Digital Communication(304181)

Teaching Scheme:
Lectures: 4 Hrs/ Week

Examination Scheme:
In Semester Assessment:
Phase I : 30
End Semester Examination:
Phase II: 70

Course Objectives:

- To understand the building blocks of digital communication system.
- To prepare mathematical background for communication signal analysis.
- To understand and analyze the signal flow in a digital communication system.
- To analyze error performance of a digital communication system in presence of noise and other interferences.
- To understand concept of spread spectrum communication system.

Course Outcomes:

After successfully completing the course students will be able to

- Analyze the performance of a baseband and pass band digital communication system in terms of error rate and spectral efficiency.
- Perform the time and frequency domain analysis of the signals in a digital communication system.
- Select the blocks in a design of digital communication system.
- Analyze Performance of spread spectrum communication system.

Unit I : Digital Transmission of Analog Signal 8L

Introduction to Digital Communication System: Why Digital?, Block Diagram and transformations, Basic Digital Communication Nomenclature. Digital Versus Analog Performance Criteria, Sampling Process, PCM Generation and Reconstruction, Quantization Noise,Non-uniform Quantization and Companding, PCM with noise: Decoding noise, Error threshold, Delta Modulation, Adaptive Delta Modulation, Delta Sigma Modulation, Differential Pulse Code Modulation, LPC speech synthesis.

Unit II : Baseband Digital Transmission 7L

Digital Multiplexing: Multiplexers and hierarchies, Data Multiplexers.Data formats and their spectra, synchronization: BitSynchronization, Scramblers, Frame Synchronization.Inter-symbol interference, Equalization.

Unit III : Random Processes 8L

Introduction, Mathematical definition of a random process, Stationary processes, Mean, Correlation &Covariance function, Ergodic processes, Transmission of a random process through a LTI filter, Power spectral density, Gaussian process, noise, Narrow band noise, Representation of narrowband noise in terms of in phase & quadrature components

Unit IV : Baseband Receivers 8L

Detection Theory: MAP, LRT, Minimum Error Test, Error Probability, Signal space representation : Geometric representation of signal, Conversion of continuous AWGN channel to vector channel, Likelihood functions, Coherent Detection of binary signals in presence of noise, Optimum Filter, Matched Filter, Probability of Error of Matched Filter, Correlation receiver.

Unit V : Passband Digital Transmission 8L

Pass band transmission model, Signal space diagram, Generation and detection, Error Probabilityderivationand Power spectra of coherent BPSK, BFSK and QPSK.Geometric representation, Generation and detection of - M-ary PSK, M-ary QAM and their error probability, Generation and detection of -Minimum Shift Keying, Gaussian MSK, Non-coherent BFSK, DPSK and DEPSK, Introduction to OFDM

Unit VI : Spread Spectrum Techniques 7L

Introduction, Pseudo noise sequences, A notion of spread spectrum, Direct sequence spread spectrum with coherent BPSK, Signal space dimensionality & processing gain, Probability of error, Concept of jamming, Frequency hop spread spectrum, Wireless Telephone Systems, Personal Communication System.

Text Books

1. Simon Haykin, “Digital Communication Systems”, John Wiley&Sons, Fourth Edition.
2. A.B Carlson, P B Crully, J C Rutledge, “Communication Systems”, Fourth Edition, McGraw Hill Publication.

Reference Books

1. Ha Nguyen, Ed Shwedyk, “A First Course in Digital Communication”, Cambridge University Press.
2. B P Lathi, Zhi Ding “Modern Analog and Digital Communication System”, Oxford University Press, Fourth Edition.
3. Bernard Sklar,Prabitra Kumar Ray, “Digital Communications Fundamentals and Applications” Second Edition,Pearson Education
4. Taub, Schilling, “Principles of Communication System”, Fourth Edition, McGraw Hill.
5. P Ramkrishna Rao, Digital Communication, McGrawHil Publication