



Jordan University of Science and Technology
Faculty of Engineering
Electrical Engineering Department

EE435 Power Electronics - JNQF Level: 7

First Semester 2023-2024

Course Catalog

3 Credit Hours. Power semiconductor devices: types, drive circuits, protection circuits, and power loss calculation. AC-DC converters: uncontrolled and fully-controlled single-phase and three-phase rectifiers, half-controlled rectifiers. AC-AC converters: cycloconverters, ac voltage controllers. DC-AC converters: single-phase and three-phase inverters. DC-DC converters: step-down, step-up, and step-down/up converters.

Text Book

Title	Power Electronics
Author(s)	Hart, D.
Edition	1st Edition
Short Name	Textbook
Other Information	

Course References

Short name	Book name	Author(s)	Edition	Other Information
Ref#1	Power Electronics	Lander, C.	3rd Edition	
Ref#2	Power Electronics: Circuits, devices, and Applications	Rashid, M. H.	4th Edition	
Ref#3	Power Electronics, Converters, Applications, and Design	Mohan, N., Undeland, T. M., Robbins, W.	3rd Edition	
Ref#4	Power Electronics Circuits	Batarseh, I.	1st Edition	

Instructor

Name	Prof. Moh"D Rashad Al-Mothafar
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Office Location	E2L3
Office Hours	Sun : 13:30 - 14:30 Mon : 10:15 - 11:30 Tue : 13:30 - 14:30 Wed : 10:15 - 11:30 Wed : 13:00 - 14:30
Email	mothafar@just.edu.jo

Class Schedule & Room
Section 1: Lecture Time: Mon, Wed : 11:30 - 13:00 Room: E2114

Tentative List of Topics Covered		
Weeks	Topic	References
Week 1	Power semiconductors; Types and applications of power electronic converters	
Weeks 2, 3, 4, 5, 6	AC-DC converters: Single-phase half-wave rectifiers (uncontrolled, controlled); Single phase and bi-phase full-wave Rectifiers: Uncontrolled, fully controlled, half-controlled; Three-phase bridge rectifiers: Uncontrolled, fully controlled; Applications	
Weeks 7, 8	Effect of source inductance on rectifier circuits: Single phase, three-phase; Input-side power factor; Inversion limits; Regulation	
Weeks 9, 10, 11	DC-AC converters: Single-phase inverters: (Single-leg, H-bridge); PWM inverter; Three-phase inverter; Applications	
Week 12	AC-AC converters: Single-phase cycloconverter, single-phase transformer tap changer	
Weeks 13, 14, 15	DC-DC converters: Step-down, step-up, step-down/up; Applications; Switching loss in power semiconductor devices; Protection of power semiconductor devices using snubber circuits	

Mapping of Course Outcomes to Program Outcomes and NQF Outcomes	Course Outcome Weight (Out of 100%)	Assessment method
Recognize the use of semiconductor devices in power electronic converter circuits and the power losses of these devices. [1SO1] [1L7K1]	3%	Homework
Analyze various single-phase and three-phase un-controlled and phase-controlled rectifier circuits, including the effect of source inductance. [1SO1] [1L7S1]	40%	First Exam, Second Exam, Homework
Analyze the operation of single-phase half-bridge, full-bridge, and sinusoidal PWM inverters. [1SO1] [1L7S1]	18%	Second Exam, Homework

Analyze the operation of the three-phase inverter circuit under 180-degree and 120-degree control. [1SO1] [1L7S1]	5%	Homework
Analyze the operation of the single-phase AC voltage controller, the transformer tap changer and the single-phase cycloconverter. [1SO1] [1L7S1]	9%	Homework
Design the buck, the boost, and the buck-boost DC-DC converters operating in the continuous-conduction mode under open-loop conditions, with power losses taken into consideration. [1SO1] [1L7S2]	20%	Homework
Design CRD snubber circuits to protect the semiconductor devices used in power electronic converters. [1SO1] [1L7S2]	5%	Homework

Relationship to Program Student Outcomes (Out of 100%)						
SO1	SO2	SO3	SO4	SO5	SO6	SO7
100						

Relationship to NQF Outcomes (Out of 100%)		
L7K1	L7S1	L7S2
3	72	25

Evaluation	
Assessment Tool	Weight
First Exam	25%
Second Exam	25%
Homework	10%
Final Exam	40%

Policy	
First Exam	Covers single-phase uncontrolled controlled rectifiers
Second Exam	Covers: - Three-phase uncontrolled and controlled rectifiers - Single-phase inverters
Final Exam	Covers all topics outlined in this syllabus

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