



Paper ID : 261097

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Subject Code: BEC601

Roll No:

BTECH

(SEM. VI) THEORY EXAMINATION 2025-26

DIGITAL COMMUNICATION

TIME: 3 HRS

M.MARKS: 70

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief.

2x7 = 14

Q.N.	Question	CO	Level
(a)	Write the important properties of Cumulative Distribution Function (CDF) of a random variable X.	1	K2
(b)	Considering a random variable X, mathematically define the following statistical parameters-(i) Mean Value of X, (ii) Second Order Moment of X, (iii) Variance of X, and (iv) Standard Deviation of X?	1	K2
(c)	What is Scrambling? Explain any one scrambling technique with suitable example?	2	K3
(d)	Discuss any two advantages of PSK technique over ASK technique?	3	K2
(e)	Explain the concept of spread spectrum technique briefly?	4	K2
(f)	Define the Shannon's Channel capacity theorem?	5	K2
(g)	Explain the linear block coding with suitable example?	5	K2, K3

SECTION B

2. Attempt any *three* of the following:

7 x 3 = 21

(a)	Show that PSD and Autocorrelation function of random process are Fourier transform pair?	1	K3
(b)	Discuss the Gram-Schmidt Orthogonalization procedure in detail?	2	K3
(c)	Explain the implementation of DPSK modulation scheme with supporting mathematical expressions and diagram?	3	K3
(d)	Describe the concept behind Frequency Hopped Spread Spectrum (FHSS) technique? Also discuss how does the original signal is recovered from FHSS signal?	4	K3
(e)	A Discrete memoryless source has four symbols x_1, x_2, x_3, x_4 with probabilities $P(x_1)=0.4, P(x_2)=0.3, P(x_3)=0.2, P(x_4)=0.1$. (i) Calculate the entropy $H(x)$, (ii) Find the amount of information contained in messages, $x_1 x_2 x_1 x_3$ and $x_4 x_3 x_3 x_2$, and compare with $H(x)$ obtained in part (i)?	5	K5

SECTION C

3. Attempt any *one* part of the following:

7 x 1 = 7

(a)	Define the probability density function and cumulative distribution function of Gaussian random variables. Also establish relationship between Q-function and complementary error function?	1	K3
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(b)	Explain the following terms- (i) Wide sense stationery random process (ii) Ergodic random process?	1	K3
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4. Attempt any one part of the following:

7 x 1 = 7

(a)	Derive the equation of Power Spectral Density of On-Off Signaling scheme and explain the properties of obtained PSD curve?	2	K2
(b)	Explain how does the eye diagram is obtained and also discuss how eye diagram is helpful in examining the Inter Symbol Interference (ISI)?	2	K3, K4

5. Attempt any one part of the following:

7 x 1 = 7

(a)	Draw the block diagram of transmitter and receiver section of QPSK system and explain the functionality of each block. Also give the relevant mathematical expressions and draw the QPSK waveform.	3	K2
(b)	Explain the FSK modulation/demodulation scheme along with its constellation diagram?	3	K3

6. Attempt any one part of the following:

7 x 1 = 7

(a)	Explain the functionality of Matched filter in digital receiver with required mathematical equations?	4	K3
(b)	Derive the equation for probability of error of BPSK modulation scheme?	4	K3

7. Attempt any one part of the following:

7 x 1 = 7

(a)	A Discrete Memoryless Source (DMS) X has five equally likely symbols. (i) Construct a Shannon-Fano code for X, and calculate the efficiency of the code? (ii) Repeat for the Huffman code and compare the results?	5	K4, K5
(b)	Explain the systematic and non-systematic cyclic codes in detail?	5	K3