

**City University of Hong Kong
Course Syllabus**

**offered by Department of Electrical Engineering
with effect from Semester A in 202/2025**

Part I Course Overview

Course Title:	Modern Power Electronics
Course Code:	EE6427
Course Duration:	One Semester (13 weeks)
Credit Units:	3
Level:	P6
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: (Course Code and Title)	Nil
Precursors: (Course Code and Title)	EE4101 Modern Power Electronics; or equivalent
Equivalent Courses: (Course Code and Title)	Nil
Exclusive Courses: (Course Code and Title)	Nil

Part II Course Details

1. Abstract

This course aims to enable students to gain an understanding of the principles and industrial applications of modern power electronics. International regulations concerning all modern electronic equipment and the latest technology to meet these regulations will be presented.

2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs	Weighting (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	A2	A3
1.	Identify the practical characteristics of power electronic devices and circuit components.		✓		
2.	Analyse, design and implement switching methods for AC-DC and DC-AC power converters.		✓	✓	✓
3.	Acquire power conversion concepts to power system applications.		✓	✓	✓
4.	Describe international regulations related to electromagnetic compatibility and techniques to meet them.			✓	✓
		100%			

A1: Attitude

Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability

Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments

Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

3. Learning and Teaching Activities (LTAs)

(LTAs designed to facilitate students' achievement of the CILOs.)

LTA	Brief Description	CILO No.						Hours/week (if applicable)
		1	2	3	4			
Lecture	Students will engage in lectures about key concepts of power electronic converter systems.	✓	✓	✓	✓			2 hrs/wk
Tutorials	Students will engage in discussion and learning key concepts based on questions and problem solving.	✓	✓	✓				1hr/wk
Mini-project	Students will be instructed to learn projects on comparing the use of different types of circuit topology for DC-DC or DC-AC converters in electric vehicles and other applications.	✓	✓	✓	✓			2 hrs/wk For 6 weeks

4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.						Weighting	Remarks
	1	2	3	4				
Continuous Assessment: <u>50%</u>								
At least 3 assignments (may include homework, tutorial exercise, presentation etc.)	✓	✓	✓	✓			5%	
Quiz I or II	✓	✓	✓	✓			30%	
Mini-project	✓	✓	✓	✓			15%	
Examination: <u>50%</u> (Duration: 2hrs, if applicable)								
Examination	✓	✓	✓				50%	
							100%	

Remark:

To pass the course, students are required to achieve at least 30% in course work and 30% in the examination.

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Applicable to students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Examination	Achievements in CILOs	High	Significant	Moderate	Basic	Not even reaching marginal level
2. Coursework	Achievements in CILOs	High	Significant	Moderate	Basic	Not even reaching marginal level

Applicable to students admitted from Semester A 2022/23 to Summer Term 2024

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B,)	Marginal (B-, C+, C)	Failure (F)
1. Examination	Achievements in CILOs	High	Medium	Low	Not even reaching marginal level
2. Coursework	Achievements in CILOs	High	Medium	Low	Not even reaching marginal level

6. Constructive Alignment with Programme Outcomes

PILO	How the course contribute to the specific PILO(s)
1, 2	To understand the latest technology and trends in power electronic technology.
1, 2, 3, 4	To analyze power electronic circuits and systems.

Part III Other Information (more details can be provided separately in the teaching plan)

1. Keyword Syllabus

Power Electronic Devices

Review of power electronic devices - power diode, power BJT, power MOSFET, IGBT. Switching characteristics. Device limitations and protection techniques, snubber circuits. Base/gate drive circuits; isolation techniques

DC-DC Conversion

Series-pass supplies, efficiency, performance, applications. The switch-mode supply principle, comparison with series pass, applications. The off-line supply switch-mode system. Step-up and step-down topologies; buck, boost and flyback, transformer coupled circuit arrangements

AC-DC Conversion

Performance parameters, Power factor correction circuit.

DC-AC Inversion

Principle of operation, performance parameters, modulation techniques, harmonic reductions. Inverter types; three-phase, series resonant

2. Reading List

2.1 Compulsory Readings

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

1.	Nil
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2.2 Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)

1.	N Mohan, T M Undeland and W P Robins: <u>Power Electronics: Converters, Applications and Design</u> , (2nd Edition, John Wiley & Sons, 1995)
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