

LABORATORY 2

Programme: M.Tech. (ECE)

Year: 2017

Semester: ODD

Course: LAB Core Course

Credits: 2

Hours: 24

Course Context and Overview (100 words): This course will provide relation between Signal modelling and wireless system simulation. Review of Signal Modelling, Channel Modelling, Signal transmission over AWGN and Rayleigh channel, MIMO transceiver simulation using various diversity (Transmit: Alamouti), Receive Diversity (SC, MRC). Simulation and modeling of OFDM system under Multipath scenario.

Prerequisites Courses: Digital Communication, Digital Signal Processing

Course outcomes (COs):

On completion of this course, the students will have the ability to:
CO1 Explain generation of random numbers with various distribution.
C02 Explain and Simulate various signal modelling techniques.
C03 Explain and Simulate various methods to equalize noise, echo, interference in wireless scenarios.
C04 Simulate various channel modelling and generate various effects of channel like multipath, Doppler spread etc.
C05 Simulate and practice OFDM system to combat multipath fading and MIMO system to combat fading using various transmit, receive diversity techniques.

Course Topics:

Topics	Lecture Hours	
UNIT – I		
1. Random Number Generation		
1.1 Generation of random number using LCG	1	3
1.2 Generation of pdf of the Uniform Radom numbers	1	
1.3 Generating Gaussian random variate using Central Limit Theorem, Box-Muller method, Rejection method.	1	
UNIT – II		
2. System modeling using AR, MA and ARMA methods		
2.1 AR,MA, ARMA based System Modeling	3	3

UNIT – III		
3. System Modeling		3
3.1 Pade's system modelling method	1	
3.2 Prony's system modelling method	1	
3.3 Shank's system modelling method	1	
UNIT – IV		
4. Noise, Echo cancellation using Adaptive Filter		3
4.1 Adaptive filter: System identification	1	
4.2 Adaptive equalization with and without noise	1	
4.3 Adaptive filter: Using RLS	1	
UNIT-V		
5. Channel Modelling		3
1.1 Modelling AWGN and Rayleigh Flat fading channel	1	
1.2 Modelling Multipath Indoor and outdoor channels	1	
1.3 Incorporating Doppler Spread in multipath channels	1	
UNIT-VI		
6. MIMO,TX and RX Diversity, ZF Detection		3
6.1 Transmit diversity: Alamouti coding	1	
6.2 Receive diversity: SC,MRC	1	
6.3 SM MIMO: Zero Forcing Detection	1	
UNIT-VII		
7. Overcome Multipath using OFDM		3
7.1 To show linear convolution becomes circular convolution in OFDM	1	
7.2 To generate block circulant matrix	1	
7.3 OFDM symbol transmission and reception	1	
UNIT-VIII		
8. Spectrum estimation		3
8.1 Spectrum estimation using periodogram	1	
8.2 Spectrum estimation using minimum variance method	1	
8.3 Eigen value decomposition for frequency estimation	1	

Textbook references (IEEE format):**Books:**

- Monson Hayes, *"Statistical Signal Processing"*, John Wiley & Sons, 1991.
- Fuqin Ziang, *"Digital Modulation Techniques"*, Archtech House, 2006.
- J.G.Andrews, *"Fundamentals of WiMax"*, Prentice Hall, 2007.
- Y.S.CHO, *"MIMO-OFDM with Matlab"*, Wiley, 2010.

Additional Resources (NPTEL, MIT Video Lectures, Web resources etc.):**Evaluation Methods:**

Item	Weightage
Lab 1-8 Performance	20
Lab Report	30
Lab Attendance	
Lab Exam.	30
Lab Exam Report	20
Total	100

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