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