PRINCIPLES OF DIGITAL COMMUNICATION

PROF. ABHISHEK DIXIT
Department of Electronics and Communications Engineering
IIT Delhi

PRE-REQUISITES : Basic idea of Signals and Systems, and probability theory

INTENDED AUDIENCE : Electronics and Communications Engineering students and professionals

INDUSTRIES APPLICABLE TO : Telecommunication Industry, e.g., Qualcomm,Ericson, Huawei

COURSE OUTLINE :

Digital communication is a fundamental course in the electronics and communication stream.The objectives of this course is to introduce the basic principles that underlie the analysis and successful design of a digital communication system. Digital communication systems have been used in all modern communication systems. Emphasis is placed on understanding system design goals and to optimize the tradeoff among basic system parameters such as signal-to-noise ratio, bandwidth, etc.

ABOUT INSTRUCTOR :

Prof. Abhishek Dixit, M.Tech. (IITD: 2010) and Ph.D. (Ghent University, Belgium: 2014) Professor Abhishek Dixit is working with the Department of Electrical Engineering, IndianInstitute of Technology Delhi, New Delhi (India) since December 2015. His research interests pertain to the domains of digital communications, error control codes, optical communications, optical networks, optical wireless communication links and networks, and fiber-wireless converged networks.

COURSE PLAN :

Week 1 : Introduction to digital communications: Interfaces and channels for digital communications

Week 2 : Geometric representation of signals: Geometric representation of signals, Gram-Schmidt orthogonalization, Geometric interpretation of signals

Week 3 : Review of random variables: Introduction to random variables, joint probability density function, characteristic functions, derived distributions

Week 4 : Review of random process: Introduction to random processes, Gaussian process, Linear functional of random process, Stationary and wide sense stationary random process, Power spectral density, White Gaussian noise

Week 6 : Waveform coding: Pulse code modulation, Differential pulse codemodulation, and delta modulation

Week 7 : Modulation - I: Complex baseband representation, degrees of freedoms, linear modulation, spectral description of linearly modulated signals

Week 8 : Modulation – II: Nyquist criterion, raised cosine family of pulses, Intersymbol interference

Week 9 : Modulation - III: Coherent binary modulation formats, e.g., ASK, FSK and PSK, Coherent QAM, M-ary modulation techniques, Orthogonal and biorthogonal modulation

Week 10 : Hypothesis testing: Optimum decision region in AWGN, Maximum Aposteriori Probability (MAP) and Maximum Likelihood Receiver, Theorem of irrelevance

Week 11 : Performance analysis of binary and M-ary signaling schemes: Performance analysis of binary signaling schemes, performance analysis of M-ary signaling schemes, bit-level demodulation, Non-coherent communication: Composite hypothesis testing, optimal demodulation for non-coherent communication

Week 12 : Performance analysis of non-coherent communication: Performance of binary and M-ary non-coherent communication