



Principles of Communication Systems - I

ABOUT THE COURSE:

This course covers fundamental concepts of communication systems, which are essential for the understanding of advanced courses in digital/ wireless communication systems. Beginning with various basic tools such as Fourier Series/ Transform, the course will also cover several important modulation techniques such as Amplitude Modulation, Frequency Modulation, Phase Modulation etc. Sampling process and Quantization, including Nyquist criterion and reconstruction of the original signal from the sampled signal will be dealt with in the later parts of the course. Further, the course will also cover concepts in probability and random variables/ processes and is designed to serve as a basic course towards introducing the students to various aspects of probability from the perspective of modern digital and wireless communications. Thus, it will focus on basic concepts in probability, random variables and random processes, while also illustrating digital/ wireless communication specific examples to better bridge the gap between theory and application.

This course is suitable for all UG/PG students and practicing engineers/ managers who are looking to enhance their knowledge of the fundamental principles underlying various communication systems as well as students preparing for their college/ university/ competitive exams.

COURSE LAYOUT:

Week 1 : Basic tools for communication, Fourier Series/Transform, Properties, Autocorrelation, Energy Spectral Density, Parseval's Relation

Week 2 : Amplitude Modulation (AM), Spectrum of AM, Envelope Detection, Power Efficiency, Modulation Index

Week 3 : Double Sideband Suppressed Carrier (DSB-SC) Modulation, Quadrature Carrier Multiplexing (QCM), Demodulation, Costas Receiver

Week 4 : Single Sideband Modulation (SSB), Hilbert Transform, Complex Pre-envelope/ Envelope, Demodulation of SSB, Vestigial Sideband Modulation (VSB)

Week 5 : Angle Modulation, Frequency Modulation (FM), Phase Modulation (PM), Modulation Index, Instantaneous Frequency

Week 6 : Spectrum of FM Signals, Carson's Rule for FM Bandwidth, Narrowband FM Generation, Wideband FM Generation via Indirect Method, FM Demodulation

Week 7 : Introduction to Sampling, Spectrum of Sampled Signal, Aliasing, Nyquist Criterion, Signal Reconstruction from Sampled Signal, Pulse Amplitude Modulation

Week 8 : Quantization, Uniform Quantizers - Midrise and Midtread, Quantization noise, Lloyd Max Quantization Algorithm, Non uniform Quantizers, Delta Modulation, Differential Pulse Code Modulation (DPCM)

Week 9 : Basics of Probability, Conditional Probability, MAP Principle

Week 10: Random Variables, Probability Density Functions, Applications in Wireless Channels

Week 11: Basics of Random Processes, Wireless Fading Channel Modeling

Week 12: Gaussian Random Process, Noise, Bit-Error and Impact on Wireless Systems