Course: Data Communications Lab
Group : 6
Semester: Fall 2025–26

TITLE :

BASK-Based Digital Signal Transmission with FDM: From Binary to ASCII Recovery

Topic:

Binary Amplitude Shift Keying (BASK) Modulation, Frequency Division Multiplexing (FDM), and Demultiplexing and Demodulation, Signal Recovery with ASCII Verification

Meet our Group Members

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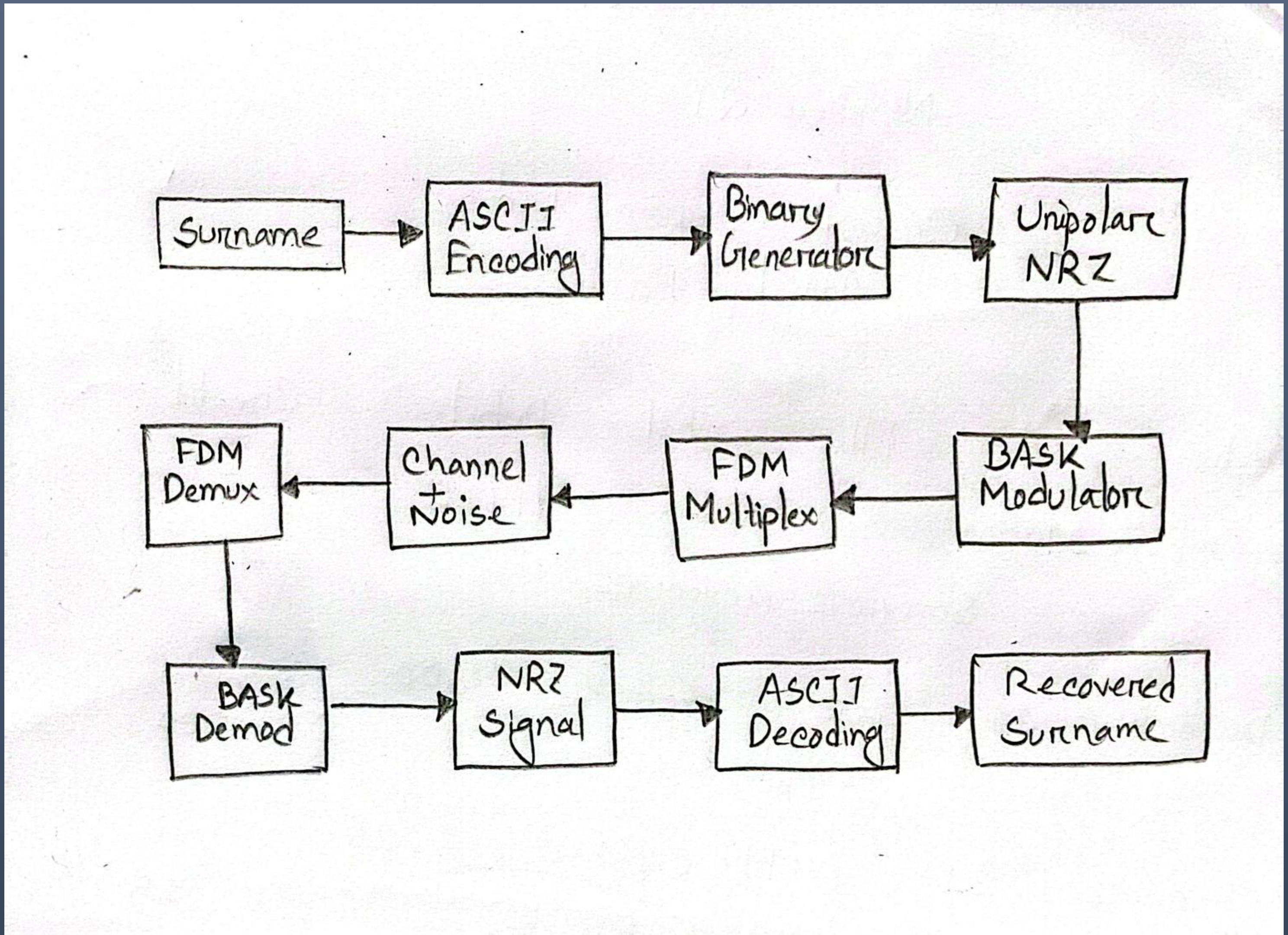
Objective of the Experiment

