Advanced Communication System

(Core Subject-M.Tech, Elective Subject-B.Tech)

Course Code:	10M11EC111	**Semester:**	1 st Sem/7th sem , M.Tech/B.Tech (ECE)
Credits:	3	**Contact Hours:**	L-3, T-0, P-0

Course Objectives

The main objective of the course is to

1. Provide student with theoretical background and applied knowledge so that they can design an optimum Single and multi-carrier communication system under given power, spectral and error performance constraints.
2. Analyze the error performance of digital modulation techniques.
3. Explore M ary signaling

Course Outcomes

After studying this course the students would gain enough knowledge

1. Analyze the design parameters of a single and multi-carrier communication system.
2. Use mathematical tools to analyze the performance of communication systems.
3. Use probability theory and stochastic processes in communication system applications
4. Learn synchronization and adaptive equalization techniques.

Course Contents

Unit	**Topics**	**References (chapter number, page no. etc)**	**Lectures**
1.	Introduction to analog and digital communication systems, communication channels and their characteristics, mathematical models for communication channels, deterministic and random signal analysis, baseband, band-pass and equivalent low-pass signal representations, orthogonal expansion of signals.	Proakis: Chapter 4	4
2.	Digital modulation Schemes: Gram Schmidt orthogonilazation procedure, Representations of digitally modulated signals, memory less modulation methods, PAM,PM,QAM, multidimensional signaling, Signaling scheme with memory, CPFSK,CPM, Power spectrum of Digitally modulated signals, PSD of a digitally modulated signals with memory, PSD of linearly modulated signals.	Proakis: Chapter 5	6
3	Optimum Receivers for AWGN Channels: Correlation demodulator, Matched filter	Proakis: Chapter 5	6

	demodulator, optimum detector, maximum likelihood sequence detector, A symbol by symbol MAP detector for signals, Probability of error calculations for binary modulation, M-ary PAM, M-ary PSK, QAM, orthogonal signals, biorthogonal signals. Optimum demodulation of CPM signals,		
4	Carrier and Symbol Synchronization: Likelihood function, carrier recovery and symbol synchronization in signal demodulation, ML carrier phase estimation, PLL, decision directed loops and non-decision directed loops, ML timing estimation, non-decision directed timing estimation, joint estimation of carrier phase and symbol timing.	Proakis: Chapter 6	6
5	Signal Design for Band Limited Channels: Characterization of band limited channels, design of band limited signals for no ISI, Design of band limited signals with controlled ISI, data detection for controlled ISI, signal design for channels with distortion, probability of error for detection of PAM with zero ISI and with partial response signals, .	Proakis: Chapter 10	6
6	Communication through Band Limited Linear Filter Channels: ML receiver for channels with ISI and AWGN, discrete time model for channel with ISI, Viterbi algorithm for discrete time white noise filter model, linear equalization – peak distortion criterion, MSE criterion and its performance, fractionally spaced equalizers, decision feedback equalization – coefficient optimization, performance characteristics.	Proakis: Chapter 11	6
7	Linear Predictive Coding (LPC): Basics of LPC, speech model-source filter model & signal processing consideration, LPC in voice conversion, vocoders, LPC analysis & synthesis filter, CELP (Code-Excited Linear Prediction), CSACELP(Conjugate-Structured Algebraic CELP).	B. P. Lathi: Chapter 3	5
8	Multicarrier Modulation Techniques: Multipath & fading in wireless communication systems, Doppler spread, delay spread, OFDM Vs (TDM, FDM, CDMA), building blocks of OFDM	Proakis: Chapter 12, 13	5

	transmitter & receiver, OFDM applications, direct sequence spread spectrum signals (DS-SS), frequency hopped spread spectrum signals (FH-SS), introduction to multicarrier (MC) DS-CDMA and time hopping TH/MC-CDMA.		
		Total Number of Lectures	44

Evaluation Scheme

1. Test 1 :15 marks
2. Test 2 : 25 marks
3. Test 3 : 35 marks
4. **Internal Assessment** : 25 marks
    - 10 Marks : Class performance, Tutorials & Assignments
    - 10 Marks : Quizzes
    - 5 marks : Attendance

Text Books

1. Proakis, John G., Digital Communications, McGraw-Hill (2000).
2. Bernard SKLAR: “Digital communications”, Pearson

Reference Books

1. Simon Haykin: “Digital communications”, Wiley Publications
2. B.P Lathi: “Modern Analog & Digital Communication Systems”, Oxford Publication

Web resources

1. http://www.nptel.ac.in/courses/117101051/