The Hong Kong University of Science and Technology

UG Course Syllabus Template

Introduction to Embedded Systems

ELEC 3300

4 Credits

Pre-requisites: COMP 2611 OR ELEC 2300 OR ELEC 2350 OR ISDN 4000F

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Course Description

This course is designed to teach techniques on how to integrate machine-level software and hardware in ARM-core microcontroller based systems. It makes use of industry-standard techniques and technologies, from which students can interface, design and program microcontroller systems. The task of the course will be to complete six laboratory experiments which address different aspects of hardware/software interfacing, and one large microprocessor/microcontroller based project which should result in the design and implementation of a small working embedded system.

Intended Learning Outcomes (ILOs)

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

ILO1: Recognize the marketing and engineering views of embedded system applications.

ILO2: Explain the building blocks of embedded systems and analyse their interfacing techniques with simple external devices.

ILO3: Explain and compare different up-to-date computer interfacing technologies.

ILO4: Use CAD tools to program and emulate the performance of the micro-controller.

ILO5: Execute a complete project in team from problem formulation, time management, 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.

Assessments:

Assessment Task	Contribution to Overall Course grade (%)	Due date
In-class activities	8%	Week 1 to 10
Homework assignments	4%	Week 3, Week 10
Laboratory experiments	15%	Week 2 to Week 7
Preliminary proposal discussion (peer)	3%	Week 5
Laboratory test	15%	Week 11
Final proposal presentation	4%	Week 7
Interim project demonstration	6%	Week 10
Final project demonstration and presentation	40%	Week 13
Final project report	5%	Week 13

Mapping of Course ILOs to Assessment Tasks

Assessed Task	Mapped ILOs	Explanation
In-class activities	ILO1, ILO3	This task assesses students' ability to catch up with the lecture materials that cover the basics of embedded systems (ILO1) and the different interfaces to the embedded system (ILO3).
Homework assignment	ILO2, ILO4	Homework evaluates students' ability to explain the use of the tools (ILO4) and to comprehend and recall the theoretical knowledge discussed in the lecture (ILO2).
Laboratory experiments	ILO2, ILO4	This task enriches students' knowledge in the circuit interfacing techniques of external devices (ILO2), and basic programming skills with CAD tools (ILO4).
Preliminary proposal discussion, Final proposal presentation, Interim project demonstration, Final project demonstration and presentation, Final project Report	ILO5	These tasks allow students to put into practice what they have learned in both hardware and software skills through their tailor-made project. Additionally, it focuses on project planning, effective teamwork, and leadership skills.

Grading Rubrics

Interim Demo and Final Demo Grading Rubrics

ELEC 3300 Interim Demo Grading Rubric

Updated: 6 Aug 2025

Acknowledgment - This rubric is adopted and modified from the INQUIRY AND ANALYSIS VALUE RUBRIC by Association of American Colleges and Universities.

Level	3	2	1	0
Hardware/Software Progress **Max : 3**	Interim demo shows workable demo and partial working functions that would be parts of their final product. (3)	Interim demo shows significant testing of the required components that would be use in the project with acceptable testing errors. (2)	Interim demo is just repeating of LAB demos, which is related to the project. (1)	Neither hardware nor software coding is being shown. (0)
Design Justification **Max : 1.5**		Able to justify the use of hardware / flow of software during interim demo. (1.5)	Cannot fully explain the use of hardware / software being used in the interim demo. (0.5)	No understanding / justification is being shown for the demo. (0)
Oral Presentation **Max : 1**		Clear and well organized presentation of the finished work within the 4-minutes time. (1)	Able to present the work, but not fully organized within the 4-minutes time. (0.5)	Presentation just repeats what is being describe from the project proposal. (0)
Submission of Photo of purchased components **Max : 0.5**			Submitted photo of purchased components to Canvas. (0.5)	No submission of photo of purchased components to Canvas. (0)

ELEC 3300 Project Grading Rubric

Project Demonstration: Max 32 marks

Project Presentation: Max 8 marks

Updated: 28 Sep 2023

Acknowledgment - This rubric is adopted and modified from the INQUIRY AND ANALYSIS VALUE RUBRIC by Association of American Colleges and Universities. Number in bracket shows the corresponding marks for that level of performance. **Students may ask to modify their codes during the project demonstration in need.**

