Paper ID : 250538

Roll No: | | | | | | | | | | | | | |

BTECH
(SEM VI) THEORY EXAMINATION 2024-25
DIGITAL COMMUNICATION

TIME: 3 HRS **M.MARKS: 70**

Note: Attempt all Sections. In case of any missing data, choose suitably.

SECTION A

1. **Attempt *all* questions in brief.** 02 x 7 = 14

Q no.	Question	CO	Level
a.	What is a random variable? How is it related to the concept of probability in communication systems?	1	K2
b.	What do you mean by the mean and variance of a random variable?	1	K2
c.	Compare PSK and FSK modulation techniques.	2	K2
d.	What is a digital communication system? Mention any two advantages over analog communication systems.	2	K2
e.	What is the expression for the Bit Error Rate (BER) of Binary Phase Shift Keying (BPSK) in an AWGN channel?	3	K2
f.	List any two application of Direct Sequence Spread Spectrum (DS-SS) systems.	4	K2
g.	What is meant by signal space representation of signals?	5	K2

SECTION B

2. **Attempt any *three* of the following:** 07 x 3 = 21

Q no.	Question	CO	Level
a.	What do you understand by statistical averages? Explain all its properties.	1	K2
b.	Describe scrambler and unscrambler with the help of suitable diagram.	2	K2
c.	Explain the working principles of ASK, FSK, and PSK modulation schemes with their constellation diagrams.	3	K2
d.	Explain the basic principles of Spread Spectrum Communication. Discuss its two main types and their key characteristics.	4	K2
e.	Construct all possible Systematic (7,4) cyclic code using a generator polynomial $g(x) = x^3 + x^2 + 1$.	5	K3

SECTION C

3. **Attempt any *one* part of the following:** 07 x 1 = 07

Q no.	Question	CO	Level
a.	Define Power Spectral Density (PSD) and state its relationship with the autocorrelation function.	1	K2
b.	Explain the concept of a random process in the context of communication systems.	1	K2

4. **Attempt any *one* part of the following:** 07 x 1 = 07

Q no.	Question	CO	Level
a.	Explain the Gram-Schmidt orthogonalization procedure used in signal space analysis.	2	K2
b.	Explain the concept of **line coding** in digital communication systems. What are the important properties a good line code should have? For a binary data stream **1010101**, draw the waveform representations using: I. Unipolar NRZ II. Polar NRZ	2	K2

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5.   **Attempt any *one* part of the following:**   **07 x 1 = 07**

Q no.	Question	CO	Level
a.	Explain the working principle of QPSK modulation with Mathematical representation of the QPSK signal, Constellation diagram and its significance,	3	K2
b.	Explain the modulation and demodulation process of Binary Amplitude Shift Keying (BFSK) with the help of neat block diagrams. Also, sketch the constellation diagram for BASK	3	K2

6.   **Attempt any *one* part of the following:**   **07 x 1 = 07**

Q no.	Question	CO	Level
a.	Derive the impulse response and frequency response of a Matched Filter for a known signal s(t).	4	K3
b.	Compare the Bit Error Rate (BER) performance of Binary ASK (BASK), Binary FSK (BFSK), and Binary PSK (BPSK) in an AWGN channel. Also, justify why BPSK is preferred over BASK and BFSK in most practical systems.	4	K2

7.   **Attempt any *one* part of the following:**   **07 x 1 = 07**

Q no.	Question	CO	Level
a.	Define and explain the concept of Mutual Information in the context of communication systems.	5	K2
b.	Find the code word length by using Shannon Fano for the probability $\{0.4, 0.2, 0.2, 0.1, 0.1\}$ for symbols s_1, s_2, s_3, s_4, s_5 Find the code efficiency, Redundancy and variance of the code of the code.	5	K3