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Question Paper Code	13615

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2025

Fifth Semester

Electronics and Communication Engineering

20ECPC501 - DIGITAL COMMUNICATION

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	*K – Level*	*CO*
1.	Entropy is a measure of (a) The amount of data transmitted. (b) The average uncertainty of a random variable. (c) The noise in a communication channel. (d) The speed of a communication system.	*1*	*K1*	*CO1*
2.	What is the unit of information in information theory? (a) Bit (b) Byte (c) Decibel (d) Watt	*1*	*K1*	*CO1*
3.	Source Coding Theorem is represented by_____. (a) Huffman's 1 st theorem (b) Shannon's 1st theorem (c) Shannon's 2nd theorem (d) Both a&b	*1*	*K1*	*CO2*
4.	Which of the following is true about Shannon-Fano coding? (a) It provides optimal compression for all sources. (b) It assigns code lengths based on probabilities, starting with the most probable symbols. (c) It is always more efficient than Huffman coding. d) It does not consider symbol probabilities in constructing codes.	*1*	*K1*	*CO2*
5.	Which of the following is a property of line codes used in digital transmission? (a) They can introduce DC components into the signal. (b) They ensure the signal has no low-frequency components. (c) They are immune to noise interference. (d) They determine the timing and synchronization of the data transmission.	*1*	*K1*	*CO3*
6.	Which of the following is a major advantage of Adaptive Differential Pulse Code Modulation (ADPCM) over Delta Modulation (DM)? (a) ADPCM has higher efficiency and better signal quality. (b) DM is more complex to implement than ADPCM. (c) DM Uses more bits to represent the signal than ADPCM. (d) ADPCM does not require any form of prediction filtering.	*1*	*K1*	*CO3*
7.	According to the Nyquist criterion, distortion less transmission requires (a) The signal must have infinite bandwidth. (b) The symbol rate must be twice the bandwidth of the channel. (c) The signal must be pulse-shaped to reduce ISI. (d) The signal should have constant amplitude throughout transmission.	*1*	*K1*	*CO4*
8.	Correlative coding helps in _____. (a) Reducing the bit error rate by introducing redundancy. (b) Shaping the signal to match the channel's characteristics. (c) Preventing ISI by controlling the correlation between symbols. (d) Increasing the bandwidth of the transmitted signal.	*1*	*K2*	*CO4*

9. In Coherent Binary Phase Shift Keying (BPSK), the detection process involves — 1 K1 CO5
(a) Detecting the amplitude of the signal.
(b) Comparing the phase shift of the received signal with a reference.
(c) Measuring the frequency of the received signal.
(d) Using a matched filter to detect the signal.

10. A convolutional code with constraint length K=3means ____. — 1 K1 CO6
(a) The code output depends on the current and previous 3 input bits.
(b) The code output depends only on the current input bit.
(c) The code uses 3 check bits for every 1 data bit.
(d) The encoder has 3 states.

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

11. List any two properties of Entropy. — 2 K1 CO1
12. Sate the channel coding theorem for discrete memoryless channel. — 2 K1 CO1
13. Define Shannon's limit. — 2 K2 CO2
14. Determine length of code words of a binary shannonfano code for a DMS with probabilities 0.5, 0.25, 0.25, 0.125. — 2 K2 CO2
15. State the principle of model based encoding. — 2 K2 CO3
16. Write any four properties of line coding. — 2 K2 CO3
17. Mention the Nyquist criterion for distortion less transmission. — 2 K2 CO4
18. Define correlative coding scheme. — 2 K2 CO4
19. Draw a block diagram of a coherent BFSK receiver. — 2 K2 CO5
20. Write the Bit error rate equation for BPSK Modulation scheme. — 2 K2 CO5
21. Mention the error detection and correction capabilities of hamming codes. — 2 K2 CO6
22. Classify systematic and non systematic codes. — 2 K2 CO6

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23. a) Consider that two sources X and Y emit symbols {x1, x2, x3} and{y1, y2, y3} with the joint probability p(X, Y) as given below in matrix form. Calculate the entropy H(X), H(Y), H(Y/X) and H(X,Y). — 11 K2 CO1

$$p(X,Y) = \begin{array}{c} \\ x_1 \\ x_2 \\ x_3 \end{array} \begin{array}{c} \begin{array}{ccc} y_1 & y_2 & y_3 \end{array} \\ \begin{bmatrix} \frac{3}{40} & \frac{1}{40} & \frac{1}{40} \\ \frac{1}{20} & \frac{3}{20} & \frac{1}{20} \\ \frac{1}{8} & \frac{1}{8} & \frac{3}{8} \end{bmatrix} \end{array}$$

OR

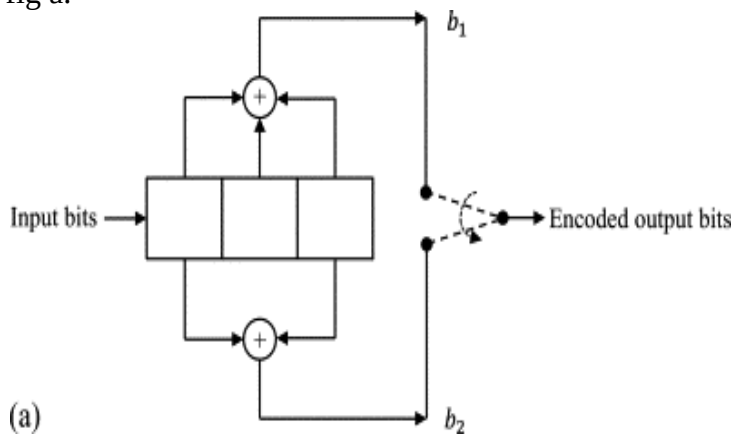
b) Define Mutual information. Find the relation between the mutual information and joint entropy of the channel input and channel output. What are the implications of the information capacity theorem? — 11 K2 CO1

24. a) Five symbols of the alphabet of discrete memory less source and their probabilities are given as {S1, S2, S3, S4, S5) and {0.4, 0.19, 0.16, 0.15, 0.15}. Construct using Shannon fano Coding and calculate the code efficiency. — 11 K3 CO2

OR

b) A DMS has six symbols x1, x2, x3, x4, x5, x6 with probability of emission 0.2, 0.3, 0.11, 0.16, 0.18, 0.05 encode the source with Huffman code and compute its efficiency. — 11 K3 CO2

25.	a)	Describe delta modulation system in detail with a neat block diagram. Also, explain two forms of quantization error in delta modulation.	*11*	*K2*	*CO3*
		OR			
	b)	Explain the principle, generation and reconstruction of DPCM System in detail.	*11*	*K2*	*CO3*
26.	a)	Explain modified duobinary signaling scheme with a neat diagram.	*11*	*K2*	*CO4*
		OR			
	b)	Explain the working of correlation receiver with neat block diagram.	*11*	*K2*	*CO4*
27.	a)	Explain in detail the detection and generation of BPSK system. Derive the expression for its bit error probability.	*11*	*K2*	*CO5*
		OR			
	b)	Describe the generation and detection of Coherent QPSK Signals.	*11*	*K2*	*CO5*
28.	a) i)	Draw the code tree of a convolutional code of code rate r = 1/2 and constraint length of K = 3 starting from the state table and state diagram for an encoder shown in the fig a.	*7*	*K3*	*CO6*



	ii)	Draw and explain the trellis diagram representation of convolutional codes.	*4*	*K3*	*CO6*
		OR			
	b)	Explain encoder and decoder of cyclic codes with appropriate diagrams.	*11*	*K3*	*CO6*