PRINCIPLES OF COMMUNICATIONS

UNIT-1

LECTURE-1

Principles of Communication

- The communication process:

  Sources of information, communication channels, modulation process, and communication networks

- Representation of signals and systems:

  Signals, Continuous Fourier transform, Sampling theorem, sequences, z-transform, convolution and correlation.

- Stochastic processes:

  Probability theory, random processes, power spectral density, Gaussian process.

- Modulation and encoding:

Basic modulation techniques and binary data transmission:AM, FM, Pulse Modulation, PCM, DPCM, Delta Modulation

- Information theory:

  Information, entropy, source coding theorem, mutual information, channel coding theorem, channel capacity, rate-distortion theory.

- Error control coding:

  linear bloc codes, cyclic codes, convolution codes

Overview of the Course

Target Audience: Computer Science Undergraduates who have not taken any course on Communication

- Communication between a source and a destination requires a channel.
- A signal (voice/video/facsimile) is transmitted on a channel: Basics of Signals and Systems
  - This requires a basic understanding of signals
    - Representation of signals
  - Each signal transmitted is characterised by power.
  - The power required by a signal is best understood by frequency characteristics or bandwidth of the signal:
    - Representation of the signal in the frequency domain - Continuous Fourier transform

- A signal trasmitted can be either analog or digital
  - ∗ A signal is converted to a digital signal by first discretising the signal - Sampling theorem - Discrete-time Fourier transform
  - ∗ Frequency domain interpretation of the signal is easier in terms of the Z-transform
  - ∗ Signals are modified by Communication media, the communication media are characterised as Systems
  - ∗ The output to input relationship is characterised by a Transfer Function

• Signal in communcation are characterised by Random variables
  - Basics of Probability
  - Random Variables and Random Processes
  - Expectation, Autocorrelation, Autocovariance, Power Spectral Density

- Analog Modulation Schemes
  - AM, DSB-SC, SSB-SC, VSB-SC, SSB+C, VSB+C
  - Frequency Division Muliplexing
  - Power required in each of the above
- Digital Modulation Schemes
  - PAM, PPM, PDM (just mention last two)
  - Quantisation
  - PCM, DPCM, DM
  - Encoding of bits: NRZ, NRZI, Manchester
  - Power required for each of the encoding schemes
- Information Theory
  - Uncertainty, Entropy, Information
  - Mutual information, Differential entropy
  - Shannon's source and channel coding theorems

- Shannon's information capacity theorem - Analysis of Gaussian channels

• Coding

- Repetition code
- Hamming codes
- Error detection codes: CRC