

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI- HYDERABAD CAMPUS
FIRST SEMESTER 2021-2022
COURSE HANDOUT PART II

Date: 20/08/2021

Course No. : ECE/EEE F311
Course Title : Communication Systems
Instructor-in-charge : Balasubramanian M
Instructors : Balasubramanian M, Gopal Krishna Kamath M, Sandeep Kumar, Runa Kumari and Prashant Wali.

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 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 a communication system. Topics like Analog to Digital conversion, Pulse coding, Modulation (Analog and Digital), source coding, channel coding, Multiple access, multiplexing techniques, will be covered with appropriate detail and mathematical description. Important topics 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 analog 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. Advance/application areas like wireless, optical and satellite communication will be covered towards the end. Students are expected to have a sound understanding of Signals and systems and be comfortable with topics in Mathematics.

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, 5th 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	Chapter in the Text 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 communication concepts.	T1& T2:Chapter 1	2
2	Deterministic and random signals and	Signals, nature of signals, Review of energy and power signals, correlation functions, power and	T1: Chapters 2 & 3 T2:Chapter	2

	their properties	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.	2	
3	Random variables, processes and Noise	Recap of Probability, Random variables & processes, statistical averages, Power spectral density, Gaussian process, Noise, Nature of noise, Sources of Noise, white noise, KTB, Noise Figure and Noise temperature, calculations, Signal-to-Noise ratio.	T1:Chapter 8,9 T2:Chapter 5 R3:Chapter 5	10
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	7
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	7
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	8
7	Introduction to Digital Communication Systems	Advantages of digital transmission, Block diagram of a digital communication system, Overview of all blocks, Measure of goodness of a digital communication system, Various definitions for bandwidth, Basics of Digital Modulation Techniques such as line coding, ASK, FSK and BPSK.	T1:Chapter 7 T2:Chapter 8	2
8	Introduction to Information Theory and Coding	Overview and necessity of information theory, Definition of self-information, Overview and an example of source coding, Overview and an example of channel coding, Statement of Shannon's Channel Capacity Theorem and its significance.	T1: Chapters 13, 14 T2: Chapter 10 R2: Chapters 4,9	2
9	Emerging Trends in Communication Systems: Optical and Mobile communications.	A brief overview of different communication technologies	Supplementary notes	2
		Total Number of Lectures		42

Laboratory component: Laboratory exercises will involve simulations using MATLAB.

6. Evaluation Scheme

Component	Duration	Weightage	Marks	Date & Time	Nature of Component
Mid-Sem Exam	90 min	30 %	90	18/10/2021 3.30 - 5.00PM	Closed Book
Quizzes	30 min (each)	10%	30	TBA	Closed Book [Best 2 out of 3 for evaluation]
Take-home Assignments		15%	45	TBA	Open Book
Weekly Lab Record Submission + Attendance		10%	30	Weekly	Open Book [Best 'n-1' out of 'n' for evaluation]
Comprehensive Exam	2 Hrs	35%	105	13/12 FN	Closed Book
Total		100%	300		

7. **Office Hours:** Will be announced in the class by the respective faculty.

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

9. **Make-up Examination:** Make-up will be given on genuine grounds only. Prior application should be made for seeking the make- up examination. No make-up will be given for quizzes and the laboratory component.

10. **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.

Balasubramanian M
Instructor-in-Charge