BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI- HYDERABAD CAMPUS
INSTRUCTION DIVISION, FIRST SEMESTER 2016-2017
COURSE HANDOUT PART II

Date: 01 - 08 - 2016

In addition to Part-I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course No. : ECE F311 / EEE F311
Course Title : Communication Systems
Instructor-in-charge : Y.Yoganandam
Instructors : Ramakanth and S. R. Zinka

1. Course description:

Analysis and design of communication systems; analog and digital modulation and demodulation, frequency conversion, multiplexing, noise and distortion; spectral and signal-to-noise ratio analysis, probability of error in digital systems, spread spectrum. Introduction to the basic principles of the design and analysis of modern digital communication systems. Topics include source coding, channel coding, baseband and passband modulation techniques, receiver design, and channel equalization.

2. Scope & Objective:

This course intends to cover the basic understanding of functionalities of various block-sets involved in communication system. The topics like Analog to Digital conversion, Pulse coding, Modulation (Analog and Digital, Baseband and Bandpass), source coding, channel coding, Multiple access, Multiplexing techniques, Spread spectrum will be covered with appropriate detail and mathematical description. Important topic like Information theory and its fundamental limits will be emphasized to appreciate the concepts of digital communication. Students will be introduced to the functioning of modern communication systems and how they perform in the presence of noise. Students will be given assignments on communication system modeling using MATLAB. The laboratory component involves system design and simulation exercises using MATLAB and Simulink and experiments based on HW boards. Advance/application areas like wireless, optical, satellite, acoustic communication will be covered towards the end. Students are expected to have sound understanding of Signals and systems, Mathematics, Electromagnetic Field theory.

3. Text Books

T1 B.P. Lathi and Zhi Ding, Modern Digital and Analog Communication Systems, 3rd OR 4th Edition, Oxford University Press, 2010

T2 Simon Haykin & Michael Moher, Communication Systems, 4th OR 5th Edition, John Wiley & Sons, 2010

4. Reference Books

R1. Proakis John, Digital Communications, 4th Edition, TMH

R2. K. Sam Shanmugam, Digital and Analog communication systems, John Wiley & Sons

R3. DIGITAL COMMUNICATIONS Fundamentals and Applications: ERNARD SKLAR and Pabitra Kumar Ray; Pearson Education 2009, 2/e.

4. Course Plan

Sl. No	Topics to be covered	Learning Objectives	Ref. to Book	No. of Lectures
1	Overview of the course, introduction to communication systems.	History of electronic communications, blocks of a typical communication system, Electronic Communication Channels, twisted pair, cable, wave guide, wireless channels, need for modulation, concept of a carrier, analog and digital communication concepts.	T1& T2:Chapter 1	1
2	Deterministic and random signals and their properties	Signals, nature of signals, Review of energy and power signals, correlation functions, power and energy spectral densities, Fourier series and Fourier Transforms, signal distortions. Real world signals, pure, distorted and noise corrupted signal examples, typical BW of various signals.	T1: Chapters 2 & 3 T2:Chapter 2	2
3	Random variables, processes and Noise	Recap of Probability, Random variables & processes, statistical averages, Power spectral density, Gaussian process, Noise, Nature of noise,	T1:Chapter 8,9 T2:Chapter 5	3

		Sources of Noise, white noise, KTB, Noise Figure and Noise temperature, calculations, Signal-to-Noise ratio.	R3:Chapter 5	
4	Transmission and reception of analog Signals: Amplitude modulation (AM)	Different Amplitude Modulation Techniques: DSB-SC, SSB-SC, VSB, AM with carrier: BW requirements of above modulation schemes. Circuits for Generation and demodulation. Noise performance of different AM systems. Frequency Division multiplexing, Super heterodyne Receivers, Practical circuits	T1:Chapter 4 T2:Chapter 3,6 R2:Chapter 7	5
5	Transmission and reception of analog Signals: Angle Modulation Phase & Frequency modulation	Angle modulation, FM transmitter and receivers, interference and bandwidth considerations, comparison of AM and FM, FM generation and demodulation, Noise performance of different Angle Modulation systems.	T1:Chapter 5 T2:Chapter 4,6 R2:Chapter 7	4
6	Digital Representation of Analog Signals and Pulse Modulation	Sampling theorem, aliasing, quantization and encoding, PAM, TDM, PPM, PWM, Quantization, PCM, Delta Modulation	T1:Chapter 6 T2:Chapter 7 R2:Chapter 10	4
7	Baseband Transmission of Digital Signals	Line codes, NRZ etc, Inter Symbol Interference (ISI), eye diagram, Nyquist Criterion for Distortionless transmission, pulse shaping, equalization	T1:Chapter 7 T2:Chapter 8	4
8	Baseband Reception of Digital Signals and Noise performance	Probability of error due to Noise, detection of digital signal in noise, threshold determination, Bit Error Probability concepts, Matched Filter, bit Energy and BER Vs Bit Energy curves	T1:Chapter 10 R3:Chapter 3	4
9	Band-Pass transmission of Digital signals	Band-Pass Transmission Model, Binary PSK ,FSK and QAM, M-Array Data Transmission Systems, Noise performance of PSK & FSK Systems	T2:Chapter 9 T1:Chapter 10 R3:Chapter 4 R2:Chapter 8	5
10	Information & Forward Error Correction	Measure of information, entropy, Source Coding Theorem, discrete memory less channels, Channel capacity & Channel Coding, Error Control Codes, Linear block & convolutional codes	T1:Chapter 13,14 T2:Chapter 10 R3:Chapter 6 R2:Chapter 9	5
11	Digital receiver design & performance analysis.	Goals of Communication system designer, Error probability plane, Nyquist bandwidth, Shannon-Hartley capacity theorem, bandwidth-Efficiency plane, BW efficiency of different modulation schemes, Modulation & coding trade-offs, Designing digital communication systems, Modulation & coding for Bandwidth limited channels	R3:Chapter 9	3
12	Introduction to Spread spectrum systems	Concept of spread spectrum, PN sequences and their use in communication systems,	T1: Chapter 11 R3:Chapter 12	2
13	Emerging Trends in Communication Systems: Optical and Mobile communications.	A brief overview of different communication technologies	Supplementary notes	1
		Total Number of Lectures		43

Laboratory component: Laboratory exercises will involve simulations using MATLAB. Also, experiments will be conducted using HW boards, Signal Sources, Oscilloscopes & spectrum analyzer.

6. **Evaluation Scheme**

Component	Duration	Weightage	Marks	Date & Time	Remarks
Test I	60 mts.	20%	60	10/09 &8:30-9:30AM	Closed Book
Test II	60 mts.	20%	60	22/10 &8:30-9:30AM	Closed Book
Final lab Exam		10%	30		Experiment to be performed & viva--voce
Regular Lab Component		10%	30		Lab attendance and performing of experiment
Comprehensive	3 Hrs	20%	60	08/12 AN	Open Book
		20%	60		Closed Book
Totals		**100%**	**300**		

7. **Chamber Consultation Hour**: Will be announced in the class.

8. **Notices**: Notices concerning this course will be on CMS.

Y.Yoganandam

Instructor-in-Charge