BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
INSTRUCTION DIVISION
SECOND SEMESTER JAN. 2016
Course Handout (Part- II)

Date: 05-01-2016

Course No. : EEE G622
Course Title : Advanced Digital Communication.
Instructor-in-Charge : SAINATH BITRAGUNTA

Scope and Objective:

This graduate level course deals with the design and performance analysis of digital and wireless communication systems. The course initially provides review on probability and random process, which is very useful mathematical tool in understanding, designing, and analyzing wireless communication systems. The design of optimum receivers for AWGN channels will be discussed. Symbol error probability (SEP) for various modulation schemes will be investigated. Carrier and phase estimation techniques will be described. The combined coding and modulation technique like trellis coded modulation will be treated. The signal design for band-limited channels will be discussed. Principles involved in spread spectrum communication systems will be discussed.

Furthermore, digital communication over fading channels will be discussed assuming mainly Rayleigh fading. Various diversity techniques to overcome problems of fading and shadowing will also be covered. This course also provides discussion on the key principles and signal processing in orthogonal frequency division multiplexing (OFDM) based wires communication systems. Introduction to software defined radio (SDR) and emerging trends in wireless communication may be discussed. The pre-requisite of Communication Systems of BITS or equivalent is presumed for this graduate level course.

2. References:

"Principles of communication engineering", by Wozencraft & Jacobs, John Wiley, 1965.
Principles of digital communication", by Viterbi & Omura, McGraw-Hill, 1979.
"Digital Communications", by John G. Proakis , 4th edition, McGraw Hill, 2001.
'Digital communication over fading channels'., M.K.Simon & M.-S. Alouini, second edition, Wiley-Blackwell, 2005.
'Wireless communication', Andrea Goldsmith, second edtion, Cambridge press, 2010.
"Probability, random variables, stochastic processes, Papoulis & Pillai, Tata McGrawHill, 2002.

Lecture No.	Topic	Learning Objective	Reference(s)
1-2.	Introduction	Introduction to digital communication systems.	Class notes/PPT
3 -7	Probability & Random processes	Probability and random variables. Description of random processes; random processes and linear systems. Power spectrum of stochastic processes; Gaussian and white processes and bandpass processes.	--do--
8-9	Signal space representation of digitally modulated signals	The concepts of representing digitally modulated signals and represent their energy in terms of Euclidean distance.	--do--
10-15	Optimum receivers	Design of optimum receivers for channels perturbed by AWGN channels. Correlation type demodulator and matched filter type demodulator.	--do--
16-17	Bit error probability	Computation of bit-error probability for QPSK, M-ary PSK, QAM signals etc.	--do--
18-19	Symbol synchronization	Signal parameter estimation and carrier phase estimation etc.	--do--
20-21	Combined modulation and coding	Trellis coded modulation	- do--
22-24	Digital transmission through band	Design for band limited signals with no	--do--

	limited channels	inter-symbol interference as well as with controlled ISI. Design for channels with distortion.	
25-26	Digital transmission through band limited channels	Probability of error in detection of digital PAM. The maximum likelihood sequence estimator.	Class notes
27-28	Continuous phase modulation	Basics of CPM, MSK,GMSK	--do--
29-30	Orthogonal Frequency Division Multiplexing (OFDM)	Multichannel communication in the presence of AWGN. An FFT based multi-carrier system.	--do--
31-31	Spread Spectrum communication	Pseudo-random noise (PN) sequence and its properties. PN sequence generation	--do--
32-33	Spread Spectrum communication	Advantages of spread spectrum. Direct sequence and Frequency hopping.	--do--
34-35	Spread Spectrum communication	Multiple access using spread spectrum i.e., CDMA and synchronization of spread spectrum systems	--do--
36-38	Digital modulation for fading channels	Robust modulation for fading channels. Rake demodulator. Performance of PSK, FSK, QPSK & MSK systems in the presence of different fading conditions.	--do--
39-42	Miscellaneous topics (introduction only)	Software defined radio (SDR), Cognitive radio (CR), Cooperative communication, Massive MIMO etc.	IEEE Papers

Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Venue	Remarks
Assignments	-	10		-
Mid-sem test	90 min	30	14/3 4:00- 5:30 PM	Closed book (CB)
Quiz 1 & 2	40 min. (each)	10	To be announced in the class.	CB
Seminar	20 min per student	10	To be announced in the class.	CB
Compre	180 min.	40	4/5 AN	CB/OB

Chamber Consultation Hour: To be announced in the class.

Course Notice: To be posted online.

Instructor-in-charge
EEE G 622