16EC303 DIGITAL COMMUNICATIONS

Hours Per Week :

L	T	P	C
3	-	2	4

Course Description and Objectives:

This course offers the fundamental, theoretical and practical concepts of digital communication systems. The objective of the course is to introduce the concepts of digital communication system and its advantages, theoretical aspects of waveform coding techniques and digital modulation techniques, basics of information theory, source coding and Error-control coding.

Course Outcomes:

Upon successful completion of this course, students should be able to:

CO1: Understand the models of digital communication systems and Information theory.

CO2: Describe and analyze digital pulse modulation techniques.

CO3: Analyze digital modulation schemesand understand the reception of digital signal.

CO4: Apply error control coding techniques for efficient communication.

CO5: Understand basic multiple access techniques for communications.

CO6: Experiment on different types of digital communication subsystems using hardware and simulationsfor a given application / problem statement.

SKILLS:

- ✓ *Design TDM.*
- ✓ *Develop pulse generators for given specification.*
- ✓ *Implement ADC, DAC techniques.*
- ✓ *Mathematical analysis of the digital modulated signals.*
- ✓ *Realize 8-PSK, 16-PSK and 32-PSK.*
- ✓ *Design SEC-DED coders.*

ACTIVITIES:

- *Implement different Digital modulation schemes using Matlab.*
- *ON-OFF Keying used in optical communication.*
- *Design M-ary technique for PSK using Matlab.*
- *Demonstrate different digital communications system blocks in Radio and TV.*

UNIT - 1 **L- 9**

ELEMENTS OF DIGITAL COMMUNICATION SYSTEMS AND BASICS OF INFORMATION THEORY : Elements of Digital Communication Systems: Model of Digital Communication Systems, Advantages of Digital Communication Systems.

BASICS OF INFORMATION THEORY: Information and entropy, Source Coding Theorem, Lossless Data Compression Algorithms- Huffman coding, Shannon-Fano coding, Mutual Information, Channel Capacity, Channel-coding Theorem, Information Capacity Law, Implications of the Information Capacity Law.

UNIT - 2 **L-9**

BASEBAND PULSE TRANSMISSION: Pulse Analog Modulation-Introduction to Pulse Amplitude Modulation (PAM), Pulse Width Modulation (PWM) and Pulse Position Modulation (PPM), Time Division Multiplexing, Pulse Code Modulation - Elements of PCM, Sampling, Quantization Process, Uniform and Non-uniform Quantization (companding), Quantization error, SNR, encoding, Different formats of encoding, Differential PCM systems (DPCM). Delta Modulation, draw backs of DM, Adaptive Delta Modulation, comparison of PCM and DM systems

UNIT - 3 **L-9**

MODULATION TECHNIQUES AND OPTIMAL RECEPTION OF DIGITAL SIGNAL: Digital Modulation Techniques - Introduction, ASK, FSK, PSK, DPSK, QPSK and QAM. Optimal Reception of Digital Signal – Base band signal receiver, matched filter,

UNIT - 4 **L-9**

ERROR CONTROL CODING: Linear Block codes- Introduction, Error detection and error correction capabilities of linear block codes, single error correcting hamming codes. Binary cyclic codes-encoding, syndrome calculation, Error detection and Error correction capabilities of cyclic codes. Convolution Codes- Introduction, encoding of convolution codes, Code tree, trellis diagram, decoding using Viterbi algorithm.

UNIT - 5 **L-9**

MULTIPLE ACCESS TECHNIQUES: Basics of TDMA, FDMA and CDMA, Spread Spectrum Modulation: Use of Spread Spectrum, Direct Sequence Spread Spectrum (DSSS), Code Division Multiple Access, Ranging using DSSS. Frequency Hopping Spread Spectrum, PN - sequences: Generation and Characteristics. Synchronization in Spread Spectrum Systems, Timing and frequency synchronization,

LABORATORY EXPERIMENTS

LIST OF EXPERIMENTS Total hours: 30

I. HARD WARE

1. Time Division Multiplexing.
2. PAM.
3. PPMand PWM.
4. Pulse Code Modulation.
5. Delta Modulation.
6. Amplitude Shift Keying.
7. Frequency Shift Keying.
8. Phase Shift Keying.
9. Differential Phase Shift Keying.

II. SOFT WARE

(i) MATLAB

1. Companding Laws.
2. Huffman Coding.
3. Convolutional Encoder/Decoder.

(ii) SIMULINK/ VSG & VSA Setup

1. FSK Modulation and Demodulation.
2. BPSK Modulation and Demodulation.
3. QPSK Modulation and Demodulation.
4. 16-QAM Modulation and Demodulation.

Note : Any 12 expriments from the above list.

TEXT BOOKS:

1. Simon Haykin, "Digital communications", 2nd edition, John Wiley, 2014.
2. Simon Haykin, Michael Moher, "Introduction To Analog And Digital Communications", 2nd edition, Wiley, 2007.
3. William Stallings" Wireless Communications and Networks" 2nd edition, Pearson Edecation, 2009.

REFERENCE BOOKS:

1. Principles of Communication Systems – Herbert Taub, Donald Schilling, GoutamSaha, 3rd Edition, McGraw-Hill, 2008
2. Digital and Analog Communication Systems – Sam Shanmugam, John Wiley, 2005
3. Digital Communications- John G. Proakis, MasoudSalehi - 5th Edition, McGraw-Hill, 2008
4. Communication Systems, Simon Haykin, Michael Moher, 4th edition, Wiley, 2007