## TEL3212 DIGITAL COMMUNICATIONS

| Hours per Semester | | | | Weighted Total Mark | Weighted Exam Mark | Weighted Continuous Assessment Mark | Credit Units |
|---|---|---|---|---|---|---|---|
| LH | PH | TH | CH | WTM | WEM | WCM | CU |
| 45 | 30 | 00 | 60 | 100 | 60 | 40 | 4 |

**Rationale**

This course discusses the principles of digital communication and they can be applied in different communication systems.

**Course Objectives**

- To understand the concepts of information theory and digital communications in today's communication systems
- To appreciate the methods used in coding, data compression, digital modulation techniques and other digital communications problems.

**Detailed Course Content:**

Introduction: **[4 Hours]**

Analog Vs. Digital Communication Systems; A General Communication System; Review of Probability Theory; Probability space, random variables, density functions, independence; Expectation, conditional expectation, Baye's rule; Stochastic processes, autocorrelation function, stationarity, spectral density

Analog-to-digital conversion: Sampling (ideal, natural, sample-and-hold); Quantization, PCM; **[4 Hours]**

Source coding (data compression): **[6 Hours]**

Measuring information, entropy, the source coding theorem; Huffman coding, Run-length coding, Lempel-Ziv;

Communication channels: Band limited channels The AWGN channel, fading channels **[6 Hours]**

Receiver design: **[6 Hours]**

General binary and M-ary signaling; Maximum-likelihood receivers; Performance in an AWGN channel; The Chernoff and union/Chernoff bounds; Simulation techniques; Signal spaces

Modulation: PAM, QAM, PSK, DPSK, coherent FSK, incoherent FSK **[6 Hours]**

Channel coding: **[6 Hours]**

Block codes, hard and soft-decision decoding, performance; Convolutional codes, the Viterbi algorithm, performance bounds; Trellis-coded modulation (TCM)

Signaling through band limited channels: **[4 Hours]**

ISI, Nyquist pulses, sequence estimation, partial response signaling; Equalization

Signaling through fading channels: Rayleigh fading, optimum receiver, performance; Interleaving

Synchronization; Symbol synchronization; Frame synchronization; Carrier synchronization **[3 Hours]**

**Learning Outcomes**

The goal of this course can be divided into three areas:

- Knowledge goal: The students should understand the functions of the various parts of a modern communication system.
- Skill goal: The students should have the ability to analyze theoretically the performance of various parts of a communication system. They should also be able to run Monte Carlo simulations for communication systems in matlab in order to estimate the performance of such systems.

- Attitude goal: The students should be aware of some of the most promising technologies for the future communication systems, such as for example MIMO techniques.

**Method of Teaching /Delivery**
The course will be taught by using lectures, tutorials and assignments.

**Mode of Assessment**
Assignments, tests and final examination. Their relative contributions to the final grade are :

| **Requirement** | **Percentage contribution** |
|---|---|
| Course work (Assignments, tests) | 40 |
| % Final examination | 60 |
| % **Total** | **100%** |

**Recommended Books and References**

- Modern Digital and Analog Communication Systems by BP Lathi
- Digital and Analog Communication by Couch
- Communication Systems by Haykins
- Probability, RV and Stochastic Processes by Popoulis

**Possible Lecturers:**
Dr. J. Butime
Dr. D. Okello
Dr. Ing. L. L.
Kaluuba Mr. D.
Nsubuga Mubiru
Mr. S. Mwanje
Mr. A Wasswa Matovu
Mr. D. Sebbaale
Mr. I. Kitone