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Subject Code:- BEC0401

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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 (20..... - 20.....)

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 modulation index of AM with carrier voltage V_c and modulating Voltage V_m is:(CO1,K2) 1
- (a) V_m/V_c
(b) V_c/V_m
(c) V_m
(d) $K_a V_c$
- 1-b. The function of multiplexing is (CO1,K2) 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-c. B.W. of DPSK is (CO2,K2) 1
- (a) $2R_b$
(b) $R_b/2$
(c) R_b
(d) None of the mentioned
- 1-d. 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-e. In Binary Phase Shift Keying system, the binary symbols 1 and 0 are represented by carrier with phase shift of (CO3,K2) 1
- (a) $\pi/2$
- (b) π
- (c) 2π
- (d) 0
- 1-f. The probability of error of DPSK is _____ than that of BPSK. (CO3,K2) 1
- (a) Higher
- (b) Lower
- (c) Same
- (d) Not predictable
- 1-g. Five source messages are probable to appear as $p(m_1) = 0.4$, $p(m_2) = 0.15$, $p(m_3) = 0.15$, $p(m_4) = 0.15$, $p(m_5) = 0.15$. The efficiency of Huffman code is _____ %.(CO4,K2) 1
- (a) 98.68
- (b) 97.6
- (c) 97.4
- (d) none of these
- 1-h. A communication channel with additive white Gaussian noise, has a bandwidth of 4 kHz and SNR of 15. Its channel capacity is _____ KBPS. (CO4,K2) 1
- (a) 2
- (b) 4
- (c) 15
- (d) 16
- 1-i. The hamming distance between equal codewords is..... (CO5,K2) 1
- (a) 1
- (b) n
- (c) 0
- (d) None of the mentioned
- 1-j. To guarantee the detection upto 5 errors in all cases, the minimum hamming distance in a block code must be.....(CO5,K2) 1
- (a) 5
- (b) 6
- (c) 11
- (d) None of the mentioned

2. Attempt all parts:-

- 2.a. How antenna height is reduced by modulation? (CO1,K2) 2
- 2.b. State any two disadvantages of PSK modulation technique.(CO2,K1) 2
- 2.c. Define pseudorandom noise sequence.(CO3,K1) 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. Calculate Hamming Weight of codeword $C = 0110000$. (CO5,K3) 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,K2) 6
- 3-b. 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,K2) 6
- 3-c. What is NRZ and RZ encoding techniques? Explain by drawing the waveforms. (CO2,K1) 6
- 3-d. Draw the block diagram of the transmitter and receiver of PCM. (CO2,K2) 6
- 3.e. Define processing gain or spreading factor and write down the difference between fast hopping and slow hopping.(CO3,K1) 6
- 3.f. A discrete memory less source X has four symbols x_1, x_2 , and x_3 with probabilities $P(x_1) = 0.4, P(x_2) = 0.2, P(x_3) = 0.2$. Calculate entropy.(CO4,K3) 6
- 3.g. Design a block code with a minimum distance of three & message block of eight bits. (CO5,K6) 6

SECTION-C

50

4. Answer any one of the following:-

- 4-a. Expression of an AM wave is $S_{AM}(t) = 50 [1 + 0.8 \cos(400\pi t)] \cos 2\pi \times 10^5 t$, Determine the carrier frequency f_c , modulating frequency f_m , and modulation index.(CO1,K2) 10
- 4-b. Derive an expression of single-tone FM signal, sketch the spectrum, Define Modulation Index and derive expression for BW and Modulation Efficiency.(CO1,K1) 10

5. Answer any one of the following:-

- 5-a. Find the Nyquist rate and the Nyquist interval for the signal $x(t) = \frac{1}{2\pi} \cos(4000\pi t) \cos(1000\pi t)$. (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. Define spread spectrum. What is the main idea of direct sequence spread spectrum? Explain disadvantages of direct sequence spread spectrum?(CO3,K1) 10

6-b. What is the concept of Matched Filter ? Calculate the probability of error for the matched filter. (CO3,K1) 10

7. Answer any one of the following:-

7-a. Design binary Huffman code for a discrete source of five independent symbols A, B, C, D, and E with probabilities 0.4, 0.2, 0.3, 0.8, and 0.02 respectively such that the variance of code word length is minimum.(CO4,K6) 10

7-b. A DMS X has six symbols X1, X2, X3, X4, X5 and X6 with probabilities $P(X1) = 0.30$, $P(X2) = 0.25$, $P(X3) = 0.20$, $P(X4) = 0.12$, $P(X5) = 0.08$ and $P(X6) = 0.05$ respectively. Construct one shannon-Fano code for X. (CO4,K6) 10

8. Answer any one of the following:-

8-a. For the message 10110, design convolutional code tree. (CO5,K6) 10

8-b. **The generator matrix for a (6, 3) block code is given below. Find all the code words for this block code. (CO5,K5)** 10

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 \end{bmatrix}$$

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