- To convert surnames into binary sequences using ASCII encoding technique
- To represent the binary data in time domain using unipolar NRZ signaling
- To modulate the binary signals using Binary Amplitude Shift Keying (BASK) and transmit them through Frequency Division Multiplexing (FDM)
- To demodulate, decode and verify the received signals in the presence of noise

SYSTEM BLOCK DIAGRAM



BINARY VECTOR GENERATION

- Two group members’ surnames were selected and written in block letters
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- Each character was converted into its ASCII value

- ASCII values were converted into binary form

- Two binary vectors were generated:
- $\mathbf{x_1}$ → First surname
- $\mathbf{x_2}$ → Second surname
- Transmission format used: **Synchronous Serial Transmission**

UNIPOLAR NRZ SIGNALING

Unipolar Non-Return-to-Zero (NRZ)

- Binary 1 → Positive voltage
- Binary 0 → Zero voltage
- Signal does not return to zero within a bit duration
- Bit duration = **1 ms**

Key Points:

- Simple digital line coding technique
- Used to represent binary vectors in the time domain
- Ideal for visualizing digital data before modulation
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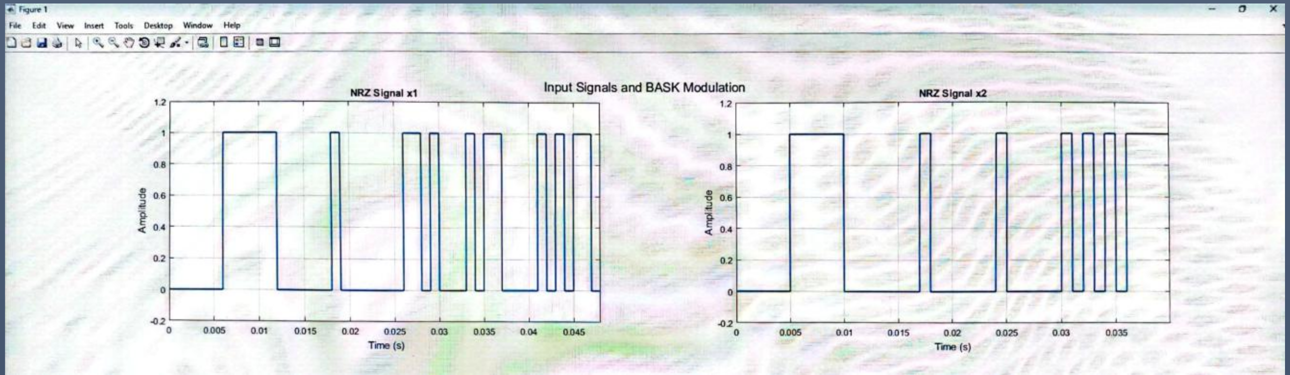
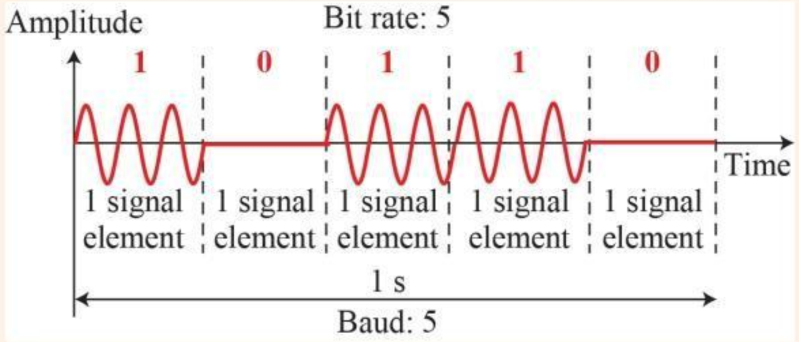
Example Time Domain Plot:

