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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 (2024 - 2025)

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

- | | | |
|------|---|----|
| 1. | Attempt all parts:- | 20 |
| 1-a. | The function of multiplexing is (CO1, K1) | 1 |
| | (a) to reduce the bandwidth of the signal to be transmitted | |
| | (b) to combine multiple data streams over a single data channel | |
| | (c) to allow multiple data streams over multiple channels in a prescribed format | |
| | (d) to match the frequencies of the signal at the transmitter as well as the receiver | |
| 1-b. | The Bandwidth of Amplitude Modulation is ____ (CO1, K1) | 1 |
| | (a) f_m | |
| | (b) $f_m/2$ | |
| | (c) $f_m/4$ | |
| | (d) $2f_m$ | |
| 1-c. | In a delta modulation system, granular noise occurs when the: (CO2, K2) | 1 |
| | (a) modulating signal increases rapidly | |
| | (b) pulse rate decreases | |
| | (c) pulse amplitude decreases | |
| | (d) modulating signal remains constant | |
| 1-d. | In BASK, distance between the signaling points is (CO2, K2) | 1 |
| | (a) $\sqrt{E_b}$ | |
| | (b) $\sqrt{2E_b}$ | |

- (c) $2\sqrt{E_b}$
- (d) None of the mentioned
- 1-e. The bandwidth of BFSK is _____ than BPSK. (CO3, K1) 1
- (a) Lower
- (b) Same
- (c) Higher
- (d) Not predictable
- 1-f. DSSS system spreads the baseband signal by _____ the baseband pulses with a pseudo noise sequence. (CO3, K1) 1
- (a) Adding
- (b) Subtracting
- (c) Multiplying
- (d) Dividing
- 1-g. The method of converting a word to stream of bits is called as..... (CO4, K1) 1
- (a) Binary coding
- (b) Source coding
- (c) Bit coding
- (d) Cipher coding
- 1-h. The channel capacity is measured in terms of: (CO4, K1) 1
- (a) bits per channel
- (b) number of input channels connected
- (c) calls per channel
- (d) number of output channels connected
- 1-i. How error detection and correction is done? (CO5, K2) 1
- (a) By passing it through equalizer
- (b) By passing it through filter
- (c) By amplifying it
- (d) By adding redundancy bits
- 1-j. The hamming distance between 100 and 001 is.....(CO5, K2) 1
- (a) 2
- (b) 0
- (c) 1
- (d) None of the mentioned

2. Attempt all parts:-

- 2.a. Name the elements of Communication system. (CO1, K1) 2
- 2.b. What is Amplitude Shift Keying? (CO2, K1) 2
- 2.c. What do you mean by BER? (CO3, K2) 2

- 2.d. Calculate the entropy of source with a symbol set containing 64 symbols each with a probability $p_i = 1/64$. (CO4, K3) 2
- 2.e. Define Syndrome Decoding. (CO5, K1) 2

SECTION-B

30

3. Answer any five of the following:-

- 3-a. Derive an expression for a single tone AM and draw its spectrum. Also derive its power expression. (CO1, K4) 6
- 3-b. For the FM signal $m(t) = 10 \cos [2\pi (10^6)t + 5 \sin 2\pi (10^3)t]$. Find the (i) modulation index (ii) modulating frequency (iii) carrier frequency (iv) amplitude of carrier. (CO1, K3) 6
- 3-c. What is Pulse Code Modulation technique? Explain the Bandwidth requirements in PCM. (CO2, K2) 6
- 3-d. Explain the generation of a FSK with the help of waveform and block diagram. (CO2, K2) 6
- 3.e. What are the different sources of noise? Explain in detail. (CO3, K2) 6
- 3.f. Elaborate Shannon – Hartley theorem of channel capacity and prove (CO4, K4) 6
- $$C_{\infty} = 1.44 \frac{S}{\eta}$$
- 3.g. Explain syndrome decoding for linear block codes in detail. (CO5, K2) 6

SECTION-C

50

4. Answer any one of the following:-

- 4-a. Explain Frequency Division Multiplexing using block diagram. (CO1, K2) 10
- 4-b. A) A 400watt carrier is modulated to a depth of 75%. Calculate total power in the modulated wave. B) A broadcast radio transmitter radiates 10 Kilowatt when modulation percentage is 60%. How much of this is carrier power? (CO1, K3) 10

5. Answer any one of the following:-

- 5-a. What is line coding? Why it is needed? Explain with diagram different types of line coding techniques. (CO2, K2) 10
- 5-b. Explain the generation and coherent detection of ASK with the help of waveform and block diagram. (CO2, K2) 10

6. Answer any one of the following:-

- 6-a. What is noise? Explain various types of noise in communication. (CO3, K2) 10
- 6-b. What are spread spectrum techniques? Explain in detail about Direct Sequence Spread Spectrum Techniques with necessary diagrams? (CO3, K2) 10

7. Answer any one of the following:-

- 7-a. A source produces six message with probabilities $1/4, 1/4, 1/8, 1/8, 1/8, 1/8$ respectively. Obtain the information content of each message and the entropy of the source. (CO4, K3) 10
- 7-b. Write note on following: a) Kraft's inequality, b) Code efficiency, c) Codeword 10

Length, d) Shannon's code. (CO4, K2)

8. Answer any one of the following:-

- 8-a. For a Hamming distance of 5, how many errors can be detected and how many can be corrected? (CO5, K3) 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, K5) 10

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