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| **ECL4502** | **Communication Engineering Lab** | **L-T-P: 0-0-3; Total 14 Sessions** |

**Prerequisite**

Analog Communication, Signals and Systems, Probability, Random Variable & Processes, Digital Communication

**COURSE OBJECTIVE**

The goal of this Lab is to gain understanding of the different components of a generalized Analog Communication system and digital communication. This Lab also will provide in-depth understanding of signals in time-domain and frequency domain. Specifically we will be implementing the analog continuous wave modulation/demodulation techniques. This Lab will provide the exposure of analog pulse wave modulation/demodulation, , sampling, quantization and pulse shaping. The broad aim of this Lab to get the students acquainted with the communication engineering experiments using MATLAB, SDR platform and Hardware kits. The lab also aims to introduce students the performance of these systems in the presence of channel noise.

**COURSE OUTCOME**

After completion of this Lab, students should be able to:

* Determine the spectral content of periodic and non-periodic signals.
* Generate analog modulated waves and demodulate the and also able to analyze the time domain and frequency domain representation of analog modulated wave.
* Evaluate the performance levels (Signal-to-Noise Ratio) of AM, FM and PM systems in the presence of additive white noise.
* Generate and analyse the Analog Pulse Modulation/Demodulation and evaluate their performance in presence of noise.
* Generate PCM signals and various line codes.
* Generate discrete and continuous random variables and study their statistical properties. They will also be able to understand random processes and their statistical properties. Able to do the Monte-Carlo Simulation.
* Generate PN sequence, study their properties and implement various line coding techniques.

**COURSE CONTENT**

**A. MATLAB Simulation based Experiments**

1. Introduction to MATLAB, Simulink and the Communication Toolbox

2. Representation of Signals in the Time Domain, Power and Energy, Fourier Series and Fourier Transform implementation in MATLAB.

3. Analog Modulation using MATLAB — DSB-SC, SSB-SC and AM waveform generation, FM and PM Modulation; Time Domain and Frequency Domain Representation. Analog Demodulation in MATLAB – Coherent AM Demodulation, Envelop Detection of AM wave.

4. Design of Pulse Modulation and Demodulation System using MATLAB.

5. Study of properties of discrete and continuous random variables; Monte-Carlo Simulation

6. Investigate the relationship between a random process, its autocorrelation function and the power spectral density function. PSD of white noise.

7. PN sequence generation and various line coding methods. Power spectral density functions associated with various line codes.

8. Execute the experiment of pulse shaping in digital communication system. Obtain frequency domain analysis.

**B. Software Defined Radio based Experiments**

1. Familiarization of the Software Defined Radio platform

2. A simple transmitter and receiver implementation in SDR with Sinusoidal baseband signal.

3. Transmission and Reception of AM Waves; Demodulation of AM, DSB-SC and SSB-SC waves. Their time domain and frequency domain presentation.

4. FM transmitter and receiver in SDR platform.

5. Execute the experiment of pulse shaping in digital communication system. Obtain frequency domain analysis.

**C. Breadboard Level Experiments**

1. Generation of AM wave using 2N2222 BJT Modulator circuit

2. Implementation of Voltage to Frequency Converter using IC 555 Timer.

3. AM Modulator Circuit, DSB-SC Balanced Modulator/Demodulator Circuit with MC 1496 IC.

4. VCO and PLL based implementation of FM modulators and demodulators

**D. Trainer Kit Based Experiments**

1. Trainer Kit based experiments on AM and FM modulation and demodulation

2. Experiment on Sampling & Reconstruction

3. PCM trainer based experiments

4. FDM and TDM Trainer based experiment

5. A/D and D/A Trainer based experiment