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MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY BHOPAL
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

EXAMINATION: END TERM **MONTH and YEAR: May 2025**

Course: B.Tech **Semester:** IV **Subject Code:** CSE-224
Subject Name: Data Communication **Maximum Marks:** 50
Duration: 180 mins **Date:** 15/05/2025 **Time:** 8:00 AM to 11:00 AM

Note: Attempt all questions. Assume missing data (if any) and mention the assumptions.

Q. No.	Questions	Marks	COs
1.	**a.** What are the three major causes of transmission impairments that can occur in data communication systems. For each type, describe the causes, effects on signal integrity and quality. Provide suitable diagrams and real-world examples where applicable. **b.** Consider a channel having a bandwidth of 10-MHz bandwidth. The signal to noise ratio on db scale is 18. Calculate the appropriate bit rate and signal level? Suggest practical applications of this type of analysis.	5 + 5	CO1
2.	**a.** Why baseline wandering is a serious concern in line coding schemes? Illustrate your answer by encoding suitable digital data using the line coding scheme that suffers from baseline wandering problem. Further, propose a solution to rectify this problem. Demonstrate your solution using the previously considered digital data. For the given 11-bit binary sequence 01101000111, provide signal diagrams illustrating the representations of the sequence using AMI and Pseudoternary encoding method and calculate the number of signal transitions in each case. **b.** In an encoding scheme, every 4 bits of data are encoded in a 5 bit codeword. It is required that in the codeword there must be at most 1 leading and at most 1 trailing 0. How many such codewords are possible?	5 +5	CO2
3.	**a.** Elucidate the principle and operational mechanism of Amplitude Shift Keying (ASK) within the domain of digital communication systems. Support your explanation with a well-annotated diagram highlighting the relationship between digital input signals and the corresponding amplitude variations of the carrier wave. A digital communication system uses Binary ASK to transmit data over a channel that occupies a bandwidth of 80 kHz, ranging from 120 kHz to 200 kHz. If the modulation index $d = 0.5$, determine: (i) The bit rate supported by the system. (ii) The center (carrier) frequency used for modulation. (iii) If the system transmits a message containing 10,000 bits, calculate the total transmission time. **b.** Consider a Multilevel Frequence Shift Keying scheme implemented to transmit 4 bits at a time. The bits are transmitted at a rate of 128 Mbps. Assume the initial frequency of the bandwidth is 100 MHz and the value of factor d which depends on the modulation and filtering process is 0. Calculate the total bandwidth and the different carrier frequencies required for data transmission	5+5	CO2
4.	**a.** A communication system has five input sources, each generating 500 words per second. Each word is of size 8 bytes. The multiplexer uses word-level interleaving, and 1 synchronizing bit is added to each frame. Based on this configuration, calculate the following: (i) What is the data rate of each source (in bits per second)? (ii) What is the frame rate of the multiplexer? (iii) What is the duration of each frame?	5+5	CO3

(iv) How many bits are there in each frame (including the synchronizing bit)?
(v) What is the overall data rate of the link?

b. An analog signal: $x(t)=5\sin(2\pi 1000t)$ is sampled and encoded using PCM with the following parameters:

- Signal frequency: 1 kHz
- Sampling frequency: 8 kHz
- Quantization levels: 16 ($\rightarrow$ 4 bits per sample)
- Signal amplitude range: ±40 V (i.e., from -40 V to +40 V)
- Uniform quantization

Calculate: i) The sampling interval, ii) The quantization step size, iii) ~~Final PCM Encoded Sequence~~ PCM for initial 5 symbols

5. **a.** Explain the process to generate Hamming Code, generate the hamming code for message 1111, after generating hamming code, assume that 4th bit from right get corrupted. Identify same bit position as error position through hamming code.

7th	6th	5th	4th Error	3rd	2nd	1st

5 + 5 **CO4**

b. Apply 2D parity check over given 32-bit sequence, in a manner that offers minimum overhead bits. During transmission (data + overhead bits), if 8th and 9th bit (from left) get in error, detect these errors.
Bit Sequence: 11001100 11001100 11001100 11001100

**********END**********