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 - CARRY OVER THEORY EXAMINATION - SEPTEMBER 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. The AM spectrum consists of (CO1) 1

(a) carrier frequency

(b) upper side band frequency

(c) lower side band frequency

(d) all of the above

1-b. The process of recovering information signal from received carrier is known as (CO1) 1

(a) detection

(b) modulation

(c) de-multiplexing

(d) sampling

1-c. 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-d. A PWM signal can be generated by: (CO2) 1

(a) an astable multi vibrator

(b) a monostable multi vibrator

(c) integrating a PPM signal

(d) differentiating a PPM signal

1-e. The binary waveform used to generate BPSK signal is encoded in (CO3) 1

(a) Bipolar NRZ format

(b) none

(c) Manchester coding

(d) Differential coding

1-f. .....is a type of digital modulation. (CO3) 1

(a) Amplitude modulation

(b) Frequency modulation

(c) Phase modulaion

(d) Frequency Shift Keying

1-g. The units of entropy is ..... (CO4) 1

(a) bits/second

(b) bits/message

(c) message/second

(d) symbol/second

1-h. Which among the following is used to construct the binary code that satisfies the prefix condition ? (CO4) 1

(a) Information rate

(b) Noiseless channel

(c) Channel coding theorem

(d) Kraft inequality

1-i. Which needs re-sending of signal? (CO5) 1

(a) Error correction

(b) Error detection

(c) Error correction & detection

(d) None of the mentioned

1-j. Which reduces the size of the data? (CO5) 1

(a) Source coding

(b) Channel coding

(c) Source & Channel coding

(d) None of the mentioned

2. Attempt all parts:-

2.a. Define the Modulation Index for FM & PM. (CO1) 2

2.b. Define Nyquist Criteria. (CO2) 2

2.c. Give the types of noise. (CO3) 2

2.d. Define Mutual Information. How it is related to channel capacity? (CO4) 2

2.e. Calculate Hamming Distance of C1 = 1010 & C2 = 0101. (CO5) 2

SECTION B 30

3. Answer any five of the following:-

3-a. Explain the communication system with the help of block diagram. (CO1) 6

3-b. Derive an expression of single -tone AM signal, sketch the spectrum, define modulation Index and derive expression for BW. (CO1) 6

3-c. What is Pulse code modulation technique? Explain the BW requirements in PCM. (CO2) 6

3-d. What is multiplexing? Explain TDM with the help of block diagram. (CO2) 6

3.e. What is the concept of Matched Filter ? Calculate the probability of error for the matched filter. (CO3) 6

3.f. Given an AWGN channel with 8 kHz bandwidth and the noise power spectral density is 10^{-12} W/Hz. The signal power required at the receiver is 0.1mW. Calculate the capacity of this channel. (CO4) 6

3.g. Explain code rate & hamming bound in detail. (CO5) 6

SECTION C 50

4. Answer any one of the following:-

4-a. Write short note on: a) Signal to Noise Ratio b) Figure of Merit c) Noise Figure (CO1) 10

4-b. For the FM signal m (t) = 10 cos [$2\pi(106)$ t + 5 sin $2\pi(103)$ t]. Find the; (i) Modulation index (ii) Modulating frequency (iii) Carrier frequency (iv) Amplitude of carrier. (CO1) 10

5. Answer any one of the following:-

5-a. What is sampling? Explain different types of sampling techniques. Which one is better? 10

(CO2)

5-b. How the BPSK signal is represented on the geometrical plane? Draw the block diagram of BPSK generation and detection. Explain its bandwidth. (CO2) 10

6. Answer any one of the following:-

6-a. Explain Direct Sequence Spread Spectrum? (CO3) 10

6-b. What is Frequency Hopping? Explain the different types of frequency hopping with necessary diagrams. (CO3) 10

7. Answer any one of the following:-

7-a. Define discrete memoryless channel (DMC) with channel matrix. A discrete memoryless source is capable of transmitting three distinct symbols m0, m1, m2. Their probabilities are 1/2, 1/4 and 1/4 respectively. Calculate the source entropy. (CO4) 10

7-b. A Gaussian channel has 1 MHz bandwidth. Calculate the channel capacity if the signal power to noise spectral density ratio 10^5. Also find the maximum information rate. (CO4) 10

8. Answer any one of the following:-

8-a. Compare linear block codes, cyclic codes and convolutional codes by giving their advantages and disadvantages. (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