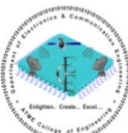## Department of Electronics & Communication Engineering

COURSE MODULE

Faculty Name/s: **Keerthi A Kumbar & Nandini G S**				Academic Year: **2025-26 (EVEN Sem)**			
Department: **ECE**							
Course Code	Course Title	Core/Elective	Prerequisite	Contact Hours			Total Hrs/ Sessions
				L	T	P	
BEC503	**Digital Communication**	**Core**	**System analysis, Probability Theory, Linear Algebra, Error Detection and Correction**	4	-	-	**50 (10 Hours / Module)**

Course objectives: This course will enable students to:

CL01: Understand the concept of signal processing of digital data and signal conversion to symbols at the transmitter and receiver

CL02: Compute performance metrics and parameters for symbol processing and recovery in ideal and corrupted channel conditions.

CL03: Understand the principles of spread spectrum communications

CL04: Understand the basic principles of information theory and various source coding techniques

CL05: Build a comprehensive knowledge about various Source and Channel Coding techniques.

CL06: Discuss the different types of errors and error detection and controlling codes used in the communication channel.

CL07: Understand the concepts of convolution codes and analyze the code words using time domain and transform domain approach.

Topics Covered as per Syllabus

Module-1

Bandpass Signals to Equivalent Lowpass: Hilbert Transform, Pre-envelopes, Complex envelopes of Band-pass Signals, Canonical Representation of Bandpass signals.

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.

Module-2

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. Frequency shift keying techniques using Coherent detection: BFSK generation, detection and error probability. BFSK using Non coherent Detection, Differential Phase Shift Keying.

Module-3

Information theory: Introduction, Entropy, Source Coding Theorem, Lossless Data Compression Algorithms, Discrete Memoryless Channels, Mutual Information, Channel capacity, Channel Coding Theorem, Information Capacity Law (Statement)

Module-4

Error Control Coding: Error Control Using Forward error Correction,

Linear Block Codes: Definitions, Matrix Descriptions, Syndrome and its properties, Minimum distance Considerations, Syndrome Decoding, Hamming Codes.

Cyclic Codes: Properties, Generator and Parity Check Polynomial and matrices, Encoding, Syndrome computation, Examples.

Module-5

Convolutional Codes: Convolutional Encoder, Code tree, Trellis Graph and State graph, Recursive systematic Convolutional codes, Optimum decoding of Convolutional codes, Maximum Likelihood Decoding of Convolutional codes: The Viterbi Algorithm, Examples

List of Text Books

1. Simon Haykin, "Digital Communication Systems", John Wiley & sons, 2014, ISBN 978-81- 265-4231-4.

List of Reference Books

1. B.P Lathi, Zhi Ding, "Modern Digital and Analog Communication Systems",4th Edition, Oxford University press, ISBN: 9780198073802, 2017
2. 2. K Sam Shanmugam, "Digital and analog communication systems", Wiley India Pvt. Ltd, 2017, ISBN:978-81-265-3680-1,.
3. 3. K.N Hari Bhat, D. Ganesh Rao, "Information Theory and Coding", Cengage Learning India Pvt Ltd, 2017, ISBN: 93-866-5092-4,.

List of URLs, Text Books, Notes, Multimedia Content, etc

1. https://www.youtube.com/watch?v=CZYfkfmbYhw
2. https://www.youtube.com/watch?v=zhB7AYfgKME
3. https://www.youtube.com/playlist?list=PLEvcKrs3Cncosm6kJCLhXVZe71aVddpCY
4. https://www.youtube.com/playlist?list=PLEvcKrs3Cncri-dVhmYe4Mn3od1Zomsu4

Course Outcomes: At the end of the course the student will be able to:

|	
CO1: Apply the concept of signal conversion to vectors in communication transmission and reception.	**L3**
CO2: Perform the mathematical analysis of digital communication systems for different modulation techniques.	**L3**
CO3: Apply the Source coding and Channel coding principles for the discrete memoryless channels.	**L3**
CO4: Compute the codewords for the error correction and detection of a digital data using Linear Block Code, Cyclic Codes and Convolution Codes	**L3**
CO5: Design encoding and decoding circuits for Linear Block Code, Cyclic Codes and Convolution Codes.	**L3**

The Correlation of Course Outcomes (CO's) and Program Outcomes (PO's)

Subject Code:	BEC503	TITLE: Digital Communication										Faculty Name: Mrs. Keerthi A Kumbar & Mrs. Nandini G S		
List of Course Outcomes	**Program Outcomes**													**Total**
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	
CO-1	3	2	-	1	2	-	-	-	-	2	-	2	11
CO-2	3	3	1	2	2	-	-	-	-	2	-	2	14
CO-3	3	3	-	2	2	-	-	-	-	2	-	2	13
CO-4	3	3	1	2	2	-	-	-	-	2	-	2	14
CO-5	3	3	1	2	2	-	-	-	-	2	-	2	14
Total	15	14	3	9	10	-	-	-	-	10	-	5	66
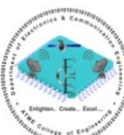
The Correlation of Course Outcomes (CO's) and Program Specific Outcomes (PSO's)

Subject Code:	BEC503	TITLE: Digital Communication	
List of Course Outcomes	**Program Specific Outcomes**		
	PSO1	**PSO2**	**Total**
CO-1	2	1	3
CO-2	2	1	3
CO-3	2	1	3
CO-4	2	1	3
CO-5	2	1	3
Total	**10**	**5**	**15**

Note: 3 = Strong Contribution 2 = Average Contribution   1 = Weak Contribution   - = No Contribute