PRINCIPLES OF COMMUNICATION SYSTEMS - II

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PRE-REQUISITES : Basic knowledge of - Probability, Calculus

INTENDED AUDIENCE : Students, practicing engineers, technical and non-technical managers of telecomm companies, students preparing for competitive exams with communication engineering subject.

INDUSTRY SUPPORT : Most companies in wireless communications area should find this useful. Examples are Qualcomm, Broadcom, Intel etc.

COURSE OUTLINE :

This course is a sequel to Principles of Communication-Part I and covers fundamental concepts of communication systems, especially focusing on various aspects of modern digital communication systems. However, all the modules in this course will be independent of the previous course and hence students who could not participate in Principles of Communication-Part I will also be able to follow the course. Beginning with the basic theory of digital communication systems pertaining to pulse shaping, modulation and optimal detection, the course will also cover several important digital modulation techniques such as Binary Phase Shift Keying (BPSK), Frequency Shift Keying (FSK), Quadrature Amplitude Modulation (QAM), M-ary Phase Shift Keying (M-PSK) etc. Other fundamental concepts such as Information Theory, Channel Capacity, Entropy Coding and Error Control Coding will be dealt with in the later parts of the course.

ABOUT INSTRUCTOR :

Prof. Aditya K. Jagannatham received his Bachelors degree from the Indian Institute of Technology, Bombay and M.S. and Ph.D. degrees from the University of California, San Diego, U.S.A. From April '07 to May'09 he was employed as a senior wireless systems engineer at Qualcomm Inc., San Diego, California, where he was a part of the Qualcomm CDMA technologies (QCT) division. His research interests are in the area of next-generation wireless cellular and WiFi networks, with special emphasis on various 5G technologies such as massive MIMO, mmWave MIMO, FBMC, NOMA, Full Duplex and others. He has contributed to the 802.11n high throughput wireless LAN standard and has published extensively in leading international journals and conferences. He was awarded the CAL(IT)2 fellowship at the University of California San Diego and the Upendra Patel Achievement Award at Qualcomm.

COURSE PLAN :

Week 1: Basic tools of Digital communication, Transmission Pulse Shaping, Power Spectral Density, Additive White Gaussian Noise (AWGN) Channel

Week 2:Optimal Receiver Design, Signal-to-Noise Power Ratio (SNR), Matched Filtering (MF)

Week 3: Maximum Likelihood (ML) Receiver, Probability of Error, Binary Phase Shift Keying and associated Prob. of Error,Amplitude Shift Keying (ASK) and Other Schemes

Week 4: Signal Space Theory, Frequency Shift Keying (FSK), Quadrature Amplitude Modulation (QAM), M-ary Phase Shift Keying (MPSK) and associated Prob. of Error

Week 5: Introduction to Wireless Communication, Performance of Digital Modulation in Fading Channels, Introduction to Information Theory, Channel Capacity

Week 6: Source Coding, Entropy Codes, Huffman Coding, Linear Block Codes

Week 7: Hamming Weight and Distance Properties, Syndrome Decoding, Convolutional Codes, Trellis Structure and Decoding of Convolutional Codes

Week 8: Pulse Shaping Filter Design, Nyquist Pulse Shaping Criterion, Raised-Cosine Filter, Passband-Baseband Equivalence