Printed page:04 **Subject Code: AEC0401**

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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B. Tech

SEM: IV- THEORY EXAMINATION (2023-2024)

Subject: ANALOG AND DIGITAL COMMUNICATION

Time: 3Hours **Max. Marks:100**

General Instructions:

IMP: Verify that you have received question paper with correct course, code, branch etc.

1. *This Question paper comprises of three Sections -A, B, & C. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*
2. *Maximum marks for each question are indicated on right hand side of each question.*
3. *Illustrate your answers with neat sketches wherever necessary.*
4. *Assume suitable data if necessary.*
5. *Preferably, write the answers in sequential order.*
6. *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. In Phase Modulation, modulation index is equal to (CO1) 1

(a) Max frequency deviation

(b) Max phase deviation.

(c) Ratio of max frequency deviation and max modulating frequency.

(d) None

1-b. A modulation index of 0.5 would be same as (CO1) 1

(a) 0.5% of Modulation Depth

(b) 1/2% of Modulation Depth

(c) 5% of Modulation Depth

(d) 50% of Modulation Depth

1-c. Non-coherent version of PSK is (CO2) 1

(a) DPSK

(b) BPSK

(c) QPSK

(d) 8-PSK

1-d. In coherent detection (CO2) 1

(a) receiver carrier is synchronized with transmitter carrier

(b) receiver carrier is not synchronized with transmitter carrier

(c) receiver carrier is synchronized in phase only with transmitter carrier

(d) receiver carrier is synchronized in frequency only with transmitter carrier

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

(a) Lower

(b) Same

(c) Higher

(d) Not Predictable

1-f. Which has same probability of error? (CO3) 1

(a) BPSK and QPSK

(b) BPSK and ASK

(c) BPSK and PAM

(d) BPSK and QAM

1-g. A source produces 4 symbols with probability 1/2, 1/4, 1/8, 1/8. Average code word length is 2 bits/symbol. The efficiency of code (CO4) 1

(a) 1

(b) 7/8

(c) 1/2

(d) 1/4

1-h. Information rate is defined as (CO4) 1

(a) Information per unit time

(b) Average number of bits of information per second

(c) (r)x(H)

(d) All of above

1-i. The hamming distance between 100 and 001 is…….. (CO5) 1

(a) 2

(b) 0

(c) 1

(d) None of the mentioned

1-j. In……coding, we divide our message into blocks, each of k bits, called…… (CO5) 1

(a) block, block-words

(b) linear, data-words

(c) block, data-words

(d) None of the mentioned

2. Attempt all parts:-

2.a. Discuss need of modulation in a communication process. (CO1) 2

2.b. Draw RZ unipolar & NRZ bipolar line coding waveforms for digital data 11000110. (CO2) 2

2.c. Discuss properties of a matched filter. (CO3) 2

2.d. Define: (i) Entropy (ii) Channel capacity (CO4) 2

2.e. What is Hamming Distance and Hamming Weight? (CO5) 2

SECTION – B 30

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

3-a. Explain FM generation with the aid of suitable diagram. (CO1) 6

3-b. Explain with the help of block diagram the elements of communication systems. (CO1) 6

3-c. Discuss generation and detection of BASK signal through block diagram. (CO2) 6

3-d. What is PCM? Draw its block diagram and explain it. (CO2) 6

3-e. Explain the concept of Frequency Hopping Spread Spectrum. (CO3) 6

3-f. Apply Shanon Fano coding on following. Find average code-word length.(CO4) 6

$\{X\} = \{x_1, x_2, x_3, x_4, x_5, x_6, x_7\}$ and probability p is given

$\{p\} = \{0.40, 0.2, 0.12, 0.08, 0.08, 0.08, 0.04\}$

3-g. Design a syndrome encoder for (7, 4) hamming code with suitable example. (CO5) 6

SECTION – C 50

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

4-a. What do you understand by PM? Explain with proper diagram, waveform and expressions. (CO1) 10

4-b. A sinusoidal carrier of 20V, 2 MHz is frequency modulated by a sinusoidal message signal of 5V, 25 KHz with kf = 50 KHz/volt. Find; i) Δf, β, BW, and power. ii) Repeat the above if message signal amplitude is doubled. (CO1) 10

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

5-a. What is Time division multiplexing (TDM)? How TDM is advantageous over FDM. Comment. (CO2) 10

5-b. Determine the Nyquist rate for a continuous-time signal x (t) = 6 cos (150πt) + 20 sin (400πt) - 10 cos (100πt). (CO2) 10

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

6-a. What is Matched Filter? Calculate the impulse response for the matched filter.(CO3) 10

6-b. What are spread spectrum techniques? Explain in detail about Direct Sequence Spread Spectrum Techniques with necessary diagrams? (CO3) 10

7. Answer any <u>one</u> 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, and m2. Their probabilities are 1/2, 1/4 and 1/4 respectively. Calculate the source entropy. (CO4) 10

7-b. Define AWGN. Given an AWGN channel with 4kHz 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) 10

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

8-a. For the message 10110, design convolutional code tree.(CO5) 10

8-b. Consider the (7, 3) cyclic generated by G (p) = p^4+ p^3+ p^2+p^1. Find various code words of this code in systematic and non-systematic form.(CO5) 10