Course Specification

(Postgraduate Programs)

Course Title:	Advanced Power Electronics
Course Code:	2202-518
Program:	Master in Electrical Engineering
Department:	Electrical Engineering
College:	College of Engineering
Institution:	King Faisal University
Version:	V2
Last Revision Date:	14 April 2025

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3)				
2. Course type				
A.	☐ University	☐ College	☒ Department	☐ Track
B.	☐ Required		☒ Elective	
3. Level/year at which this course is offered: Level 2/1st year				
4. Course General Description:				
The course examines the application of power electronics in energy conversion and control. Topics to be covered include modelling, analysis, control, and design of power electronic circuits: AC-DC rectifiers, DC-DC converters, and DC-AC inverters; Analysis and design of magnetic components and filters. Numerous application examples such as power supplies, pulse-width modulation, machine drives, HVDC transmission system, and power quality.				
5. Pre-requirements for this course (if any)**:**				
2202-482 Power Electronics				
6. Co-requisites for this course (if any)**:**				
None				
7. Course Main Objective(s):				
• Understand power electronics circuits and systems. • Understand different pulse width modulation (PWM) techniques. • Analyze, design, and simulate power electronic circuits. • Understand the modelling, control, and application of AC-DC rectifiers, DC-DC converters, and DC-AC inverters.				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		

No	Mode of Instruction	Contact Hours	Percentage
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	45
2.	**Assignments**	0
3.	**Library**	0
4.	**Projects/Research Essays/Theses**	0
5.	**Others (specify) Introduction to Simulation Software**	6
	Total	51 Hours

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Understand power electronics circuits and systems	K1	-Lectures -Solved Examples	-Assignments -Examination
1.2	Understand different pulse width modulation (PWM) techniques.	K1	-Lectures -Solved Examples	-Assignments -Examination
1.3	Identify various application of power electronic circuits	K1	-Lectures -Solved examples	-Assignments -Examination
1.4	Understand the modelling of power circuits: AC-DC rectifiers, DC-DC converters, and DC-AC inverters	K1	-Lectures Solved examples	-Assignments -Examination
2.0	**Skills**			

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
2.1	Understand the modelling of AC-DC rectifiers, DC-DC converters, and DC-AC inverters	S1	-Lectures -Solved examples	-Assignments -Examination
2.2	Use simulation tools to design power electronic circuits	S2	-Demo of simulation package	-Computer Assignments -Report submission
3.0	**Values, autonomy, and responsibility**			
3.1	Prepare report related to research project and make oral presentation	V1, V2, V3	Research Assignments	-Report submission -Presentation
...				

C. Course Content:

No	List of Topics	Contact Hours
1.	Characteristics of power semiconductor devices	3
2.	Drive and protection circuits for efficient switching of semiconductor devices	6
3.	Modeling, analysis, and control techniques	9
4.	Analysis and design of magnetic components and filters	3
5.	Design of power circuits: AC-DC rectifiers, DC-DC converters, and DC-AC inverters	6
6.	Pulse-width modulated and resonant DC-to-DC converter topologies	6
7.	pulse-width modulation and machine drives	3
8.	HVDC transmission system, and power quality	3
9.	Course Project	3
10.	Examination	3
Total		**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignments and Quizzes	Weeks 3,5,7,9,11,13	15%
2.	Midterm	Week 8	25%
3.	Research paper and oral discussion	Week 14	25%

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
4.	Final Exam	Week 15	35%
5.	Total		100%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	Modern Power Electronics and AC Drives, Bitmal K. Bose, Prentice Hall, 2nd Edition, 2010, ISBN-13: 978-0130167439
Supportive References	Introduction to Modern Power Electronics, Andrzej M. Trzynadlowski, 3rd Edition, 2015, ISBN: 978-1-119-00321-2
Electronic Materials	Handouts by the instructor.
Other Learning Materials	Scientific journal reading.

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom : 30 seats
Technology equipment (Projector, smart board, software)	Data show Matlab Software PSIM software
Other equipment (Depending on the nature of the specialty)	Computer Lab

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect: Online Course Evaluation
Effectiveness of students' assessment	EE Faculty members Students	Direct: Course Report Presentation Direct: Assessment using student grades Indirect: Assessment of CLOs
Quality of learning resources	Instructor EE Faculty members	Direct: Course Report
Overall course quality	Course Instructor	Direct: Course Report Presentation
Improvement Plans	EE Department	None

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	**EE DEPARTMENT QUALITY COMMITTEE**
REFERENCE NO.	**MEETING # 10**
DATE	**APRIL 19, 2025**