The Hong Kong University of Science and Technology

UG Course Syllabus

Introduction to Electro-Robot Design

ELEC 1100

4 Credits

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Office Hours: By email appointments

Course Description

The course introduces the fundamental knowledge of the design, implementation and evaluation of a robot and its sub-systems. It covers the basic principles of analog and digital circuits as well as robot sensing and control mechanisms. Students will need to apply the knowledge and principles learned to design and build a functional robot by the end of the course. Students who have completed ELEC 2200, ELEC 2350, ELEC 2400, ELEC 2420, or ELEC 3310, must obtain instructor's approval to take this course.

Intended Learning Outcomes (ILOs)

Through hands-on labs and term project, completed with lectures and tutorials, by the end of this course, students should be able to:

- ILO1: Recognize the history and development of major ECE fields.
- ILO2: Apply the fundamental circuit concepts to compute the output of basic electronic circuits.
- ILO3: Analyze, design, and debug simple analog circuits, and design and program for simple digital control strategies.
- ILO4: Build a real engineering system following a hierarchical design principle.
- ILO5: Work in a team environment, learn and practice effective project management.
- ILO6: Execute a complete project from problem formulation, design/implementation, up to verification and documentation.

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.

- Lab: 6 Lab Assignments (29% total; first 5 labs 5% each, final lab 4%).
- Homework: 10 Homework (3% total, 0.3% each). Questions will be released on Monday at 09:00am. Submission deadline will be Friday at 09:00am. Solutions will be provided 1 day before the due day at 09:00am.
- Exam: Lab Exam (close book, 20%) and Written Exam (close book, 25%).

- Project: Project Demo (20%) and Report (3%).

Summary Table:

Assessment Task	Contribution to Overall Course grade (%)	Due date
Homework	3%	Week 3 – 12
Laboratory experiments	29%	Week 3 – 10
Lab Exam	20%	Weeks 7 – 8 at lab class
Written Exam	25%	Week 10
Final Project Demo	20%	Weeks 12 – 13
Project Report	3%	Week 13

Mapping of Course ILOs to Assessment Tasks

Assessed Task	Mapped ILOs	Explanation
Homework, Written Exam	ILO1, ILO2	These assessments evaluate students' understanding of fundamental electronic concepts (ILO1) and their ability to apply calculations accurately in circuit analysis (ILO2).
Lab Exam	ILO2, ILO3	Lab Exam tests students' capability to analyze circuit diagrams, perform calculations (ILO2), and troubleshoot issues in both theoretical and practical scenarios (ILO3).
Laboratory experiments	ILO3, ILO4, ILO5	These lab tasks assess students' ability to use lab equipment, conduct experiments, and analyze data to verify electronic principles (ILO3). They also evaluate students' skills in troubleshooting circuit issues step by step, from basic to complex elements, ensuring proper functionality (ILO4). Collaboration is key as students work together to diagnose problems, brainstorm solutions, and make effective adjustments. This structured teamwork enhances problem-solving, communication, and practical knowledge in electronic circuit design and troubleshooting (ILO5).
Final Project Demo, Project Report	ILO5, ILO6	The final project encourages teamwork, creativity, and problem-solving skills as students collaborate to design, build, test, and optimize their electro robot car. By completing this hands-on project, students gain practical experience in applying electronic concepts to real-world

		applications and enhance their skills in project management, innovation, and technical implementation. This assessment also evaluates students' ability to document experimental procedures, record measurements accurately, and present results in a clear and organized manner (ILO5 and ILO6).

Grading Rubrics

In the final project, student groups are required to program a robot car to navigate an obstacle course from START to END. The course consists of a white line on a black surface with challenging stretches and a white wall. Groups can conduct multiple demo trials, and their project demo score will be based on the highest performance achieved across all trials.

For a 'perfect run,' the robot car must successfully complete all given tasks within one trial. If the tasks are not completed, the demo score will be determined by 'how far your car can go' in each trial. The objective is to earn as many points as possible.

Please note that the specific demo track and tasks will vary each semester. Detailed grading rubrics, including the points awarding scheme, will be provided later in the semester as part of the 'Project Guide' documentation.

Final Grade Descriptors:

[As appropriate to the course and aligned with university standards]

Grades	Short Description	Elaboration on subject grading description
A	Excellent Performance	Exhibits an exceptional grasp of basic electronic components, their applications, and calculations in laboratory experiments and written assessments. Consistently delivers high-quality work with precise measurements, accurate analysis, and thorough explanations. Demonstrates advanced problem-solving skills, showcases creativity in circuit design, and displays mastery of electronic concepts in exams and quizzes.
B	Good Performance	Displays a solid understanding of basic electronic components, their applications, and calculations in laboratory experiments, projects, exams, and quizzes. Produces work of good quality with clear explanations, accurate results, and proficient calculations. Shows competency in circuit design, analysis, and troubleshooting in both practical and theoretical assessments.
C	Satisfactory Performance	Shows a basic understanding of basic electronic components, their applications, and calculations in laboratory experiments, projects, exams, and quizzes. Meets most of the requirements with satisfactory work, functional circuits, and adequate calculations. Demonstrates some ability to analyze circuits, perform calculations, and troubleshoot issues in practical and theoretical assessments.
D	Marginal Pass	Demonstrates efforts to understand basic electronic components, their applications, and calculations in laboratory experiments, projects, exams, and quizzes. Shows potential for improvement in

		accuracy, precision, and calculations. Displays some proficiency in circuit design, analysis, and troubleshooting in both practical and theoretical assessments.
F	Fail	Lacks a solid understanding of basic electronic components, their applications, and calculations in laboratory experiments, projects, exams, and quizzes. Fails to meet the requirements, with work that falls below the acceptable standard, lacks accuracy in calculations, and demonstrates significant difficulties in circuit design, analysis, and troubleshooting in both practical and theoretical assessments.

Communication and Feedback

Assessment marks for individual assessed tasks will be communicated via Canvas within two weeks of submission. Students seeking clarification or additional feedback, including marks, should consult the instructor/teaching team within one week of receiving the feedback or as specified in the email.

Make-up Policy

- For any grading components, if you missed one due to a justified reason, you may submit the proof within one week for arrangement of a make-up session.
- All requests for special accommodation for medical reasons must be accompanied by the hard copy of the original medical certificate.

Late Submission Policy

- Late submissions will not be accepted.

Required Texts and Materials

No specific textbook, mainly use hand-outs provided by the instructors.

Reference Books/Materials:

- L. Richard Carley and Pradeep Khosla, “Introduction to Electrical and Computer Engineering – taught in Context”, The McGraw-Hill Companies, Inc.
- G. Rizzoni, “Principles and Applications of Electrical Engineering,” 5th edition, McGraw Hill, 2007
- D. V. Kerns and J. D. Irwin, “Essentials of Electrical and Computer Engineering”, Pearson, 2004
- M. M. Mano, C. R. Kime, “Logic and Computer Design Fundamentals”, 3rd edition, Prentice-hall, 2004

Additional Resources

Tinkercad Online Circuit Simulator: https://www.tinkercad.com/

Arduino Home page: https://www.arduino.cc/

Course AI Policy

In the course project, you are allowed to use any kind of tools (including Generative AI), sources, and references to aid you. However, your demo code and project report should be your own work and not copied from elsewhere. Both your code and report will be used to conduct the plagiarism check. Copying from others will result in a mark penalty or failing this course.

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.