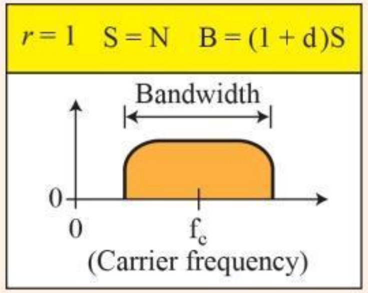
- subplot(2,1,1) → x_1
- subplot(2,1,2) → x_2



Binary Amplitude Shift Keying (BASK)

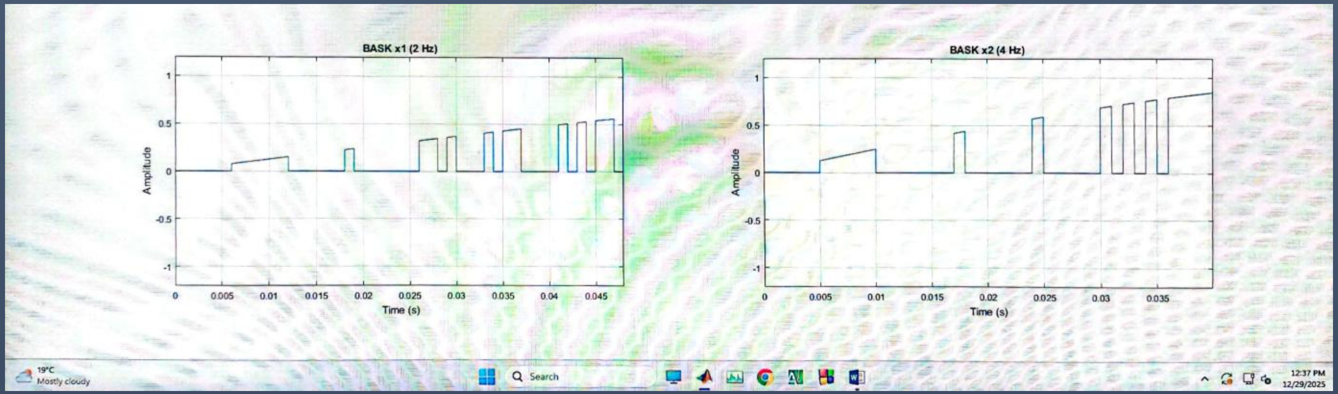
- Digital modulation technique
- **1 → Carrier present**
- **0 → Carrier absent**
- Frequency constant, **amplitude varies**





Implementation

- Carrier frequency x_1 = 2 Hz
- Carrier frequency x_2 = 4 Hz
- MATLAB:
  - `subplot(2,2,1)` → BASK of x_1
  - `subplot(2,2,2)` → BASK of x_2
- Different frequencies enable **FDM**



FREQUENCY DIVISION MULTIPLEXING (FDM) & COMPOSITE SIGNAL

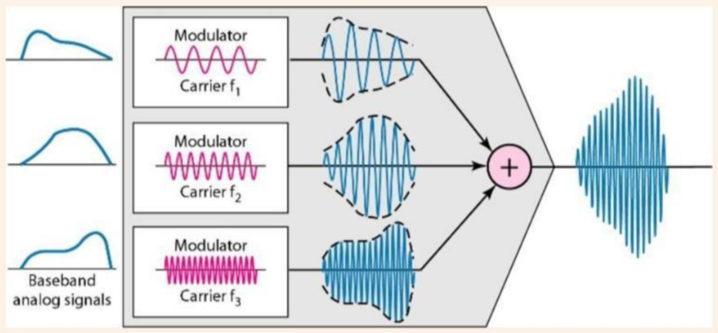
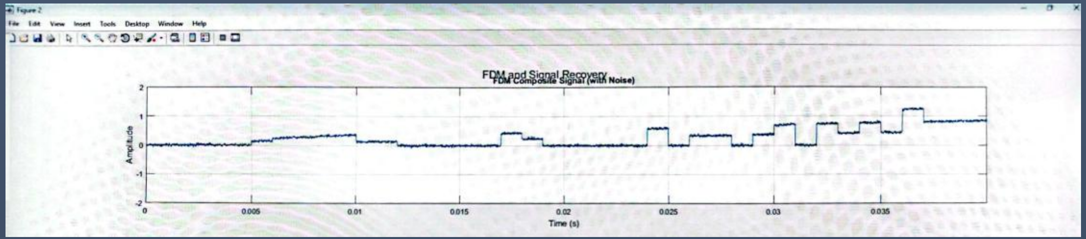


