

The Hong Kong University of Science and Technology
UG Course Syllabus

[Course Title] A System View of Communications: From Signals to Packets

[Course Code] ELEC 1200

[No. of Credits] 4

[Co-requisites] Math (one of the following) MATH 1003/1014/1020/1024; Programming (one of the following) COMP 1021/1022P

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Course Description

Have you ever wondered what technologies go into your mobile phone or a WiFi hotspot? Through hands on work with a simple but fully functional wireless communication system, you will understand the basic engineering tools used and tradeoffs encountered in the design of these systems. This course is centered on weekly laboratories, each designed to introduce an important concept in the design of these systems. The lab sessions are supported by two one-hour lectures and a tutorial that introduce the concepts for the next laboratory, as well as reviewing and expanding the concepts learned in the previous laboratory.

List of Topics

Lecture Outline

Week 1	Course Introduction; Signals; Real World Channel; Linear Time Invariant Systems; Transmitting Data; Inter-symbol Interference and Eye Diagram; Feedback Model of the Channel
Week 2	Channel Equalization; Noise; Error Correcting Codes; The Frequency Domain
Week 3	Filter and Frequency Response; Time-Frequency Analysis/Source Coding; Signal Transmission – Multiplexing; Signal Transmission – De-multiplexing; Introduction to Networks; Link Layer; Network Layer
Week 4	Transport Layer; Application Layer; Course Review

Laboratory Outline

1. Introduction to MATLAB
2. Characterizing and Modeling an IR Channel
3. Communication Protocol and Bit Error Rate
4. Eye Diagram and Equalization
5. SNR and Bit Error Rate

6. Time-Frequency Analysis of Signals

7. Signal transmission using Frequency Division Multiplexing

Intended Learning Outcomes:

- CO1: Examine a voice communication system to identify the practical context of key theoretical concepts in ECE.
- CO2: Identify typical problems and tradeoffs encountered in electronic and computer engineering systems.
- CO3: Analyze simple approaches to address a range of problems and tradeoffs.
- CO4: Use software tools, such as MATLAB, to investigate potential solutions to problems and tradeoffs in order to validate an analysis, and to handle cases not amenable to simple analysis.
- CO5: Work in a cooperative setting on real hardware where the simplifying assumptions used in theoretical analysis may be violated, and assess the benefits and limitations of such analysis.

Textbook(s):

N/A

Reference Book(s)/Materials:

(F) Frenzel, Louis E, "Principles of electronic communication systems." 5th Edition, McGraw-Hill, 2023 (ebook).

(OWN) Alan V. Oppenheim, Alan S. Willsky and S. H. Nawab, Signals and Systems, 2nd Ed., Prentice Hall, 1997

Relationship of Course to Program Outcomes:

- PO1 An ability to apply knowledge of mathematics, science and Electronic and Computer Engineering. (CO1, CO2, CO3, CO4)
- PO2 An ability to design and conduct experiments, as well as to analyze and interpret data. (CO5)
- PO3 An ability to design efficient and economical Electronic and Computer Engineering systems, components or process subject to practical constraints.
- PO4 An ability to function in a multi-disciplinary environment through teamwork.
- PO5 An ability to identify, formulate and solve Electronic and Computer Engineering problems. (CO1, CO2, CO3, CO4)
- PO6 An ability to understand professional practices and ethical responsibilities.

Grading Scheme:

Lab	25%
Homework	10%
Midterm Exam	25%
Final Exam	40%