DIGITAL COMMUNICATIONS

V Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEC009	Core	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Understand the different digital modulation techniques.
II. Discuss the importance of error detection and correction codes and use them in the presence of the channel.
III. Describe and analyze the methods of transmission of digital data using baseband and carrier modulation techniques.
IV. Decompose codes separately into source codes and develop competency in modeling and analyzing communication system elements

COURSE OUTCOMES (COs):

CLO 1: Understand the different digital modulation techniques.
CLO 2: Discuss the importance of error detection and correction codes and use them in presence of channel noise.
CLO 3: Describe and analyze the methods of transmission of digital data using baseband and carrier modulation techniques.
CLO 4: Decompose codes separately into source codes, channel codes, and develop competency in modeling and analyzing communication system elements.

COURSE LEARNING OUTCOMES (CLOs):

1. Understand the basic concepts of pulse amplitude modulation (PAM), pulse position modulation (PPM) and pulse width modulation (PWM).
2. Describe the advantages and disadvantages of digital communication systems and remember the concept of pulse code modulation technique.
3. Understand the concept of sampling, quantization and coding.
4. Understand and remember the concept of amplitude shift keying modulation and demodulation..
5. Analyze the frequency shift keying modulator, coherent and non-coherent frequency shift keying detectors.
6. Describe the difference between binary phase shift keying ad quadrature phase shift keying techniques.
7. Understand the concept of baseband transmission and various line coding formats used in digital communication systems.
8. Describe the significance of pulse shaping to reduce inter-symbol interference in digital communications.
9. Understand the operation of raised cosine filter and eye patterns of various ASK, PSK and FSK digital modulation techniques.
10. Understand and Remember the concept of mutual information and entropy in information theory.
11. Design various mathematical modeling schemes for communication channel and determine their channel capacity.
12. Analyze various spread spectrum modulation schemes such as direct sequence spread spectrum and frequency hopping spread spectrum.
13. Analyze the significance of linear block codes and convolution codes in digital communications.
14. Interpret the difference between Block codes and binary cyclic codes.
15. Understand various types approaches such as time domain approach and transform domain approach for implementation of convolution codes.
16. Design different types of error detection and correction techniques for linear block codes and convolution codes.
17. Acquire experience in building and troubleshooting simple digital communication system using digital modulation and demodulation techniques.
18. Acquire the knowledge and develop capability to succeed national and international level competitive examinations.

Unit-I	PULSE DIGITAL MODULATION	Classes: 10
Pulse Modulation: Analog pulse modulation, Types of pulse modulation; PAM (Single polarity, double polarity); Generation & demodulation of PWM; Generation and demodulation of PPM; Introduction: Elements of digital communication systems, advantages and disadvantages of digital communication systems, applications; Pulse Digital Modulation: Elements of PCM; Sampling, quantization and coding; Quantization error, non-uniform quantization and companding; Differential PCM (DPCM);Adaptive DPCM; Delta modulation and its drawbacks; Adaptive delta modulation; Comparison of PCM and DM systems; Noise in PCM and DM systems.		
Unit -II	**DIGITAL MODULATION TECHNIQUES**	**Classes: 08**
Digital Modulation Techniques**:** Introduction, ASK modulator, coherent ASK detector, non-coherent ASK detector, FSK, bandwidth and frequency spectrum of FSK, non-coherent FSK detector, coherent FSK detector; BPSK, coherent BPSK detection; QPSK; DPSK, DEPSK; Optimal reception of digital signal**:** Baseband signal receiver; Probability of error; Optimum filter; matched filter, probability of error using matched filter; Probability of error for various line encoding formats; Correlation receiver; Calculation of probability of error for ASK, FSK, BPSK.		
Unit -III	**BASE BAND TRANSMISSION AND PULSE SHAPING**	**Classes: 10**
Base Band Transmission: Requirements of a line encoding format, Various line encoding formats: Unipolar, Polar, Bipolar; Scrambling techniques: BZ8S, HDB3, computation of power spectral densities of various line encoding formats. **Pulse Shaping**: Inter symbol interference; pulse shaping to reduce ISI; Nyquist,,s criterion; Raised cosine filter; Equalization; Correlative level coding; Duo-binary encoding, modified duo –binary coding; Eye diagrams for ASK,PSK,FSK; Cross Talk.		
Unit -IV	**INFORMATION THEORY AND SOURCE CODING**	**Classes: 09**
Information Theory: Information, entropy, conditional entropy; Mutual information; Channel capacity; Various mathematical modeling of communication channels and their capacities; Hartley Shannon law; Tradeoff between bandwidth and S/N ratio; Source coding: Fixed length and variable length Source Coding Schemes, Huffman coding; Source coding to increase average information per bit; Lossy source coding; Spread spectrum modulation: Use of spread spectrum; Direct sequence spread spectrum (DSSS); Code division multiple access using DSSS, frequency hopping spread spectrum; PN-Sequences: Generation and characteristics; Synchronization in spread spectrum systems.		
Unit -V	**LINEAR BLOCK CODES AND SOURCE CODES**	**Classes: 08**
Linear Block Codes: Introduction to error control coding; Matrix description of linear block codes, error detection and error correction capabilities of linear block codes; Hamming code; Binary cyclic codes algebraic structure, encoding, syndrome calculation and decoding; Convolution Codes: Introduction, Encoding of convolution codes; Time Domain Approach; Transform Domain Approach; General approach; State, Tree And Trellis Diagram; Decoding using Viterbi Algorithm; Burst Error Correction: Block Interleaving and convolution interleaving.		

Text Books:

1. Herbert Taub, Donald L. Schilling , "Principles of Communication Systems", TMH, 3rd edition,2008
2. K. Sam Shanmugam, "Digital and Analog Communication Systems", John Wiley & Sons, 2nd Edition, 2005.
3. Simon Haykin, "Digital communications", John Wiley, 3rd Edition,2005.

Reference Books:

1. John Proakis, "Digital Communications", TMH, 2nd Edition 1983.
2. B.P.Lathi, "Modern Analog and Digital Communication", Oxford reprint, 3rd Edition, 2004.
3. Singh, Sapre, "Communication Systems Analog and Digital", TMH, 2nd Edition, 2004.

Web References:
1. http://www.igniteengineers.com 2. http://www.ocw.nthu.edu.tw 3. http://www.uotechnology.edu.iq
E-Text Books:
1. https://www.jntubook.com/dgital-communications-textbook 2. http://tradownload.com/results/neamen-digital-communications-.html 3. http://www.everythingvtu.wordpress.com