	Capstone	Milestones		Benchmark	Below Benchmark
	4	3	2	1	0
Project Complexity Max : 12	The whole project consists of a complex hardware and software design. Careful hardware design and software design algorithm is being shown. (12)	Hardware consists of various kind of interface before going to the processor, with software controlling the other interfaces. (9)	Project hardware includes extra hardware/software components and other features of the processor. (6)	Project hardware is a mix of analogue and digital signals, software part used majority lab-covered features of the processor. (3)	The processor directly controls all the aspects of the hardware, simple controls are used in the software. (0)
Design Justification Max : 10	System is designed with clear and correct justification. Students show the appropriate use of analog, digital signals and methodology. (10)	System is designed with appropriate use of analog, digital signals, and correct methodology. (6)	System is designed only according to the LAB material. Little justification and demonstration the use of I/O in the design. (4)	Little understanding of the project. System is designed with weak justification and demonstration of LAB knowledge or methodology. (2)	No understanding of the project. System is designed without any justification of LAB knowledge nor methodology. (0)
Project Originality Max : 6	Application of labs together with extra circuits or software extended to creative design. (6)	Extended integration of lab materials with extra circuits or software. (4)	Project is an application of all the labs done before. (2)	Project is an application of three or more of the lab experiments. (1)	Project is an application of less than three lab experiments. (0)
Completeness Max : 4	The project can run smoothly without major error. (4)	The project can run with specified inputs. It encounters error with input that is not specified. (3)	The project can run smoothly, however, it encounters errors on specified input. (2)	The project can run, however, it encounters errors on specified input. (1)	The project cannot run, however, can show partial functionality with forced input with either hardware or software. (0)
Oral Presentation with PPT Max : 8	Presentation referenced to information or analysis that significantly supports the project work. (8)	Project presentation is clear and consistent with the supporting material. (6)	Project functions are described clearly with explanation of special features. (4)	Fair description of project, still understandable, but is not often repeated and is not memorable. (2)	Project function can only be deduced, it is not explicitly stated in the presentation. (0)

Final Grade Descriptors:

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

Grades	Short Description	Elaboration on subject grading description
A	Excellent Performance	Students with excellent performance in the course demonstrate a strong grasp of lecture materials, effectively utilize tools discussed, excel in laboratory experiments, and excel in various project stages. They exhibit exceptional hardware and software skills, meticulous project planning, efficient teamwork, and effective leadership abilities.
B	Good Performance	Students with good performance in the course exhibit a solid understanding of lecture materials, proficient use of tools, competent completion of laboratory experiments, and demonstrate satisfactory progress in project stages. They showcase commendable hardware and software skills, effective project planning, teamwork, and leadership potential.
C	Satisfactory Performance	Students with satisfactory performance demonstrate an adequate understanding of lecture materials, satisfactory use of tools, and completion of laboratory experiments. They make acceptable progress in project stages, displaying satisfactory hardware and software skills, project planning, teamwork, and leadership.
D	Marginal Pass	Students with a marginal pass show limited understanding of lecture materials, inconsistent use of tools, and incomplete or inconsistent performance in laboratory experiments. Their progress in project stages is minimal, and they exhibit limited hardware and software skills, project planning, teamwork, and leadership abilities.
F	Fail	Students who fail the course display a lack of understanding of lecture materials, inadequate use of tools, and unsuccessful completion of laboratory experiments. They show little to no progress in project stages, lacking essential hardware and software skills, project planning, teamwork, and leadership capabilities.

Communication and Feedback

- Homework assessment marks will be provided via Canvas within three weeks of submission.
- Laboratory assignment feedback will be given during the demonstration to the marker.
- Peer discussion comments will be available on iPeer three days after submission.
- Final Proposal Presentation comments will be released one week after submission.
- Interim Demo and Final Demo comments will be given during the demonstration.
- Students seeking clarification or further feedback, including marks, should consult the instructor/teaching team within one week of receiving the feedback or as specified in the email.

Late submission Policy

To ensure fairness for students who submit assignments on time, a penalty for late submission is listed as follows:

- Late submission within 12 hours, 25% penalty will be applied.
- Late submission between 12 to 24 hours, 50% penalty will be applied.
- Late submission for more than 24 hours will not be accepted.

Required Texts and Materials

No specific Text Book

Additional Resources

STMicroelectronics STM32F103ZET6 Datasheet

STM32 Reference Manual

STM32 Cortex M3 Programing Manual

Course AI Policy

The use of Generative AI in project is permitted with proper acknowledgement and will NOT be contributed to the students' work.

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.