Course Title: Communication System Engineering
Course Code: ETEG 320
Credit Hours: 3

Course Description:
This course provides an understanding of the essentials elements of analog and digital communications systems. This course builds on the theory introduced in signal and systems and complements the applied communication system courses.

Course Contents:

Unit 1: Linear Modulation
Introduction of Analog Communication System; Block diagram of analog communication system, Baseband and band pass system; Overview of Modulation; Amplitude Modulation (AM); Double Sideband Suppressed-Carrier (DSB-SC) modulation; Demodulators- Square law; Synchronous demodulation; Carrier recovery techniques; Single-Sideband Suppressed Carrier (SSB-SC) modulation and demodulation; Vestigial Side Band (VSB) modulation and applications

Unit 2: Angle Modulation
Frequency Modulation (FM) - Narrowband and Wideband FM; Phase Modulation (PM); Spectra of angle modulated signals; Pre-emphasis and de-emphasis in angle modulated system. FM broadcast technical standards

Unit 3: Digital Modulation Techniques
Introduction of Digital Communication System; Block diagram of digital communication system, Types of Digital Modulation and Demodulation Techniques; Binary Amplitude Shift Keying (BASK); Binary Frequency Shift Keying (BFSK); Binary Phase Shift Keying (BPSK); M-ary Techniques; Quadrature Phase Shift Keying (QPSK); Quadrature Amplitude Modualtion (QAM); Error probability in PSK systems; Matched filter

Unit 4: Pulse Modulation and Waveform Coding Technique
Types of Pulse Modulation; Pulse Amplitude Modulation (PAM) and bandwidth requirement; Natural and flat top sampling of PAM; Signal recovery techniques; Pulse Code Modulation (PCM) - Encoders, Decoders, Quantization, Quantization error and Companders, Multiplexing and synchronous digital hierarchy, Differential PCM, Noise in PCM systems; Delta Modulation (DM) - Characteristic, Encoding methods, Adaptive DM and continuously variable DM, Sigma delta modulation, noise in DM systems.

Unit 5: Noise in Communication System
Definition of noise; Statistical description of noise; Types of noise; Equivalent noise bandwidth; White Gaussian noise; Signal to Noise Ratio (SNR); Bit Error Ratio (BER); Bit Error Rate (BER); Figure of Merit; Channel noise- Additive White Gaussian Noise (AWGN) channel; Effect of noise in communication system

Unit 6: Information Theory
Information and information source; Information content; Entropy; Source coding theorem- Shannon Fano and Huffman; Information rate; Shannon's theorem and channel capacity; Capacity of an Additive White Gaussian Noise (AWGN) channel

Unit 7: Error Control Coding
Introduction of channel coding; Hamming distance; Parity and parity coding; Block codes- Linear block code; Systematic linear block coding (coding & decoding); Cyclic code (coding & decoding); Introduction to convolution coding- code trees, trellis, state diagram and decoding method.

Case study: Modulation Techniques Used in Modern Communications System.

References:
1. H. Taub and D.L. Schilling, *Principles of Communications Systems*, McGraw Hill 1986
2. B.P. Lathi, *Modern Analog and Digital Communication Systems*, 2nd Ed
3. George Kennedy and Bernard Devis, *Electronic Communications System*, 3rd Ed., Tata Mc Graw Hill
4. D. Roddy and J. Coolen, *Electronic Communications*, PHI.

Evaluation:
In-Semester Evaluation: 50%
End-Semester Evaluation: 50%