GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRONICS & COMMUNICATION (COMMUNICATION SYSTEMS ENGG)
(05)
ADVANCED DIGITAL COMMUNICATION
SUBJECT CODE: 2730502
M.E. SEM-III

Type of course: Major Elective-IV

Prerequisite: Digital communication, Probability and Random Processes

Rationale: To learn various digital modulations, performance of the system in the presence of noise, equalization and synchronization techniques of the digital communication systems.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks		Practical Marks				
L	T	P	C	ESE (E)	PA (M)	ESE (V)		PA (I)		
						ESE	OEP	PA	RP	
4	0	2#	5	70	30	20	10	10	10	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Introduction** Elements of Digital Communication System: Communication channels and their characteristics, mathematical models for channels, representation of Band pass signals and Systems,Gram-Schmidt orthogonalization procedure, representation of digitally modulated signals , performance of memoryless modulation methods , signalling schemes with memory - CPFSK - CPM.	8	19
2	**Optimum Receiver for Additive White Gaussian Noise Channel** Coherent and noncoherent demodulation: Matched filter,Correlator demodulator, square-law, and envelope detection; Detector: Optimum rule for ML and MAP detection Performance: Bit-error-rate, symbol error rate for coherent and noncoherent schemes.	8	19
3	**Carrier and Symbol Synchronization** Signal Parameter Estimation: Carrier phase estimation, symbol timing estimation, joint estimation of carrier phase and symbol timing, performance characteristics of ML estimators.	8	19
4	**Band-Limited Channels** Pulse shape design for channels with ISI: Nyquist pulse, Partial response signaling (duobinary and modified duobinary pulses), demodulation; Channel with distortion: Equalization: MLSE, linear equalization, decision feedback equalization, ML detectors, adaptive linear equalizer - adaptive decision feedback equalization	12	29
5	Concept of parallel transmission, Multichannel and multicarrier CDMA Systems, fading, multi-path channel, OFDM, Future Trends	6	14

Reference Books:

1. John G.Proakis, Digital Communication , McGraw Hill
2. Stephen G. Wilson, Digital Modulation and Coding", Pearson Education (Asia) Pte. Ltd, 2003.
3. Andrew J. Viterbi, "CDMA: Principles of spread spectrum communications ",Prentice Hall, USA, 1995.
4. J. G. Proakis and M. Salehi, Fundamentals of Communication Systems, Pearson Education, 2005.
5. S. Haykins, Communication Systems, 5th ed., John wiley, 2008.
6. M. K. Simon, S. M. Hinedi and W. C. Lindsey, Digital Communication Techniques: Signaling and detection, Prentice Hall India, N. Delhi, 1995.
7. W. Tomasi, Advanced Electronic Communication Systems, 4th Ed., Pearson Education, 1998.

Course Outcome:

Advanced concepts of digital communication techniques will be understood by the students. Understand the design, application and practical implementation of various Digital Modulation techniques.

List of Experiments:

Based on the syllabus.

Value Added Experiments

- Parametric evaluation of Communication Signals.
- Spectrum Analysis of a signal using Fast Fourier Transform.
- Familiarization with Spectrum Analyser.
- To measure parameters of an unknown signal using Spectrum Analyser.

Open Ended Problems

1. Determine the ML phase estimate for offset QPSK.
2. Derive the equations for the Gram-Scmidt procedure for a set of complex valued M signal waveforms.
3. Determine the bit rate that can be transmitted through a 4-kHz voice-band telephone channel if the following modulation methods are used. 1. Binary PAM 2. Four Phase PSK 3. 8-point QAM. Assume that the transmitter pulse shape has a raised cosine spectrum with a 50 percent roll-off.
4. Assess the cost of the cyclic prefix (used in multicarrier modulation to avoid ISI) in terms of extra channel bandwidth and extra signal energy.

Journals:

IEEE Transactions on Communication
IEEE Transactions Information Theory
Digital Communication and Networks- Elsevier

List of Software:
Matlab

List of Open Source Software: Scilab

Learning website:
www.nptel.ac.in

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.