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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech (ECE-Working Professional)

SEM: II - 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

20

1. Attempt all parts:-

- 1-a. Frequency range of voice signal is(CO1,K2) 1
- (a) 0 - 4.5MHz
 - (b) 20Hz - 20kHz
 - (c) 300Hz - 3.5kHz
 - (d) Either 'a' or 'b'
- 1-b. Frequency division multiplexing is used for(CO1,K3) 1
- (a) Digital signal
 - (b) Discrete signal
 - (c) Continuous signal
 - (d) None of them
- 1-c. In which modulation technique does the phase of the carrier signal is changed by varying the sine and cosine inputs at a particular time?(CO2,K2) 1
- (a) frequency modulation
 - (b) phase shift key modulation
 - (c) Analog modulation
 - (d) PCM
- 1-d. How many quantization voltage levels are present in a PCM signal?(CO2,K2) 1
- (a) 0
 - (b) 2^{-n}

- (c) n^2
 (d) 2^n
- 1-e. In FHSS(CO3,K2) 1
- (a) A carrier frequency is shifted in discrete increments in a pattern dictated by a code sequence.
 (b) A carrier frequency is not shifted in discrete increments in a pattern dictated by a code sequence.
 (c) A carrier frequency is shifted in discrete increments in a pattern dictated by a message signal.
 (d) none
- 1-f.is a type of digital modulation. (CO3,K2) 1
- (a) Amplitude modulation
 (b) Frequency modulation
 (c) Phase modulation
 (d) Frequency Shift Keying
- 1-g. The noiseless channel will have an.....capacity. (CO4,K2) 1
- (a) infinite
 (b) finite
 (c) 0
 (d) 1
- 1-h. If the SNR of 8 kHz white bandlimited Gaussian channel is 25 dB the channel capacity is:(CO4,K2) 1
- (a) 2.40 kbps
 (b) 46.84 kbps
 (c) 66.47 kbps
 (d) 26.84 kbps
- 1-i. The.....of errors is more difficult than the..... (CO5,K2) 1
- (a) correction, detection
 (b) detection, correction
 (c) creation, correction
 (d) creation, detection
- 1-j. In.....error correction, the receiver asks the sender to send the data again.(CO5,K2) 1
- (a) backward
 (b) retransmission
 (c) forward
 (d) None of the mentioned

2. Attempt all parts:-

- | | | |
|------|---|---|
| 2.a. | Define FDM. (CO1,K1) | 2 |
| 2.b. | What is Amplitude Shift Keying? (CO2,K1) | 2 |
| 2.c. | What is direct sequence spread spectrum?(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 $C = 0110100$.(CO5,K3) | 2 |

SECTION-B

30

3. Answer any five of the following:-

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|------|---|---|
| 3.a. | A 107.6 MHz carrier signal is frequency modulated by a 7kHz sine wave . The resultant FM signal has a frequency deviation of 50 kHz. Determine the modulation index and the carrier swing of the FM wave.(CO1,K2) | 6 |
| 3.b. | Derive an expression of single -tone AM signal, sketch the spectrum, define Modulation Index and derive expression for BW. (CO1,K1) | 6 |
| 3.c. | What do u mean by polar and unipolar line coding techniques?(CO2,K2) | 6 |
| 3.d. | What is NRZ and RZ encoding techniques? Explain by drawing the waveforms. (CO2,K1) | 6 |
| 3.e. | Elaborate spread spectrum techniques and its type in details.(CO3,K2) | 6 |
| 3.f. | Elaborate types of channels in information theory. (CO4,K2) | 6 |
| 3.g. | Giving block diagram, explain the operation of any convolutional encoder.(CO5,K2) | 6 |

SECTION-C

50

4. Answer any one of the following:-

- | | | |
|------|---|----|
| 4-a. | 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,K3) | 10 |
| 4-b. | Derive an expression of single-tone AM 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. | A Television signal having a bandwidth of 4.2 MHz is transmitted using binary PCM system. Given that the number of quantisation levels is 512.Determine: i) Code word Length, ii) Transmission bandwidth iii) Final Bit rate(CO2,K2) | 10 |
| 5-b. | A bandpass signal has spectral range that extends from 20 to 82 KHz.Find the acceptable range of sampling frequency f_s .(CO2,K2) | 10 |

6. Answer any one of the following:-

- | | | |
|------|---|----|
| 6-a. | Explain BPSK and derive an expression for error probability for BPSK.(CO3,K2) | 10 |
| 6-b. | Prove that the maximum signal to noise ratio for the matched filter is found to be, | 10 |

$$\text{Max}\left(\frac{S}{N}\right)_o = 2\left(\frac{E}{N_o}\right)$$

(, K3)(CO3,K2)

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,K3) 10
- 7-b. A source produces six message with probabilities 1/4, 1/4, 1/8, 1/8, 1/8, and 1/8 respectively. Obtain the information content of each message and the entropy of the source. (CO4,K2) 10

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,K2) 10
- 8-b. Draw the code tree for the given input sequence 11010 for encoder N =3 and L Modulo 2 Adder = 2. (CO5,K2) 10

REG: JAN_JUN-2025