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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: IV - CARRY OVER THEORY EXAMINATION - APRIL 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

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1. Attempt all parts:-

1-a. The carrier and modulating signals are $A_c \cos \omega_c t$ and $A_m \cos \omega_m t$ the AM signal is: (CO1) 1

- (a) $A_c (1 + m \cos \omega_c t)$
- (b) $A_c (1 + m \cos \omega_m t) \cos \omega_c t$
- (c) $A_m (1 + m \cos \omega_c t) \cos \omega_m t$
- (d) $A_m (1 + m \cos \omega_m t) \cos \omega_c t$

1-b. Carson's rule is used to calculate: (CO1) 1

- (a) bandwidth of FM signal
- (b) signal to noise ratio
- (c) modulation index
- (d) noise figure

1-c. In time division, connection is established using: (CO2) 1

- (a) data exchange
- (b) galvanic connection

- (c) data exchange & galvanic connection
- (d) none of the mentioned
- 1-d. Which of the following digital modulation can be decoded non coherently? (CO2) 1
- (a) QAM
- (b) APSK
- (c) BPSK
- (d) BFSK
- 1-e. The BPSK signal has +V volts and -V volts respectively to represent (CO3) 1
- (a) 1 and 0 logic levels
- (b) 11 and 00 logic levels
- (c) 10 and 01 logic levels
- (d) 00 and 11 logic levels
- 1-f. Whose bandwidth is maximum? (CO3) 1
- (a) PSK
- (b) ASK
- (c) FSK
- (d) DPSK
- 1-g. The method of converting a word to stream of bits is called as. (CO4) 1
- (a) Binary coding
- (b) Source coding
- (c) Bit coding
- (d) Cipher coding
- 1-h. Read the following expression regarding mutual information $I(X;Y)$. Which of the following expressions is/are correct: 1
- (a) $I(X;Y) = H(X) - H(Y/X)$
- (b) $I(X;Y) = H(X) - H(X/Y)$
- (c) $I(X;Y) = H(X) + H(Y) - H(X,Y)$
- (d) $I(X;Y) = H(X) + H(Y) + H(X,Y)$ (CO4)
- (a) (a) and (c)
- (b) (b) and (c)
- (c) (c) and (d)
- (d) (a) and (d)
- 1-i. The divisor in a cyclic code is normally called the (CO5) 1

- (a) degree
- (b) generator
- (c) redundancy
- (d) None of the mentioned

1-j.	The syndrome depends only (CO5)	1
	(a) Transmitted code word	
	(b) Error pattern	
	(c) Receive code word	
	(d) Parity pattern	

2. Attempt all parts:-

2.a.	How antenna height is reduced by modulation? (CO1)	2
2.b.	What is Amplitude Shift keying? (CO2)	2
2.c.	Define Noise. (CO3)	2
2.d.	Explain the significance of the entropy $H(X/Y)$ of a communication system where X is the transmitter and Y is the receiver. (CO4)	2
2.e.	What do you mean by generator matrix? (CO5)	2

SECTION B

30

3. Answer any five of the following:-

3-a.	1200W is contained at the carrier frequency of an AM signal. Determine the power content of each of the sidebands for each of the following percent modulations: (a) 40%, (b) 50%, (c) 75%, (d) 100% (CO1)	6
3-b.	Derive an expression of single-tone AM signal, sketch the spectrum. Define Modulation Index and derive expression for BW and Modulation Efficiency. (CO1)	6
3-c.	Explain sampling process and its type. (CO2)	6
3-d.	What are the major drawbacks of PSK? (CO2)	6
3.e.	What do you understand by spread spectrum communication? Explain the two types of spread spectrum modulation techniques. (CO3)	6
3.f.	Write short notes on concept of information. (CO4)	6
3.g.	Compare different ARQ systems on the basis of their operation and performance. (CO5)	6

SECTION C

50

4. Answer any one of the following:-

- 4-a. Explain Frequency Division Multiplexing. (CO1) 10
- 4-b. An AM signal in which the carrier is modulated upto 70%, contains 1500W at the carrier frequency. Determine the power content of the upper and lower sidebands for this percentage of modulation. Calculate the power at the carrier and the power content of each of the sidebands when the percentage modulation drops to 50%. (CO1) 10

5. Answer any one of the following:-

- 5-a. What is transmission bandwidth of PCM system? What is quantisation error and explain why instead of quantisation error, the PCM system is immune to external Noise? (CO2) 10
- 5-b. Draw the Transmitter and Receiver Block diagram for BFSK signal. Show the BFSK signal in the orthogonal plane. (CO2) 10

6. Answer any one of the following:-

- 6-a. Find the noise voltage at the input of a television RF amplifier, using a device that has a 200 ohm equivalent noise resistance and a 300 ohm input resistor. The bandwidth of the amplifier is 6MHz. The operating temperature of the amplifier is 290 degree kelvin. (CO3) 10
- 6-b. Explain the elements of block diagram for spread spectrum communication. (CO3) 10

7. Answer any one of the following:-

- 7-a. Develop Shannon-Fano code for five messages given by probabilities $1/2, 1/4, 1/8, 1/16, 1/16$. Calculate the average no. of bits/messages. (CO4) 10
- 7-b. A discrete memoryless source has five symbols x_1, x_2, x_3, x_4 and x_5 with probabilities $p(x_1) = 0.4, p(x_2)=0.19, p(x_3)=0.16, p(x_4)=0.14$ and $p(x_5)=0.11$. Construct the Shannon-Fano code for this source. Calculate the average code length and coding efficiency of the source. (CO4) 10

8. Answer any one of the following:-

- 8-a. 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
- 8-b. Design a syndrome calculator for a (7,4) cyclic Hamming code generated by the polynomial $G(p) = p^3 + p + 1$. Evaluate the syndrome for $Y = (1001101)$. (CO5) 10