Printed Page:- Subject Code:- AEC0401

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: IV - THEORY EXAMINATION (2021 - 2022)

Subject: Analog and Digital Communication

Time: 3 Hours Max. Marks: 100

General Instructions:

1. The question paper comprises three sections, A, B, and C. You are expected to answer them as directed.
2. Section A - Question No- 1 is 1 marker & Question No- 2 carries 2 mark each.
3. Section B - Question No-3 is based on external choice carrying 6 marks each.
4. Section C - Questions No. 4-8 are within unit choice questions carrying 10 marks each.
5. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION A 20

1. Attempt all parts:-

1-a. If the carrier of 100 percent modulated AM wave is suppressed, the percentage power saving will be (CO1) 1

(a) 50

(b) 66.66

(c) 150

(d) 100

1-b. Amplitude modulation is (CO1) 1

(a) change in amplitude of the carrier according to modulating signal.

(b) change in frequency of the carrier according to modulating signal.

(c) change in amplitude of the modulating signal according to carrier signal.

(d) change in amplitude of the carrier according to modulating signal frequency.

1-c. In a delta modulation system, granular noise occurs when the: (CO2) 1

(a) modulating signal increases rapidly

(b) pulse rate decreases

(c) pulse amplitude decreases

(d) modulating signal remains constant

1-d. The use of non uniform quantization leads to: (CO2) 1

(a) reduction in transmission bandwidth

(b) increase in maximum SNR

(c) increase in SNR for low level signals

(d) simplification of quantization process

1-e. The bandwidth of BFSK is _______________ than BPSK. (CO3) 1

(a) Lower

(b) Same

(c) Higher

(d) Not predictable

1-f. The maximum bandwidth is occupied by (CO3) 1

(a) ASK

(b) BPSK

(c) FSK

(d) None of the above

1-g.	Information theory deals with: (CO4) (a) Measure of source information (b) The information capacity of a channel (c) Coding as means of utilizing channel capacity for information transfer (d) All of the above	1
1-h.	The entropy is defined as the average information per message. (CO4) (a) TRUE (b) FALSE	1
1-i.	In……..error correction, the receiver corrects errors without requesting retransmission. (CO5) (a) backword (b) onward (c) forward (d) None of the mentioned	1
1-j.	Which are forward error correcting codes? (CO5) (a) Block codes (b) Convolutional codes (c) Block & Convolutional codes (d) None of the mentioned	1

2. Attempt all parts:-

2.a.	Define modulation index. Write the conditions for over modulation, under modulation and critical modulation. (CO1)	2
2.b.	What is Sampling Theorem? (CO2)	2
2.c.	Write the expression for BER of BFSK. (CO3)	2
2.d.	What is channel redundancy? (CO4)	2
2.e.	Write difference between Systematic & Non-Systematic Cyclic Code. (CO5)	2

SECTION B 30

3. Answer any <u>five</u> of the following:-

3-a.	Why the carrier is suppressed in Conventional Amplitude modulation? What are the disadvantages and advantages of suppressing carrier? Explain with the help of mathematical expression. (CO1)	6
3-b.	Explain with the help of block diagram the elements of communication systems. (CO1)	6
3-c.	What is NRZ and RZ encoding techniques? Explain by drawing the waveforms. (CO2)	6
3-d.	Explain the generation of a FSK with the help of waveform and block diagram. (CO2)	6
3.e.	An amplifier operating over the frequency range from 12 to 20 MHz has a 40 kΩ input resistance. What is the the RMS noise voltage at the input to this amplifier at room temperature? (CO3)	6
3.f.	Given an AWGN channel with 4 kHz bandwidth and the noise power spectral density is 10^{-24} W/Hz. The signal power required at the receiver is 0.1 mW. Calculate the capacity of this channel. (CO4)	6
3.g.	Define Hamming Distance and Hamming Weight. Calculate Hamming Distance of C1 = 1111 & C2 = 1001. Calculate Hamming Weight of codeword C = 0110100. (CO5)	6

SECTION C 50

4. Answer any <u>one</u> of the following:-

4-a.	For the FM signal m (t) = 10 cos [2π (106) t + 5 sin 2π (103) t]. Find the; (i) Modulation index (ii) Modulating frequency (iii) Carrier frequency (iv) Amplitude of carrier. (CO1)	10
4-b.	Give message signal m(t) = sin(2000πt), Kf = 100 kHz , Kp = 10 rad. Calculate: a) BW of	10

FM, b) BW of PM, c) if the message signal is doubled, find the BW of FM & PM, d) if the message signal frequency is doubled, find the BW of FM & PM. (CO1)

5. Answer any <u>one</u> of the following:-

5-a.	An analog signal is expressed by the equation $x(t) = 3 \cos 50\pi t + 10 \sin 300\pi t - \cos 100\pi t$. Calculate the Nyquist rate for the signal. (CO2)	10
5-b.	Draw the waveforms of ASK, PSK and FSK signals, what are their bandwidth requirements? Write their advantages and disadvantages. (CO2)	10

6. Answer any <u>one</u> of the following:-

6-a.	Explain Frequency Hoping Spread Spectrum. (CO3)	10
6-b.	A transmitter transmit symbols with 3-bits per symbol. Calculate the ratio of bit error probability Pb to the symbol error probability Pe. (CO3)	10

7. Answer any <u>one</u> of the following:-

7-a.	Develop Shannon-fano code for three messages given by probabilities 1/2, 1/4, 1/8. Calculate the average number of bits/message. (CO4)	10
7-b.	Write note on following: a) Kraft's inequality, b) Code efficiency, c) Codeword Length, d) Shannon's code. (CO4)	10

8. Answer any <u>one</u> of the following:-

8-a.	Consider a (7,4) cyclic code with generator polynomial $g(x) = 1 + x + x^3$. Let data word d = (1010), find the corresponding systematic code word. (CO5)	10
8-b.	Sketch the encoder and syndrome calculator for the generator polynomial $g(x) = 1 + x + x^3$, and obtain the syndrome for the received codeword 1001011. (CO5)	10