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*German Jordanian University*

*Department of Communication Engineering*

*Digital Communication Systems Lab Syllabus*

*ECE 313-Lab*

***Instructor:***

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***Lab Room:***

C409 Communication Systems Lab.

***Experiments List:***

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| --- | --- | --- |
| ASSIGNMENT/Project | Experiment | Week |
|  | MATLAB Introduction | 1 |
|  | Sampling | 2 |
|  | PCM Encoding and Decoding | 3 |
| Random Data Generation | Line Code Encoding and Decoding | 4 |
| Pulse shaping | ASK Modulation and Demodulation | 5 |
| Digital modulation  And demodulation | FSK Modulation and Demodulation | 6 |
|  | Mid Exam | 7 |
| Channel Modeling | PSK Modulation and Demodulation | 8 |
| Digital system performance evaluation | Modeling digital Communication System Using MATLAB | 9 |
| Testing Digital Communication system using USRPs | Introduction to LabVIEW and software defined radio SDR-USRPs | 10 |
| Project Report and Poster | Project Demonstration | 11 |
|  | Final Exam | 12 |
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***Grading policy***

|  |  |
| --- | --- |
| 15% | Experiments Reports |
| 15% | Matlab assignment |
| 20% | Midterm exam |
| 20% | Project |
| 30% | Final exam |

**Assignments /Project**

* **Random Data Generation:**

The students have to use the rand, randn, and randi functions to create sequences of pseudorandom numbers.

* **Pulse Shaping:**

# The students have to design Raised cosine filter for pulse shaping using different filter parameters.

* **Digital Communication**

The Students have to be able to use different modulation/demodulation schemes such as MQAM, MPSK, and MFSK in order to modulate the generated data.

* **Channel Modeling**

The students have to be able to simulate AWGN and Rayleigh channel and to be familiar with channel parameters such as channel variance and Signal to Noise Ratio SNR. Rayleigh channel is considered as Flat channel based on Jack Model where the channel effects can be eliminated using zero forcing equalizer.

* **Digital system performance evaluation :**

The students have to use different communication system performance evaluation tools such as scatter plot, Bit Error Rate BER, Eye diagram. Also, Compare theoretical BER with simulation results

* **Testing Digital Communication system using USRPs**

In this Assignment the students have to be able to do practical implementation for real communication system using USRPs and realize the practical challenges ,study the effect of changing different system parameters such as transmitter gain, distance between transmitter and receiver ,carrier frequency..etc. In addition, the student have to measure SNR using Spectrum analyzer.

**Project:**

**Phase 1:**

In this part the students have to implement 3 stages digital communication system using MATLAB and carry out its performance using different system parameters and channel model.

**Data Source**

**Modulation**

**Pulse Shaping**

**Demodulation**

**Filter**

**Channel**

**Recovered Data**

**Expected Results**

* BER of the system for different modulation order In AWGN channel compared with theoretical value.
* Signal Constellation Diagram for transmit and receiver at SNR=5 and SNR=20

For each modulation order.

* BER of the system for modulation order 4 in with and without Pulse shaping
* BER of the system for BER of the system for different modulation order In Rayleigh channel

**Phase 2:**

In final stage of the project the student have to do practical implementation for designed communication system using USRPs and realize the practical challenges

**Expected Results**

* GUI for both Transmitter and Receiver.
* Signal Constellation Diagram for both transmitter and Receiver.
* Spectrum of the received signal at receiver side with estimated SNR.

**Phase 3 :**

Report, Presentations, and live demonstration.