



American International University- Bangladesh (AIUB)
Faculty of Engineering

Course Name: Data Communication
Semester: Fall 2023
Total Marks: 30

Course Code: COE 3201
Term: Final
Submission Date: 23-11-2023
Assignment: 02/OBE

Course Outcome Mapping with Questions

Item	COs	POIs	K	P	A	Marks	Obtained Marks
Q1	CO4	P.f.2.C6	K7	P1, P3, P7		30	
Total:						30	

Student Information:

Student Name:	Student ID:
Section:	Department:

Marking Rubrics (to be filled by Faculty):

	Excellent [15]	Proficient [12]	Good [10]	Acceptable [7]	Unacceptable [5]	No Response [0]	Secured Marks
Problem	Detailed unique response explaining the concept properly and answer is correct with all works clearly shown.	Response with no apparent errors and the answer is correct, but explanation is not adequate/unique.	Response shows understanding of the problem, but the final answer may not be correct	Partial problem is solved; response indicates part of the problem was not understood clearly.	Unable to clarify the understanding of the problem and method of the problem solving was not correct	No Response/(Copied/identical submissions will be graded as 0 for all parties concerned)	
1							
2							
Comment						Total marks (30)	

Use your ID (ID = AB-CDEFG-H)

(For example: If B=1, C=2 and E=1, BCE= 121)

1. A voice channel occupies a bandwidth of **BCE** kHz. Three voice channels are multiplexed together using FDM (Frequency Division Multiplexing).

(a) Propose the minimum required Bandwidth for the setup mentioned above.

(b) Design the configuration of multiplexing and demultiplexing process as an illustration using the above voice channels, bandwidth and the guard bands with proper labeling (choose carrier frequency range of your preference according to the Bandwidth).

(a) Minimum Required Bandwidth Calculation:

The formula for the minimum bandwidth in FDM is given by:

$$\text{Minimum Bandwidth} = \sum_{i=1}^n (\text{Channel bandwidth}_i) + \text{Guard Bands}$$

Given:

- Each voice channel bandwidth = 141 kHz
- Number of channels (n) = 3
- Guard band on each side of each channel = 10 kHz

Substitute the values:

$$\text{Minimum Bandwidth} = 3 \times 141 \text{ kHz} + 2 \times 10 \text{ kHz} + 2 \times 10 \text{ kHz}$$

$$\text{Minimum Bandwidth} = 423 \text{ kHz} + 20 \text{ kHz}$$

$$\text{Minimum Bandwidth} = 443 \text{ kHz}$$

So, the minimum required bandwidth for the FDM setup is 443 kHz.

(b) Configuration of Multiplexing and Demultiplexing:

For simplicity, let's choose the carrier frequency range from 0 to 443 kHz. The individual frequency ranges for each voice channel are:

- Voice Channel 1: 0 kHz to 141 kHz
- Voice Channel 2: 153 kHz to 294 kHz
- Voice Channel 3: 306 kHz to 447 kHz

We have left 9 kHz guard bands on both sides of each channel to avoid interference.

Illustration of FDM Configuration:



In the multiplexing process, the signals from each channel are combined to form a composite signal. In the demultiplexing process, these signals are separated back into their original channels.

This configuration ensures that each voice channel gets its allocated bandwidth without interference from neighboring channels, and the guard bands help prevent crosstalk between adjacent channels.

This detailed explanation covers the calculation and illustration steps for the FDM setup. If you have any specific questions or if there's anything else you'd like to discuss, feel free to ask!