SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA
School of Electronics and Communication Engineering
Major Examination (Even Sem) 2022-23(May, 2023)
Class: B Tech ECE 2021 Batch (IV Semester)
Total Number of Questions: 5

Course Title: Digital Communication Engineering
Time Allowed: 3 Hrs.

21BEC127

Course Code: ECL 2152
Max Marks: [50]

Instructions / Note:
i. Attempt All Questions. ii. Support your answer with neat freehand sketches/diagrams, wherever appropriate.
iii. Assume any missing data to suit the case / derivation / answer (Scientific Calculator is allowed)

SECTION A (Descriptive)

Q1. With appropriate plots elaborate on these formats: a) Unipolar NRZ b) Unipolar RZ c) Polar NRZ d) Polar RZ e) Manchester (*2*5= 10 marks*)

Q2. Explain BFSK generation and demodulation with suitable diagrams. (5+5= 10 marks)

Q3. What is channel matrix? With help of channel diagrams mention the channel matrices for different types of channels.   (2+8= 10 marks)

SECTION B (Numerical)

Q4. *(10 marks)*

Consider two real valued signals, $x(t)$ band-limited to [−500 Hz, 500 Hz] and $y(t)$ band-limited to [−1 kHz, 1 kHz]. For $z(t) = x(t) \cdot y(t)$, the Nyquist sampling frequency (in kHz) is _____.

Q5. *(10 marks)*

Let $Q(\sqrt{\gamma})$ be the BER of a BPSK system over an AWGN channel with two-sided noise power spectral density $N_0/2$. The parameter γ is a function of bit energy and noise power spectral density.
A system with two independent and identical AWGN channels with noise power spectral density $N_0/2$ is shown in the figure. The BPSK demodulator receives the sum of outputs of both the channels.
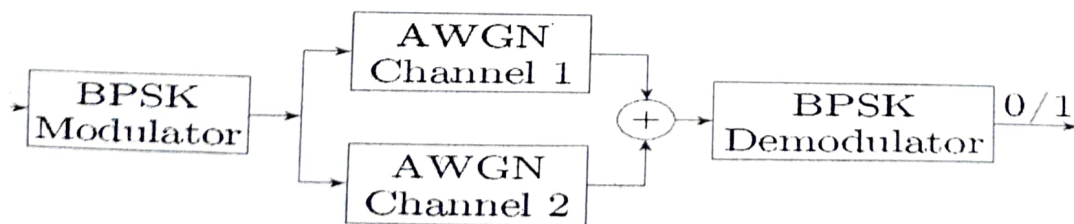
If the BER of this system is $Q(b\sqrt{\gamma})$, then the value of b is _____.

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SECTION A (Descriptive Type)

Q1. Differentiate the following:

   a) Quantizer and Encoder in PCM
   b) Ideal and Natural Sampling
   c) PAM and PPM
   d) Analog and Digital Modulation
   e) SNR and Signal to Quantization Ratio

(2x5=10 marks)

SECTION B (Numericals)

Q2. Find the Nyquist sampling rate of the signal

$$x(t) = sinc(200t)\ sinc^2(1000t)\ \text{in samples/s.}$$

(5 marks)

Q3. Consider a binary digital communication system with equally likely 0's and 1's. When binary 0 is transmitted, the detector input can lie between the levels -0.25 V and +0.25 V with equal probability. When binary 1 is transmitted, the voltage at the detector can have any value between 0 and 1V with equal probability. If the detector has a threshold of 0.2V (i.e., if the received signal is greater than 0.2V, the bit is taken as 1). Find the average bit error probability.

(5 marks)

Course Outcomes:
CO1: Introduce the principles and applications of digital communication. CO2: Understand various pulse modulation techniques CO3: Comprehend pass band modulation CO4: Different channels in Digital Communications

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SECTION A (Descriptive)

Q1. What is non uniform quantization and why does it give better SNR as compared to uniform quantization technique? (4 marks)

Q2. Define companding. Differentiate between μ and A law companding. (4 marks)

Q3. Explain why adaptive delta modulation is better than delta modulation to overcome slope overload distortion and granular noise distortion. (4 marks)

SECTION B (Numerical)

Q4. In a PCM system, if the code word length is increased from 6 to 8 bits, the signal-to-quantization-noise ratio improves by what factor? (4 marks)

Q5. (Write all steps for obtaining correct option below) (4 marks)

The input to a linear delta modulator having a step size $\Delta= 0.628$ is a sine wave with frequency f_m and peak amplitude E_m. If the sampling frequency $f_s= 40$ kHz, the combination of the sine wave frequency and the peak amplitude, where slope overload will take place is:

	E_m	f_m
a)	0.3 V	8kHz
b)	1.5V	4 kHz
c)	1.5 V	2 kHz
d)	3.0 V	1 kHz

*********************************End*********************************