



**Communication Systems**  
**BEG332EC**

**Year: II**

**Semester: IV**

Teaching Schedule Hours/Week			Examination Scheme				
Theory	Tutorial	Practical	Internal Assessment		Final		Total
			Theory	Practical	Theory	Practical	
3	1	3/2	20	25	80	-	125

**Course Objective:** To familiarize the students of Computer Engineering with basic principles of analog and digital communication.

**Course Contents:**

**1. Signals and Systems**

**6 Hrs**

- 1.1 Definition, Types, Representation and Properties of signals used in Communication system
- 1.2 Review of Fourier series and Fourier transforms
- 1.3 Energy and power signal; Parseval's theorem
- 1.4 Types and Properties of systems
- 1.5 Block Diagram of General Communication System and concept of bandwidth
- 1.6 Noise and its effect on communication systems

**2. Continuous Wave Linear Modulation**

**7 Hrs**

- 2.1 Need for modulation
- 2.2 Time domain expression, spectral representation, power, and transmission bandwidth of DSB-AM, DSB-SC, SSB, VSB
- 2.3 Generation methods of DSB-AM, DSB-SC, SSB
- 2.4 Demodulation of AM Signals: Square law, envelope detection, synchronous detectors
- 2.5 Introduction to Phase Locked Loop (PLL), PLL as a Universal detector of AM Signals
- 2.6 Super heterodyne receiver for standard AM radio
- 2.7 Threshold effects in AM

**3. Non-Linear Modulation**

**7 Hrs**

- 3.1 Definition, time domain representation and transmission bandwidth of single tone modulated FM and PM
- 3.2 Transmission bandwidth for FM, Carlson's rule
- 3.3 Narrow band and wide band FM
- 3.4 Generation methods of FM: Direct Method and Armstrong Method
- 3.5 Demodulation of FM: Limiter discriminator method and PLL
- 3.6 Introduction to Stereo FM transmission and reception
- 3.7 Threshold effects in FM

**4. Introduction to Digital Communication System**

**8 Hrs**

- 4.1 Block Diagram of Digital Communication System, Advantages and Disadvantages of Analog Communication System
- 4.2 Nyquist sampling theorem, sampling of band limited analog signals, spectrum of sampled signals, Aliasing effects, reconstruction of original analog signal
- 4.3 Pulse Amplitude Modulation, bandwidth requirement and reconstruction methods



- 4.4 Pulse Code Modulation
- 4.5 Quantization noise in PCM
- 4.6 Need for companding in PCM
- 4.7 Introduction to DPCM, DM, ADM and ADPCM and comparison with PCM
- 5. Base-band Digital Communication System** **4 Hrs**
  - 5.1 Introductions to Information Theory: Definition of Information and Entropy
  - 5.2 Shannon's channel capacity theorem and the information rate, Nyquist data rate
  - 5.3 Base-band (BB) digital communication system, Line coding schemes-NRZ, RZ, Manchester, AMI
  - 5.4 Inter-symbol Interference
- 6. Modulated Digital Data Communication System** **3 Hrs**
  - 6.1 ASK, FSK, PSK and QAM
  - 6.2 M-ary data communication systems and its impact on bandwidth
- 7. Multiplexing Systems** **3 Hrs**
  - 7.1 Introduction to Multiplexing, types of multiplexing – TDM, FDM
  - 7.2 DM in telephony hierarchy
  - 7.3 T1 and E1 hierarchy in digital telephony and calculation of data rate
  - 7.4 Introduction to Multiple Access Techniques – FDMA, TDMA, CDMA
- 8. Examples of Communication Systems** **7 Hrs**
  - 8.1 Satellite communication system-block diagram and working
  - 8.2 Terrestrial microwave links - block diagram and working, concept and its application
  - 8.3 Optical fiber links-block diagram, advantages of optical fiber, types, attenuation and dispersion characteristics and their impact on system performance
  - 8.4 Cellular mobile communication - GSM system architecture and system features
  - 8.5 Communication Systems in Nepal: Past and Present

**Laboratory:**

1. Modulation and Demodulation of DSBAM, DSBSC and SSB
2. Modulation and Demodulation of FM
3. Sampling and Reconstruction of signal
4. Digital Modulation Techniques – ASK, FSK and PSK
5. Field visit to demonstrate different communication systems

**References:**

1. S. Haykin, "An Introduction to Analog & Digital Communication", (Latest Edition)
2. Leon W. Couch, "Digital & Analog Communication System", (Latest Edition), Pearson Education Asia
3. B. P. Lathi, "Modern Digital & Analog Communication Systems", (Latest Edition)
4. J. Proakis, M. Saheli, "Communication Systems Engineering", Prentice Hall, New Jersey