

Assignment 4
Marks 20
Answer any two

1. i) Five sensors with data rates of 96 Kbps, 48 Kbps, 48 Kbps, 192 Kbps, and 96 Kbps send their data to a central hub using a TDM scheme. A synchronization bit is added for every frame. If the channel capacity is 480 Kbps, design the frame structure and visually represent the MUX input and output. Discuss the importance of maintaining synchronization for real-time sensor data collection. [5]

ii) A communication system has 5 channels, each requiring 100 kHz bandwidth. The total available bandwidth for multiplexing is 600 kHz. How many guard bands are necessary, and what will be their total bandwidth? [5]
2. FOUR channels, with bit rates of 300 kbps, 200 kbps, 200 kbps, and 100 kbps respectively, are to be multiplexed, with 3 interleaved bits, and 1 synchronization bit per frame. **You can use pulse stuffing for ONE input channel only.** Based on this, answer the following questions. [10]
 - a) Draw the TDM scheme.
 - b) Find the input bit duration for each source.
 - c) Determine the input slot duration for each connection.
 - d) Calculate the frame rate.
 - e) Determine the size of a frame in bits.
 - f) What is the output data rate of the system?
 - g) Calculate the output bit duration.
 - h) Calculate the output slot duration.
 - i) What is the duration of a frame?
3. Suppose we are using a (2,5) encoding scheme and the assignment of datawords to codewords are as follows: [10]

Datawords	Codewords
00	00000
01	01011
10	10101
11	11110

- i) What is the minimum Hamming distance?
- ii) How many bits can be corrected and detected by guarantee?

- iii) The receiver receives 01001. Can this codeword be corrected? Explain.
- iv) The receiver receives 01000. Can this codeword be corrected? Explain.

4. i) A sender and receiver are using the CRC method for error control. Given the divisor is $x^3 + x^2 + 1$ and the dataword is $x^7 + x^6 + x^4 + x$, find the codeword that is sent to the receiver using **Binary Division**. [5]
- ii) Now, on the receiver side, verify if the received data was corrupted or not during the transmission using **Polynomial Division**. State your conclusion along with the reasoning. [5]