BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
INSTRUCTION DIVISION
FIRST SEMESTER 2017-2018

Course Handout (Part - II)

Date: 02/08/2017

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. : **EEE F311**
Course Title : **Communication Systems**
Instructor-in-charge : **SAINATH BITRAGUNTA**
Tutorial Instructor(s) : **Sainath Bitragunta, Rahul Singhal, Ashutosh Kar**
Practical Instructor(s) : **Sainath Bitragunta, Rahul Sharma, Ritesh Kumar,Abhishek Joshi, Anuj Ojha, Prashant Upadyay**

1. Course description:

The course starts with an overview of communication systems. It covers brief historical background, types of communication, communication process, generic model and block diagram, etc. Later comes useful concepts in signal and systems which are useful for understanding and analyzing communication engineering. The course covers two types of communication systems, namely, analog and digital. The focus will be on fundamental working principles of these systems. Specifically, it covers linear and non-linear modulation. Performance analysis those analog modulation schemes in the presence of noise. Later part covers concepts like sampling, pulse code modulation (PCM), differential PCM, delta modulation (DM), inter-symbol interference, Nyquist criterion. Rest of the course coversdigital modulation schemes such as phase shift keying (PSK), quadrature amplitude modulation (QAM) etc., followed by brief coverage of information theory and coding and lastly emerging trends in communication systems.

The course has lab component as well. It includes experiments onthe review of signals and systems, analog, pulse, and digital modulation and demodulation techniques using MATLAB. Finally, lab ends with a few experiments on the performance analysis of digital communication system using MATLAB.

2. Objectives & Outcomes:

Communication systems come in different types, namely, voice communication systems, data communication systems, satellite communication systems, optical communication systems so on. The course mainly covers fundamental principles of analog and digital communication systems along with basics of information theory and error control coding techniques. This course serves as a pre-requisite course to learn several advanced courses on communications such as wireless communication, satellite communication, optical communication, data communication.

Expected outcomes of this course and manifold. After completion of the course students are expected to model, design, and analyze basic analog and digital communication systems. Furthermore, they should be able to perform Monte-Carlo simulationsusing MATLAB and/or Simulink to validate system analysis. Students will also be given assignments or projects on topics in communication system design, modeling and simulation. Students registering in this course are expected to have knowledge in basic engineering mathematics and a decent understanding of electronic devices and circuits, signals and systems.

3. Text Books

T1 B.P. Lathi and Zhi Ding, Modern *Digital and Analog Communication Systems,* 4thEdition, Oxford University Press, 2010.

4. Reference Books

R1 Upamanyu madhow, Introduction to communication systems, CUP, 2014.

R2 Simon Haykin, *Communication Systems,4*th Edition, John Wiley & Sons, 2000.

R3 Taub & Schilling, principles of communication systems,*4*th Edition, McGraw-Hill,

R4 H. Tsu, Analog & digital communications, Schaum's outline series, 2nd Edition, 2003.

R5 A. Papoulis, probability, random variables, and stochastic processes, 3rd Edition, 1991.

5. Course Plan

Lect. No.	Topics to be covered	Learning Objectives	Source
1,2	Overview of the course, Introduction to Communication Systems.	Brief history of electronic communication systems, Types of communication systems, Analog vs. digital communication, Issues and design aspects of communication systems	Chapter 1 (T1) &R1
3,4,5	Signals analysis	Classification of signals, correlation and convolution,review of Fourier series and Fourier Transforms power and energy spectral densities, signal distortion.	Chapters 2& 3 (T1),R1
6,7, 8,9	Amplitude Modulation (AM), DSB-SC, SSB-SC, VSB signals	Generation and demodulation of AM signals, modulator and modulator circuits, Frequency Division multiplexing	Chapter 4 (T1),R2, R3
10,11, 12,13	Frequency Modulation , FM generation and demodulation,	Angle modulation, FM transmitter and receivers, interference and bandwidth considerations, comparison of AM and FM	Chapter 5 (T1),R2,R3
14,15, 16	Sampling of analog signals, PCM	Sampling theorem, aliasing, quantization and encoding, PAM, PCM	Chapter 6(T1),R2,R3
17,18	DPCM and Delta Modulation	Differential PCM, Delta modulation and Adaptive DM	Chapter 6,(T1),R2,R3
19, 20,21, 22	Digital Transmission	Basic line coding formats, Regenerative repeaters, pulse shaping, eye diagram, BER, M-ary baseband signaling	Chapter 7,(T1),R2,R3
23,24, 25,26, 27	Random Variables & Processes	Fundamentals of Probability Theory & Random Variables, Random processes, their classification and power spectral densities, bandpass random process, optimum filtering	Chapters 8& 9(T1),R5,R2

28,29, 30	Performance analysis of Digital communication systems	Optimal threshold detection, Matched filters and Optimum receivers	Chapter 10(T1),R2
31,32, 33	Information Theory	Measure of information, entropy, Source Coding - Huffman code	Chapter 13(T1),R2
34,35, 36	Channel Capacity	Channel capacity of AWGN channel, Shannon's theorem and limits	Chapter 13(T1),R2
37,38, 39,40	Error Detection and Correction Codes	Hamming codes, Linear block codes, Cyclic codes, Convolutional codes	Chapter 14(T1),R2
41,42	Review of the course, Introduction to advanced topics	Optical, Satellite, Wireless communication systems, Software defined radio (SDR), Cognitive radio (CR)	R1, IEEE papers

6.**Laboratory component:** Laboratory exercises will mainly involve simulations using MATLAB programming. Additional details will be announced in the class.

7. **Evaluation Scheme**

Component	Duration	Weightage	Date & Time	Venue	Remarks
Mid-Sem Test	90 mins.	25%	11/10 2:00 - 3:30 PM	TBA	Closed Book (CB)
Tutorials		10%	Regular Tutorial Sessions		CB
Laboratory Test(s)		25%	Regular Lab Sessions		Regular-lab Evaluation (10%) plus Final Evaluation (15%)
Comprehensive Examination	3 hrs	40%	7/12 FN	TBA	OB+CB

** Details will be announced separately*

8. **Chamber Consultation Hour**: To be announced in the class.

9. **Notices**: Notices concerning this course will be displayed on EEE Notice Board or on *nalanda.bits-pilani.ac.in.*

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