



EEE6410 COMPUTER COMMUNICATIONS

Credits: 10

Course Description including Aims

Processing techniques to enable transmission and storage of data with reliability and security are a key element in nearly all of today's computing systems. This course deals with data coding techniques required for reliable and secure data transmission and storage; it covers various aspects of digital communication tying in elementary communication theory with practical solutions to problems encountered. The aims of this course are :

1. To make students aware of the various techniques available for transmitting binary data, and the situations where each might be appropriate.
2. To look at problems that are associated with signal distortion and the limitations that these impose on a data channel.
3. To examine ways of reliably transmitting information in the presence of non-ideal communication channels.
4. To outline the use of cipher primitives for securing data in digital communication.
5. To make students aware of some of the communication standards that exist.

Outline Syllabus

Asynchronous Communication : RS232, timing constraints, character framework, standards, UARTs, error checking, modems. **Synchronous Serial Communication :** How it differs from asynchronous communication, biphase codes, Miller codes, ternary codes, advantages, uses, bandwidth requirements, constraint lengths and self clocking ability. **Transmission Media :** Twisted pair, coax, optic fibre, waveguide, radio. Advantages and disadvantages of each, cost, signal distortion associated with communication. **Data Compression:** lossless compression, lossy compression, DCT, JPEG. **Data Integrity :** Error detection, parity check, cyclic redundancy checking, theory and hardware implementation. Error correction, distance, coding gain, BER, soft-decision decoding, Galois fields, algebraic and non-algebraic decoding of block codes. Hamming codes BCH codes, Reed Solomon codes, hardware implementation issues. Convolutional codes, Viterbi decoding. Practical configurations, cross-interleaving, multi-stage coding, serial and parallel concatenation, introduction to Turbo codes. **Introduction to data security: principles, private-key and public key ciphers .**

Time Allocation

24 lectures plus 12 hours of additional support material.

Recommended Previous Courses

Background knowledge equivalent to EEE104 "Digital Systems", EEE206 "Communication Systems", and EEE317 "Principles of Communications" will be of value.

Assessment

2 hour examination, answer 3 out of 4 questions.

Recommended Books

Wade	<i>Coding Techniques</i>	Palgrave
Stallings	<i>Data and Computer Networks</i>	McMillan
Tanenbaum	<i>Data Communications and Networking</i>	Prentice-Hall
Guy	<i>Data communications for Engineers</i>	Macmillan
Houghton	<i>The Engineer's error coding Handbook</i>	Chapman & Hall

Objectives

By the end of this module successful students will be able to

1. Make sensible choices about the type of communication system that will be required in a given situation, and the type of channel coding that will be best suited to the given environment.
2. Display awareness of the sorts of problems that will arise as a result of the design choices made in their solution.
3. Demonstrate a working knowledge of the techniques available for combating errors in a given system, and the sorts of errors they will encounter.
4. Demonstrate a working knowledge of the techniques available for data compression (both lossy and lossless).
5. Show an awareness of some of the communications standard that are provided.
6. Describe the basis of data security and be aware of the techniques that exist to encrypt/decrypt data.
7. Design a simple error control codec.