int. Lmtd.

Ethical Rules and Course Policy	Students are not allowed to collaborate on homework assignments, exams, and project reports. Project reports will be written and graded individually.

LEARNING ACTIVITIES

Activities	Number	Weight (%)
Lecture	10	60%
Group Works	3	20%
Presentations	10	20%
	Total	100

ASSESSMENT

Evaluation Criteria	Weight (%)
MIDTERM EXAM	25%
Homework Assignments	20%
Group Project Assignments & Presentations	20%
Attendance/Participation	05%
Final Exam/Submission	30%
Total	100%

For a detailed description of grading policy and scale, please refer to the website https://goo.gl/HbPM2y section 28.

COURSE LOAD

Activity	Duration (hour)	Quantity	Work Load (hour)
In class activities	3	16	48
Homework Assignments	5	11	55
Group work	3	12	36
Research (web, library)	3	16	48
Required Readings	5	16	80
Pre-work for Presentation	8	2	16
	General Sum		283

ECTS: 7,5 (Work Load/25-30)

CONTRIBUTION TO PROGRAMME OUTCOMES*

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14
LO1	5	3	0	0	0	0	0	2	1	0	0	0	0	0
LO2	0	5	4	0	0	0	0	5	1	0	0	0	0	0
LO3	0	0	5	0	0	0	0	5	0	0	0	0	0	3
LO4	0	0	0	5	0	0	0	5	0	0	0	0	0	3
LO5	0	0	0	0	5	5	5	5	0	0	0	0	5	5
LO6	0	0	0	0	0	0	0	0	5	5	5	5	5	5

* Contribution Level: 0: None, 1: Very Low, 2: Low, 3: Medium, 4: High, 5: Very High

WEEKLY SCHEDULE

W	Topic	Outcomes
1	Introduction and understanding the basic mechanical requirements for electric drives and three phase circuits review	LO1
2	Basic characteristics of DC machines and transfer function derivation. Single phase and three phase DC machine drives.	LO1, LO2
3	DC/DC converter based chopper DC machine drives. Closed loop speed and torque control of DC machines with speed and current feedback structures.	LO2, LO3
4	Introduction to AC drives and performance characteristics of three phase induction machines.	LO4

5	Stator voltage control and rotor voltage control and frequency control of induction machines.	LO5
6	Voltage and frequency control, current control and constant slip-speed control of induction machines.	LO5
7	Closed loop control of induction machines.	LO5
8	Midterm Exam	LO1, LO2, LO3, LO4, LO5
9	Basic principle of vector control. Direct and quadrature axis transformation	LO6
10	Synchronous machine drives for cylindrical rotor, salient pole motors.	LO6
11	Reluctance and permanent magnet motors. Closed loop control of synchronous machines	LO6
12	Design of speed controller for PMSM drives	LO6
13	Variable reluctance and permanent magnet stepper motor control. Linear induction motors and high voltage drives.	LO5, LO6
14	Final Exam	LO1, LO2, LO3, LO4, LO5, LO6