

## B.E E&C SIXTH SEMESTER SYLLABUS

### DIGITAL COMMUNICATION

**B.E., VI Semester, Electronics & Communication Engineering/  
Telecommunication Engineering**

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC61	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50 (10 Hours/Module)	Exam Hours	03

CREDITS – 04

**Course Objectives:** The objectives of the course is to enable students to:

- 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	RBT Level
<p><b>Bandpass Signal to Equivalent Lowpass:</b> Hilbert Transform, Pre-envelopes, Complex envelopes, Canonical representation of bandpass signals, Complex low pass representation of bandpass systems, Complex representation of band pass signals and systems (Text 1: 2.8, 2.9, 2.10, 2.11, 2.12, 2.13).</p> <p><b>Line codes:</b> Unipolar, Polar, Bipolar (AMI) and Manchester code and their power spectral densities (Text 1: Ch 6.10).</p> <p>Overview of HDB3, B3ZS, B6ZS (Ref. 1: 7.2)</p>	L1, L2, L3
Module-2	
<p><b>Signaling over AWGN Channels-</b> 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 1: 7.1, 7.2, 7.3, 7.4).</p>	L1, L2, L3
Module-3	
<p><b>Digital Modulation Techniques:</b> 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 1 of 7.6, 7.7).</p> <p>Frequency shift keying techniques using Coherent detection: BFSK</p>	

<p>generation, detection and error probability (Relevant topics in Text 1 of 7.8).</p> <p>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 1: 7.11, 7.12, 7.13).</p>	
<b>Module-4</b>	
<p><b>Communication through Band Limited Channels:</b> 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 2: 9.1, 9.2, 9.3.1, 9.3.2).</p> <p>Channel Equalization: Linear Equalizers (ZFE, MMSE), Adaptive Equalizers (Text 2: 9.4.2).</p>	L1, L2, L3
<b>Module-5</b>	
<p><b>Principles of Spread Spectrum:</b> 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 2: 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.4.2).</p>	L1, L2, L3
<p><b>Course Outcomes:</b> At the end of the course, the students will be able to:</p> <ul style="list-style-type: none"> <li>• Associate and apply the concepts of Bandpass sampling to well specified signals and channels.</li> <li>• Analyze and compute performance parameters and transfer rates for low pass and bandpass symbol under ideal and corrupted non band limited channels.</li> <li>• Test and validate symbol processing and performance parameters at the receiver under ideal and corrupted bandlimited channels.</li> <li>• Demonstrate by simulation and emulation that bandpass signals subjected to corrupted and distorted symbols in a bandlimited channel, can be demodulated and estimated at receiver to meet specified performance criteria.</li> </ul>	
<p><b>Question paper pattern:</b></p> <ul style="list-style-type: none"> <li>• The question paper will have ten questions</li> <li>• Each full question consists of 16 marks.</li> <li>• There will be 2 full questions (with a maximum of Three sub questions) from each module.</li> <li>• Each full question will have sub questions covering all the topics under a module</li> <li>• The students will have to answer 5 full questions, selecting one full question from each module</li> </ul>	
<b>Text Books:</b>	

1. Simon Haykin, "Digital Communication Systems", John Wiley & sons, First Edition, 2014, ISBN 978-0-471-64735-5.
2. John G Proakis and Masoud Salehi, "Fundamentals of Communication Systems", 2014 Edition, Pearson Education, ISBN 978-8-131-70573-5.

**Reference Books:**

1. B.P.Lathi and Zhi Ding, "Modern Digital and Analog communication Systems", Oxford University Press, 4<sup>th</sup> Edition, 2010, ISBN: 978-0-198-07380-2.
2. Ian A Glover and Peter M Grant, "Digital Communications", Pearson Education, Third Edition, 2010, ISBN 978-0-273-71830-7.
3. John G Proakis and Masoud Salehi, "Communication Systems Engineering", 2<sup>nd</sup> Edition, Pearson Education, ISBN 978-93-325-5513-6.

  
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