The Hong Kong University of Science and Technology

UG Course Syllabus

Integrated Power Electronics

ELEC 4430

3 credits

Pre-requisites: ELEC 3400

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Office Hours: Thursday, 3pm – 4pm, Room 2520 and zoom

Additional office hours by appointment

Course Description

Power computation, diodes and rectifier circuits, power factor correctors, switch mode power converters, magnetic components, switch capacitor power converters, linear regulators, and integrated circuit techniques for controller design.

Intended Learning Outcomes (ILOs)

By the end of this course, students should be able to:

IL01: **recognize** magnetic quantities such as magnetic flux, permeability and reluctance, and **compute** magnetic quantities relating to inductors and transformers. (PL01)

IL02: **recognize** and **compute** electrical quantities such as power and work done related to both DC and AC circuits. (PL01)

IL03: **compute** operating parameters and characterize the performance of power converters and regulator circuits. (PL01)

IL04: **analyze** and **design** component parameters for power converters and regulator circuits. (PL03)

IL05: **apply** software (CAD) tools to design, simulate and analyze power converters and regulator circuits. (PL02)

Assessment and Grading

This course will be assessed using criterion-referencing and grades will not be assigned using a curve. Detailed rubrics for each assignment are provided below, outlining the criteria used for evaluation.

Assessments:

Assessment Task	Contribution to Overall Course grade (%)	Due date
Homework	10%	
Project	15%	
Midterm Examination	25%	
Final Examination	50%	

* Assessment marks for individual assessed tasks will be released within two weeks of the due date.

Mapping of Course ILOs to Assessment Tasks

Assessed Task	Mapped ILOs	Explanation
Homework sets, midterm and final examination	ILO1, ILO2	to test whether students recognize and compute electrical and magnetic quantities.
Homework sets, midterm and final examination	IL03	to test whether students can compute operating parameters and characterize the performance of power converters and regulator circuits.
Software project	IL04, IL05	to test whether students can apply software tool to analyze and design component parameters for power converters and regulator circuits.

Grading Rubrics

	Excellent	Good	Satisfactory	Inadequate	Poor
Marks (0 – 10)	9.0 - 10	6.0 – 8.9	4.0 – 5.9	2.0 – 3.9	0 – 1.9
Criteria	Correct answer, coherent reasoning, excellent understanding of problem statement	Minor mistake, clear reasoning, good understanding of problem statement	some mistakes, traceable reasoning, fair understanding of problem statement	Major mistakes, reasoning hard to follow, weak understanding of problem statement	No or wrong answer, no or incorrect reasoning, wrong interpretation of problem statement

Final Grade Descriptors:

Grades	**Short Description**	**Elaboration on subject grading description**
A	Excellent Performance	Demonstrates a strong grasp of lecture materials and effective utilization of software tools. Student should exhibit exceptional skills in problem solving and exceptional ability to analyze and evaluate issues.
B	Good Performance	Shows good knowledge and understanding of the main subject matter, competence in problem-solving, and the ability to analyze and evaluate issues. Displays high motivation to learn and the ability to work effectively with others.
C	Satisfactory Performance	Possesses adequate knowledge of core subject matter, competence in dealing with familiar problems, and some capacity for analysis and critical thinking. Shows persistence and effort to achieve broadly defined learning goals.
D	Marginal Pass	Has threshold knowledge of core subject matter, potential to achieve key professional skills, and the ability to make basic judgments. Benefits from the course and has the potential to develop in the discipline.
F	Fail	Shows insufficient understanding of the subject matter and lacks the necessary problem-solving skills. Shows limited ability to think critically or analytically and exhibits minimal effort towards achieving learning goals. Does not meet the threshold requirements for professional practice or development in the discipline.

Course AI Policy

Students are not expected to use generative artificial intelligence tools to complete assessment tasks.

Communication and Feedback

Scores of homework, midterm examination and project will be posted via Canvas within three weeks of submission. Feedback on assignments will include highlighting wrong calculations and wrong reasoning. For project submission, feedback will include highlighting large deviation from expected values and simulation results, and incomplete tasks. Students who have further questions about the feedback, including dispute in marking, should consult the instructor within five working days after the feedback is received.

Resubmission Policy

There will be penalties for late submission of homework and projects. No resubmission will be considered after the solutions have been posted.

Required Texts and Materials

No textbook is required.

Useful reference text: Daniel W. Hart, Power Electronics, McGraw-Hill International Edition, 2011.

Extensive lecture notes will be distributed.

Lectures will be recorded in zoom and made available after class.

Instructor's class written notes will be distributed after class.

Academic Integrity

Students are expected to adhere to the university's academic integrity policy. Students are expected to uphold HKUST's Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct. Please refer to Academic Integrity | HKUST – Academic Registry for the University's definition of plagiarism and ways to avoid cheating and plagiarism.

Additional Resources

N/A