FIRST SEMESTER 2016-2017

Course Handout Part II

Date: 02/08/2016

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.	***: EEE F311***
Course Title	***: Communication Systems***
Instructor-in-charge	***: SAINATH BITRAGUNTA***
Tutorial Instructor(s)	***: Praveen Kumar AV, Rahul Singhal, Vinita Tiwari***
Practical Instructor(s)	***: Sainath Bitragunta, G M Sundaram, G. S. S. Chalapathi, S. Harshvardhan, Abhishek Joshi, Anuj Ojha***

1. Course description:

Course starts with an overview of communication systems which include brief historical background, types of communication, elements of communication systems, analog versus digital systems etc. Next, it introduces concepts in signal and systems which are useful for understanding and analyzing communication systems . The course introduces two types of communication systems, namely, analog and digital. 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 is also an integral part of this course. Later part of the course covers concepts like sampling, pulse code modulation (PCM), differential PCM, delta modulation (DM), inter-symbol interference, Nyquist criterion. Topics in the remaining part of the course include digital modulation schemes such as phase shift keying (PSK), quadrature amplitude modulation (QAM) etc., followed by brief coverage of information theory and coding. Finally, this course ends with a very brief introduction to some advanced topics in communication systems.

The course has lab component as well. It includes experiments on analog and digital communication systems.

2. Scope & Objective:

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 will be a stepping stone to learn advanced courses on communications such as wireless communication, satellite communication, optical communication.

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 simulations using 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,* 4th Edition, 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	Chapters 2& 3 (T1),R1

		energy spectral densities, signal distortion.	
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	Line coding, Regenerative repeaters, Pulse shaping, ISI, Eye diagram	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, band pass 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	Advanced topics	Brief introduction to 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%	6/10 2:00 - 3:30 PM	*	Closed Book (CB)
Quizzes		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%	9/12 FN	*	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.*

Instructor-in-Charge
EEE F311
Chamber: 2210-A