Semester: V	Department of Electronics and communication	AY: 2026-27
Course Code: BEC503	Course Name Digital Communication	

Question Bank

Q.	Module-01	M	L	C
1.	Explain the Hilbert transform and derive the representation of a bandpass signal using its pre-envelope and complex envelope.	8	L3	CO1
2.	Explain the canonical representation of bandpass signals with suitable mathematical expressions.	7	L2	CO1
3.	Explain the geometric representation of signals and discuss its significance in digital communication.	8	L2	Co1
4.	Describe the Gram–Schmidt orthogonalization procedure and illustrate it with a suitable example.	8	L3	CO1
5.	Explain how a continuous AWGN channel can be converted into a vector channel.	7	L2	CO1
6.	Derive or explain the optimum receiver for signal detection in an AWGN channel.	8	L3	CO1
7.	Explain coherent detection and maximum-likelihood (ML) decoding for digital signals in AWGN.	8	L2	CO1
8.	Explain the correlation receiver with a block diagram and derive its decision rule.	7	L3	CO1
9.	Explain the matched-filter receiver and show why it maximizes the output signal-to-noise ratio at the sampling instant.	8	L3	CO1
10.	Compare correlation receivers and matched-filter receivers, stating their similarities and differences.	6	L2	CO1
	Module-02			
11.	Explain the generation and coherent detection of BPSK with transmitter and receiver block diagrams.	7	L2	CO2
12.	Derive the probability of error for coherent BPSK in an AWGN channel.	6	L3	CO2
13.	Explain the generation and coherent detection of QPSK and draw the relevant signal constellation.	8	L2	CO2
14.	Discuss M-ary PSK and derive or explain its symbol representation and bandwidth considerations.	7	L3	CO2
15.	Explain M-ary QAM with a constellation diagram and discuss its advantages and limitations.	8	L2	CO2
16.	Compare BPSK, QPSK, M-PSK and M-QAM in terms of bandwidth efficiency, complexity and error performance.	8	L2	CO2

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17.	Explain the generation and coherent detection of BFSK with suitable block diagrams.	7	L2	CO2
18.	Derive the probability of error for coherent BFSK and compare it with BPSK.	7	L3	CO2
19.	Explain noncoherent detection of BFSK and obtain its probability-of-error expression.	8	L3	CO2
20.	Explain differential phase-shift keying (DPSK), including its transmitter, receiver and performance comparison with coherent PSK.	8	L2	CO2
	Module-03			
21.	Define information, self-information and entropy. Derive the expression for the entropy of a discrete source.	8	L3	CO3
22.	State and explain the important properties of entropy with suitable examples.	7	L2	CO3
23.	Explain the Source Coding Theorem and discuss its significance in lossless compression.	8	L2	CO3
24.	Explain lossless data-compression algorithms and work through a suitable example of one such algorithm.	6	L3	CO3
25.	Define a discrete memoryless channel (DMC) and represent it using a transition-probability matrix.	8	L2	CO3
26.	Define mutual information and derive its relationship with entropy.	7	L3	CO3
27.	Explain channel capacity and determine the capacity of a binary symmetric channel.	8	L3	CO3
28.	State and explain the Channel Coding Theorem and its implications for reliable communication.	7	L2	CO3
29.	Explain the Information Capacity Law (Shannon–Hartley theorem) and discuss the effects of bandwidth and signal-to-noise ratio.	8	L3	CO3
30.	Differentiate entropy, mutual information and channel capacity, giving the mathematical expressions for each.	8	L2	CO3
	Module-04			
31.	Explain forward error correction (FEC) and distinguish error detection from error correction.	7	L2	CO4
32.	Define linear block codes and explain codewords, generator matrices and parity-check matrices.	6	L2	CO4
33.	Explain the syndrome of a received vector and describe how syndrome decoding identifies errors.	8	L3	CO4
34.	Define minimum Hamming distance and explain its role in error-detection and error-correction capability.	7	L2	CO4
35.	Explain the construction and encoding procedure of a Hamming code with a worked example.	8	L3	CO4

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36.	Explain cyclic codes and list their important properties.	6	L2	CO4
37.	Explain generator and parity-check polynomials/matrices used in cyclic coding.	8	L2	CO4
38.	Describe the encoding procedure for cyclic codes using a suitable example.	7	L3	CO4
39.	Explain syndrome computation and decoding of cyclic codes with an example.	8	L3	CO4
40.	Compare linear block codes, Hamming codes and cyclic codes in terms of construction and decoding.	7	L2	CO4
	Module-05			
41.	Explain the basic principles of convolutional coding and define code rate and constraint length.	8	L2	CO5
42.	Draw and explain a convolutional encoder using a suitable generator sequence.	7	L3	CO5
43.	Explain the trellis diagram and state diagram of a convolutional code, using an example.	6	L2	CO5
44.	Describe recursive systematic convolutional (RSC) codes and explain how they differ from non-recursive codes.	8	L2	CO5
45.	Explain the operation of a convolutional encoder and determine its output for a given input sequence.	6	L3	CO5
46.	Explain optimum decoding of convolutional codes and the role of maximum-likelihood sequence estimation.	7	L2	CO5
47.	Describe the Viterbi algorithm with a trellis diagram and a worked example.	8	L3	CO5
48.	Explain the steps involved in the Viterbi algorithm: branch metrics, path metrics, survivor paths and traceback.	7	L2	CO5
49.	Compare hard-decision and soft-decision Viterbi decoding.	8	L2	CO5
50.	Explain the advantages, limitations and applications of convolutional codes in digital communication systems.	7	L2	CO5

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