Printed Page:- 04 **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 (2022-2023 **)**

Subject: Analog and Digital Communication

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

General Instructions:

IMP: *Verify that you have received the question paper with the 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. The equation of the FM signal is 10 cos [$2\pi \times 10^6$ t +5 sin ($2\pi \times 10^3$ t)]. The modulating frequency is: CO1 1

(a) 10^6 Hz

(b) 5 Hz

(c) 10^3 Hz

(d) 2 Hz

1-b. The general equation for FM for sinusoidal message signal is CO1 1

(a) X(t) = Ac cos θi (t)

(b) X(t) = Ac cos[Wc t + K_f m(t)]

(c) X(t) = Ac cos[Wc t + βsin Wm t]

(d) X(t) = Ac cos[Wc t + βcos Wm t]

1-c. Dynamic range of a signal is 8V. It is passed through a 4 levels PCM system. Quantization error will be CO2 1

(a) 1V

(b) 0.5V

(c) 2V

(d) 0.25V

1-d. Bandwidth of PCM is equal to CO2 1

(a) n fs/2

(b) fs

(c) 0

(d) none

1-e. The probability of error of DPSK is _____ than that of BPSK. CO3 1

(a) Higher

(b) Lower

(c) Same

(d) Not predictable

1-f. In Binary Phase Shift Keying system, the binary symbols 1 and 0 are represented by carrier with phase shift of CO3 1

(a) π/2

(b) π

(c) 2π

(d) 0

1-g. Assume the source is designed to send two symbols but due to some error in the circuit it is emitting only one symbol. The information content of that source (in bits) is CO4 1

(a) 0

(b) 1

(c) 0.5

(d) none of these

1-h. Consider a binary memory less source X with four message signals x1, x2, x3 and x4. If the entropy H(X) is equal to 2 bits/symbol, then the probability of occurrence of symbol x3 is equal to CO4 1

(a) 1/4

(b) 3/4

(c) 1/2

(d) 1

1-i. Which operates on continuous stream of data? CO5 1

(a) Block codes

(b) Convolutional codes

(c) Block & Convolutional codes

(d) None of the mentioned

1-j. The most common hamming codes are a generalized version of..... CO5 1

(a) Hamming(7, 4) code

(b) Hamming(8, 4) code

(c) Hamming(6, 3) code

(d) Hamming(5, 7) code

2. Attempt all parts:-

2.a. What are the differences between Frequency modulation and Amplitude modulation? CO1 2

2.b. What is the need of line coding? CO2 2

2.c. Draw the signal space diagram of BASK signal. CO3 2

2.d. Define DMC. CO4 2

2.e. Define Hamming codes. CO5 2

SECTION B **30**

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

3-a. An AM transmitter radiates 9K Watts of power when the carrier is unmodulated and 10.125K Watts when the carrier is sinusoidally modulated. Find the modulation index, percentage of modulation. Now, if another sine wave, corresponding to 40 percent modulation is transmitted simultaneously, then calculate the total radiated power. CO1 6

3-b. What do you mean by phase modulated wave? Derive its equation with neat diagram and spectrum. What are the differences between Phase modulation and Frequency modulation? CO1 6

3-c. Draw the block diagram of the transmitter and receiver of PCM. CO2 6

3-d. Differentiate digital and analog modulation in brief. CO2 6

3.e. Define BER and calculate error probability in the case of BFSK. CO3 6

3.f. Explain Source coding theorem. CO4 6

3.g. What is constraint length for convolutional encoders? CO5 6

SECTION C **50**

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

4-a.	List the degeneration techniques of FM. Explain any one of them. CO1	10
4-b.	List the degeneration techniques of AM. Explain any one of them. CO1	10

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

5-a.	Draw and explain the block diagram of DPSK transmitter and receiver. Write its advantages ang disadvantages. CO2	10
5-b.	Determine the Nyquist rate for a continuous-time signal $x(t) = 6 \cos 150\pi t + 20 \sin 400\pi t - 10 \cos 100\pi t$ CO2	10

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

6-a.	Explain in detail the sources of noise and types of noise. CO3	10
6-b.	Explain BASK and derive an expression for error probability for BASK. CO3	10

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

7-a.	Explain different kind of channels and how to design channel matrix. CO4	10
7-b.	Show that a 'n' letter discrete memoryless source has maximum entropy of Log_2 (n). CO4	10

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

8-a.	For a Hamming distance of 5, how many errors can be detected and how many can be corrected? What do you understand by Syndrome decoding? CO5	10
8-b.	Consider the following (k+1, k) systematic linear block code with the parity check digit Ck+1 given by Ck+1 = d1 + d2 + d3 + ...+dk. (i) Construct the appropriate generator matrix for this code. (ii) Determine the error detecting or correcting capabilities of this code. CO5	10