| Semester | V | Course Title | Digital Communication | Course Code | 18EC52 |
|---|---|---|---|---|---|
| Teaching Period | 50 Hours | L – T – P – TL* | 3 – 1 – 0 – 4 | Credits | 4 |
| CIE* | 40 Marks | SEE* | 60 Marks | Total | 100 Marks |

**CREDITS – 04**

**Course Objectives:**

- Understand the mathematical representation of signal, symbol, noise and channels.
- Apply the concept of signal conversion to symbols and signal processing to symbols in transmitter and receiver functional blocks.
- Compute performance issues and parameters for symbol processing and recovery in ideal and corrupted channel conditions.
- Compute performance parameters and mitigate for these parameters in corrupted and distorted channel conditions.

## Module -1

**Waveform Coding Techniques:** Pulse Code Modulation, Channel noise and error probability, Differential Pulse Code Modulation, Delta Modulation, Quantization noise in DM, Adaptive Delta Modulation. Text 1: 5.1-5.6

**Line codes:** Unipolar, Polar, Bipolar (AMI) and Manchester code and their power spectral densities (Text 2: Ch 6.10). Overview of HDB3, B3ZS, B6ZS (Ref. 1: 7.2) **L1, L2, L3**

## Module -2

**Signaling over AWGN Channels:** Introduction, Geometric representation of signals, Gram-Schmidt Orthogonalization procedure, Conversion of the continuous AWGN channel into a vector channel, Optimum receivers using coherent detection: ML Decoding, Correlation receiver, matched filter receiver (Text 2: 7.1, 7.2, 7.3, 7.4). **L1, L2, L3**

## Module -3

**Digital Modulation Techniques:** Phase shift Keying techniques using coherent detection: generation, detection and error probabilities of BPSK and QPSK, M–ary PSK, M–ary QAM (Relevant topics in Text 2 of 7.6, 7.7).

Frequency shift keying techniques using Coherent detection: BFSK generation, detection and error probability (Relevant topics in Text 2 of 7.8).

Non coherent orthogonal modulation techniques: BFSK, DPSK Symbol representation, Block diagrams treatment of Transmitter and Receiver, Probability of error (without derivation of probability of error equation) (Text 2: 7.11, 7.12. 7.13). **L1, L2, L3**

| Module -4 |
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| **Communication through Band Limited Channels:** Digital Transmission through Band limited channels: Digital PAM Transmission through Band limited Channels, Signal design for Band limited Channels: Design of band limited signals for zero ISI– The Nyquist Criterion (statement only), Design of band limited signals with controlled ISI-Partial Response signals, Probability of error for detection of Digital PAM: Probability of error for detection of Digital PAM with Zero ISI, Symbol–by–Symbol detection of data with controlled ISI (Text 3: 9.1, 9.2, 9.3.1, 9.3.2). **L1, L2, L3** |
| **Module -5** |
| **Spread Spectrum Communication Systems:** Model of a Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Systems, Effect of De-spreading on a narrowband Interference, Probability of error (statement only), Some applications of DS Spread Spectrum Signals, Generation of PN Sequences, Frequency Hopped Spread Spectrum, CDMA based on IS-95 (Text 3: 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.4.2). **L1, L2, L3** |
| **Course Outcomes:** At the end of the course, students will be able to:<br>• **Explain** the various waveform coding techniques and the performance of baseband signals.<br>• **Estimate** the AWGN Channel behavior using gram-Schmidt orthogonal procedure and coherent detection.<br>• **Determine** the probability of error for the different modulation techniques [BPSK, QPSK, BFSK and DPSK].<br>• **Design** the different methods to reduce ISI in digital communication.<br>• **Explain** the various concepts of Spread Spectrum Techniques. |
| **Text Book:**<br>• Simon Haykin, "An Introduction to Analog and Digital Communications", John Wiley and Sons, Inc. 2013, ISBN:9788126536535.<br>• Simon Haykin, "Digital Communication Systems", John Wiley & sons, First Edition, 2014, ISBN 978-0-471-64735-5.<br>• John G Proakis and Masoud Salehi, "Fundamentals of Communication Systems", 2014 Edition, Pearson Education, ISBN 978-8-131-70573-5. |
| **Reference Books:**<br>• B.P.Lathi and Zhi Ding, "Modern Digital and Analog communication Systems", Oxford University Press, 4th Edition, 2010, ISBN: 978-0-198-07380-2.<br>• Ian A Glover and Peter M Grant, "Digital Communications", Pearson Education, Third Edition, 2010, ISBN 978-0-273-71830-7.<br>• John G Proakis and Masoud Salehi, "Communication Systems Engineering", 2nd Edition, Pearson Education, ISBN 978-93-325-5513-6. |