Syllabus

Code/Name	Sec 402.38 / Static Power Conversion 2
Type	Elective
Credit/ECTS	6/6
Hour per Week	3
Level/Year	Undergraduate/4
Semester	Spring
Classroom	A103
Content	Voltage-fed inverters; waveshaping; PWM, stepped and square-waveforms, voltage regulation, harmonics. Current-fed inverters; analysis, effect of SCR turn-off time on voltage waveform, overlap. DC-DC switching converters; time-ratio control, effect of loading, parameter optimization. Device failure mechanisms. Thermal considerations, protection of switching elements.
Prerequisites	None
Textbooks	*Primary* Power Electronics, N. Mohan, T. M. Undeland, W.P. Robbins, John Wiley Publishing Co., 2003 *Supplementary* Fundamentals of Power Electronics, R.W. Erickson and D. Maksimovic, Kluwer, 2001.
Objectives	• To comprehend basic dc-dc converter topologies and their operating characteristics • To comprehend basic dc-ac converter topologies and their operating characteristics, harmonic characteristics • To determine continuous and discontinuous operation modes and their conditions • To determine the basic isolation requirements and derive the isolated converter topologies and derive their voltage transfer characteristics
Course Outcomes	In this course you will be able to: CO1 Characterize the inverter output voltage waveforms, calculate the fundamental component and for square wave mode of operation, evaluate the distortion CO2 Characterize the inverter output voltage waveforms for pwm mode of operation, investigate the harmonic spectrum CO3 Extend the concept from single to three-phase applications and evaluate the control and power flow issues

Weekly Schedule of Topics

W	Topic
1	Introduction to forced commutated circuits, Gate Turn-Off devices, DC/DC, DC/AC, AC/AC conversion, review of basic power electronics concepts
2	BJT, MOSFET, IGBT, IGCT, Switching pole, hard switching
3	Basic converter topologies, Voltage input-output function derivations
4-5	DC-DC Converter behavior
6-8	SMPS: DC/DC converters with isolation
9	Modelling and control of DC/DC converters: state-space averaging, voltage/current mode control, cascade control
10	DC/AC Converters (Inverters) Basics voltage source inverter, current source inverter, single phase half and full (H) bridge inverter

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11	Modulation, sinusoidal PWM, harmonic spectrum, optimal PWM, phase displacement control
12-13	Three phase voltage source inverters, basic topology, six step operating mode.
14	Hard switching and soft switching, ZVS, ZCS, Resonant Converters

Contribution to Program Outcomes*

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	1	1	0	0	1	1	1	0	0
CO2	1	2	1	1	0	0	1	1	1	0	0
CO3	3	1	1	1	0	0	1	1	1	0	0
CO4	0	1	0	0	0	0	1	1	0	0	0
CO5	0	0	1	1	0	0	1	1	0	0	0

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

Requirements	Basic knowledge of Electromagnetic Field Theory
Course Policy	• Be in the class on time. • English should always be used to communicate with one another. • At least 70% attendance is required, otherwise a grade of **DZ** will be assigned.
Cheating & Plagiarism	• Copying or letting someone copy your work on exams, assignments, or reports is cheating. • Cutting and pasting text, figures and tables from web sources or any other electronic source is plagiarism. • The consequence of academic dishonesty is to receive a grade of **FF** for the course.
Evaluation	Midterm 40% Final Exam 60% Total 100%

Instructor

Name/Surname	Akın Uktav	Email	akin.oktav@alanya.edu.tr
Room	209	Office Hours	W 11.30-12.30	F 13.30-14.30

Prepared by Akın Uslu on February 5th, 2024.