FUNDAMENTAL COMMUNICATION SYSTEM

Course Objectives

- To introduce the basic concepts and elements of communication systems.
- To understand analog modulation and demodulation techniques.
- To study angle modulation methods such as FM and PM.
- To learn sampling, pulse modulation, and signal reconstruction techniques.
- To analyze digital communication and shift-keying modulation techniques.

Module-I (6 hours)

Introduction to basic elements of communication systems. Signal transmission through linear systems: condition for distortion less transmission of signals through networks. Different types of distortion and their effect on the quality of output signals, transmission of transient signals, distortion analysis.

Module-II (6 hours)

Amplitude modulation: Modulation principle and definitions, sideband and carrier power, generation of AM signal, demodulation of AM signal. Different type of modulator circuits, square law modulator, balanced modulator. Demodulator basic principle of coherent detections, square law detectors, average envelope and peak envelope detectors.

Module-III (6 hours)

Frequency and phase modulation: Principles and definitions, relationship between frequency and phase modulations. phase and frequency deviations, spectrum of FM signal, bandwidth considerations. Effect of modulation index on bandwidth, narrow band and sideband FM and PM principles, circuit for realization of FM and PM. Demodulation: Principle of demodulation: different type of demodulator, discriminator, use of PLL etc.

Module-IV (6 hours)

Sampling Theorem and Signal Reconstruction: Sampling process, practical difficulties, aliasing and antialiasing filter. Applications of Sampling Theorem: PAM, PWM, and PPM signals.

Module-V (6 hours)

Digital and Shift-Keying Modulation Techniques: Quantization, quantization error, non-uniform quantization, companding, encoder design, transmission bandwidth and output SNR. Differential PCM, Delta modulation (DM), adaptive delta modulation (ADM), Principles of Digital Data Transmission: Components of a digital communication system. Line coding techniques: polar, unipolar, bipolar, and ON-OFF signaling. Modulation and demodulation of ASK, BFSK and BPSK.

Course Outcomes

After successful completion of the course, students will be able to:

CO1: Explain the fundamental concepts of communication systems and analyze signal transmission through linear networks.

CO2: Analyze and design amplitude modulation and demodulation circuits for communication systems.

CO3: Evaluate frequency and phase modulation techniques, their spectra, bandwidth requirements, and demodulation methods.

CO4: Apply sampling theorem and pulse modulation techniques (PAM, PWM, PPM) in signal processing applications.

CO5: Analyze digital communication systems, quantization techniques, line coding schemes, and ASK, FSK, and PSK modulation methods.

Text Books

1. Simon Haykin, Communication Systems, 5th Edition, Wiley India.
2. B. P. Lathi and Zhi Ding, Modern Digital and Analog Communication Systems, Oxford University Press.
3. H. Taub and D. L. Schilling, Principles of Communication Systems, McGraw Hill.

Reference Books

1. George Kennedy and Bernard Davis, Electronic Communication Systems, McGraw Hill.
2. John G. Proakis and Masoud Salehi, Fundamentals of Communication Systems, Pearson Education.
3. Dennis Roddy and John Coolen, Electronic Communications, Pearson Education.