Figure 6.4: FDM Process

- Multiple signals sent over one channel
- Each signal uses a different frequency band
- Signals combine to form a composite signal
- Provides interference-free transmission

Working Principle

- Input signals are BASK modulated with different carriers
- Modulated signals are added together
- Receiver uses band-pass filters to separate signals



Composite Signal

- s(t)=s1(t)+s2(t)+n(t)s(t) = s_1(t) + s_2(t) + n(t)s(t)=s1(t)+s2(t)+n(t)
- n(t)n(t)n(t): Gaussian noise (channel effect)

Demultiplexing

Separates individual signals from a **composite FDM signal**

How It Works

•Composite signal passes through **band-pass filters**

•Each filter extracts one signal:

- **x_1 → 2 Hz carrier**
- **x_2 → 4 Hz carrier**

•Unwanted frequencies are removed

Result

•Clean, interference-free signals

•Ready for **BASK demodulation**

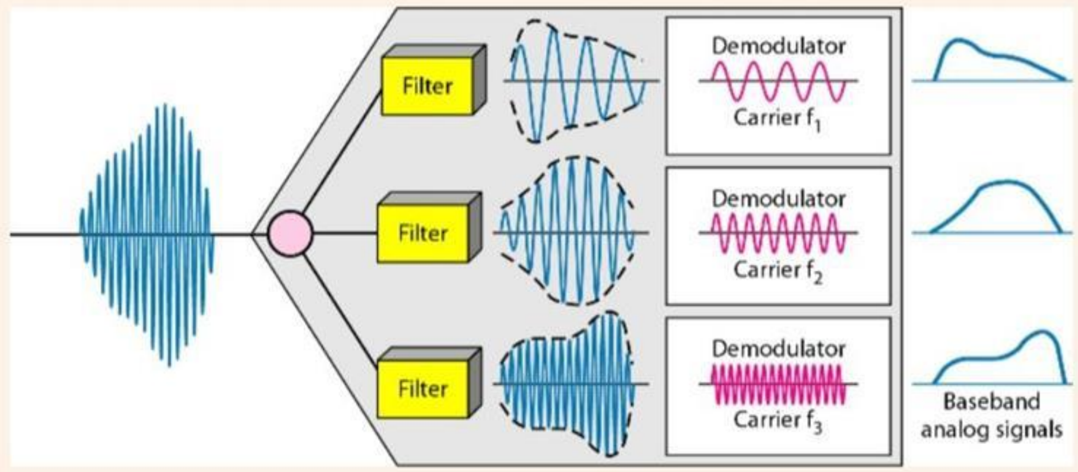


Figure 6.5: FDM demultiplexing example

BASK Demodulation

Definition

•Process of recovering original binary data from a BASK signal

•Works even in the presence of noise

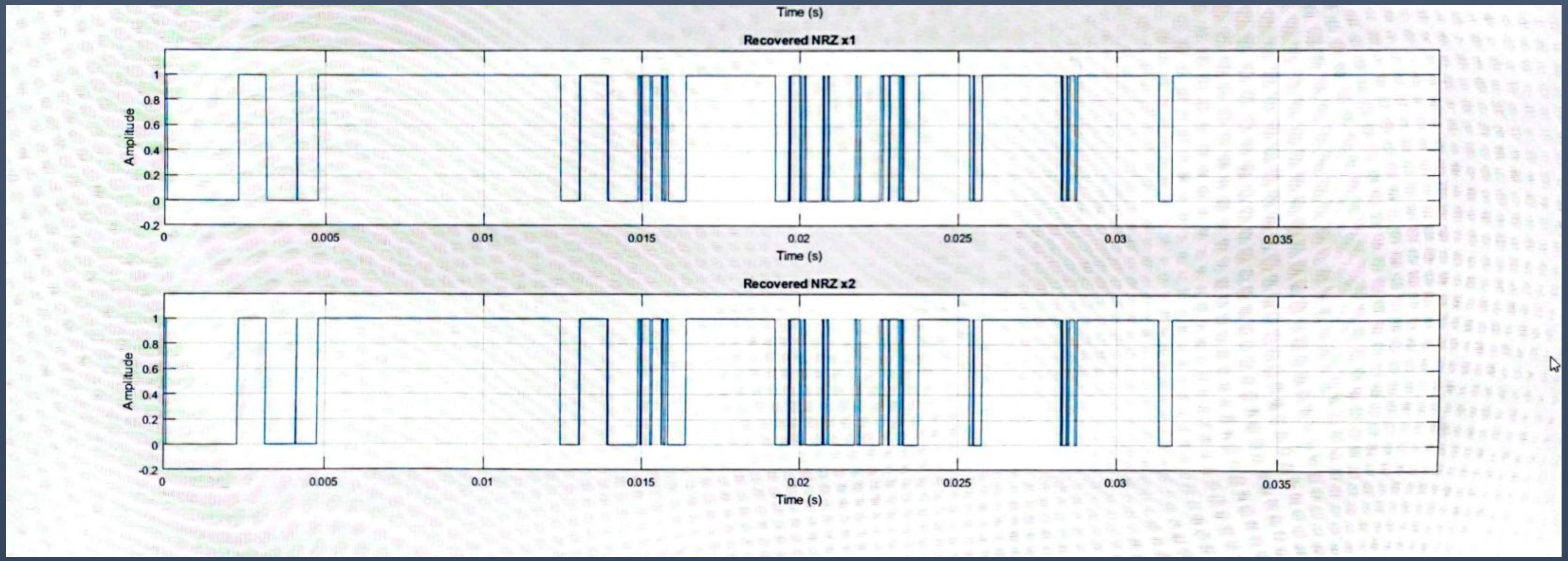
Demodulation Steps

•Multiply received signal with carrier

•Apply low-pass (moving average) filter

•Use threshold detection (1 or 0)

•Recover unipolar NRZ signals



MATLAB Output

•**rx_1** → Recovered x_1 (NRZ)

•**rx_2** → Recovered x_2 (NRZ)

ASCII Decoding & Verification

ASCII Decoding

•Sample recovered NRZ bits
•Group into 8-bit blocks
•Convert to decimal → ASCII characters

Verification Result
•x_1 → RAHMAN
•x_2 → BASAK

Conclusion
• Confirms successful transmission and correct data recovery

RESULT ANALYSIS

Analysis of Results

•Noise slightly distorts signal amplitude, but recovery is still possible.
•Proper carrier frequency selection ensures correct separation during demultiplexing.
•Low-pass filtering effectively removes high-frequency noise.
•Threshold detection successfully recovers original binary bits.

Effect of Noise

•Higher noise levels can lead to **more bit errors**.
•Proper filtering and carrier selection **improve SNR** and maintain signal integrity.

CONCLUSION

- BASK modulation and FDM were successfully implemented.
- Multiple digital signals were transmitted simultaneously.
- Original data was accurately recovered and verified.
- Demonstrates a complete digital communication system from source to destination.
- Validates theoretical concepts of digital communication in a practical setup.

THANK YOU EVERYONE