BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI,
HYDERABAD CAMPUS

SECOND SEMESTER 2019-2020

Course Handout (Part-I)

Date: 01/01/2020

Course No. **: EEE G622**

Course Title **: Advanced Digital Communication.**

Instructor-in-charge : Dr. Prashant K. Wali

Course Description:

Introduction to Digital communication, review of probability and statistic processes; review of source coding and characterization of signals; optimum receivers for additive white gaussian noise channel; carrier & symbol synchronization; channel capacity & coding; block & convolutional codes; communication through band – limited linear filter channels; adaptive equalization multicarrier systems; digital communication through fading multipath channel; future trends in digital communication.

The course introduces topics and concepts in the areas of advance digital communications systems, This course deals with the design of digital communication systems, the representation of digitally modulated signals and characterization of narrowband signals and systems. The design of modulation and optimum demodulation and detection for channels perturbed by AWGN will be discussed. 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. Equalization for channels perturbed by ISI & AWGN will be treated. Spread spectrum concepts and modulation will be discussed and orthogonal frequency division multiplexing (OFDM) will be treated. Modulation and demodulation for mobile radio channels will be discussed. Introduction to emerging trends will be discussed. The pre-requisite of EEE C383 Communication Systems of BITS or equivalent is presumed for this graduate level course.

Scope and Objective:

Most modern telecommunications systems are digital. The purpose of this course is to describe the operating principles and performance of advanced digital communications systems. It is beneficial to provide the students with a wide variety of opportunities, both in the industry as well as in the R & D field. With the knowledge of this course students can work in various domain.

2. Text Book(s): "Digital Communications", by John G. Proakis ,4th edition, McGraw Hill, 2001.
Reference Book(s): 1."Communication System", by Simon Haykins,4th edition, John Wiley, 2001.
2. Communication Systems Engr" Proakis and Salehi, McGraw Hill.

Lecture No.	Topic	Learning Objective	Ref. To TB/RB
1.	Introduction	Introduction to digital communicationsystems.	Ch 1----- T1
2 -4.	Random processes	Probability and random variables.Description of random processes;random processes and linear systems.Power spectrum of stochasticprocesses; Gaussian and whiteprocesses and bandpass processes.	Ch 2------T1

5 -7.	Signal space representation of digitally modulated signals	The concepts of representing digitally modulated signals and represent theirenergy in terms of Euclidean distance.	Ch 4------T1
8-9	Optimum receivers	Design of optimum receivers forchannels perturbed by AWGN channels.Correlation type demodulator andmatched filter type demodulator.	Ch 5------ T1
10-11	Optimum receivers	Demodulation and detection of carrier-phase modulated signals.	Ch-5-----T1
12-13	Optimum receivers	Demodulation and detection of Quadrature amplitude modulatedsignals.	Ch-5-----T1
14-16	Bit error probability	Computation of bit-error probability forQPSK, M-ary PSK, QAM signals etc.	Ch-5-----T1
17-19	Symbol synchronization	Signal parameter estimation and carrierphase estimation and symbol timingestimation and ML estimators.	Ch-6-----T1
20-21	Combined modulation and coding	Trellis coded modulation	Ch-8-----T1
22-24	Digital transmission through band limited channels	Design for band limited signals with no inter-symbol interference as well aswith controlled ISI. Design for channelswith distortion.	Ch-9-----T1
25-26	Digital transmission through band limited channels	Probability of error in detection of digital PAM. The maximum likelihoodsequence estimator.	Ch-9-----T1
27-29	Equalizer design	Design of transmitting and receivingfilters for a known channel and channelequalization. Linear and non-linearequalizers life decision feedbackequalizer, predictive DFE andfractionally spaced equalizers	Ch-10---T1
30-31	Orthogonal Frequency Division Multiplexing (OFDM)	Multichannel communication in the presence of AWGN. An FFT basedmulti-carrier system.	Ch-12----T1 .
32	Spread Spectrum	Pseudo-random binary sequence and itsproperties. PN sequence generation	Ch-13----T1
33	Spread Spectrum	Advantages of spread spectrum. Directsequence and Frequency hopping.	Ch-13-----T1
34	Spread Spectrum	Mutiple access using spread spectrumi.e., CDMA and synchronization ofspread	Ch-13-----T1

		spectrum systems	
35-38	Digital modulation for fading channels	Robust modulation for fading channels. Rake demodulator. Performance of PSK, FSK, QPSK & MSK systems in the presence of different fadingconditions.	Ch-14-----T1
39-42	Current Research Scenario	Cognitive Radio, Software-definedRadio, Spectrum Sensing, 4G-LTE, etc.	Supp. Notes/Papers

3. Evaluation Scheme

Component	Duration	Weightage	Marks	Date & Time	Evaluation type
Mid sem	90 min	16.66%	50	4/3 , 1:30- 03:00 PM	Closed Book
Surprise Quizzes		13.33%	40	-	Closed Book
Lab		20%	60	-	Open Book
Term Project		20%	60	-	Open Book
Compre. Exam.	3 hours	30%	90	08/05 FN	Closed Book
Total			**300**		

5. Chamber Consultation Hour: To be announced in the class

email: wali@hyderabad.bits-pilani.ac.in

6. Notices: EEE Notice Board and CMS.

7. Make-up Examination:

No make-up will be given for Surprise Quizzes.However for Tests and Comprehensive Examination make-up examination will be given only in **extremely genuine cases** for which prior permission of the instructor-in-charge is required.

8. Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor-in-charge

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