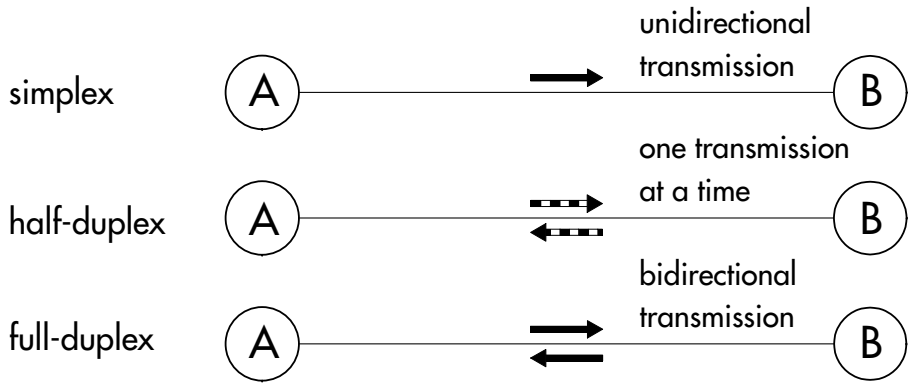
Data Conversion & Transmission

Prof. Dr. M. Zahurul Haq
zahurul@me.buet.ac.bd
http://teacher.buet.ac.bd/zahurul/

Department of Mechanical Engineering
Bangladesh University of Engineering & Technology

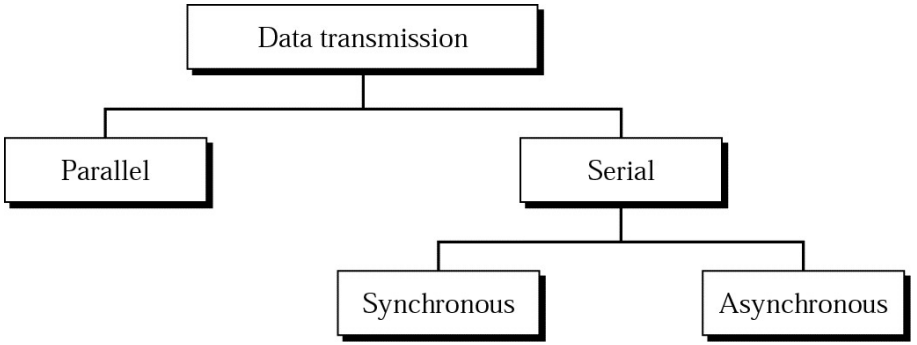
ME 361: Instrumentation & Measurement

Data Transmission Modes



e068.eps

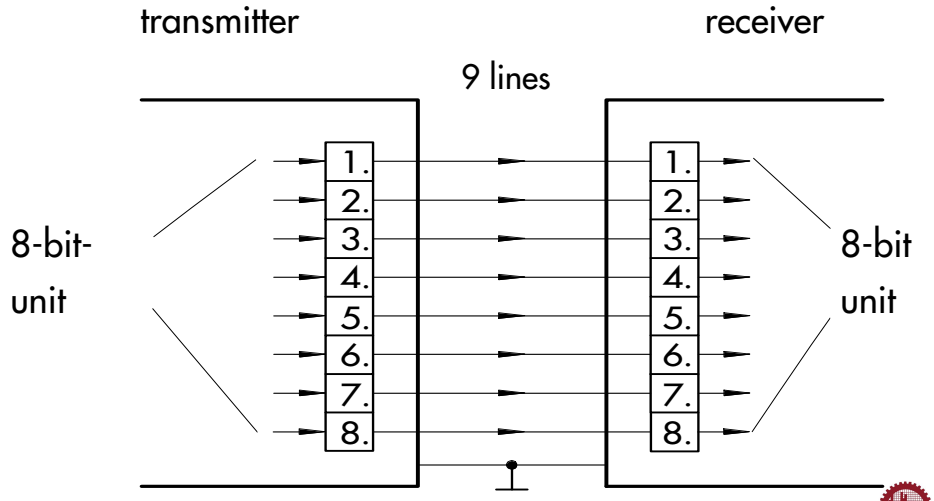
Data Transmission Types



e069.eps

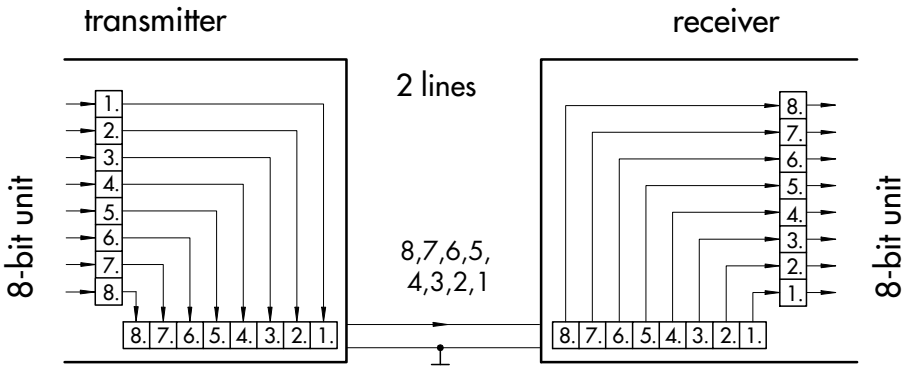
1. **Parallel** - n wires are used to send n bits at one time.
2. **Serial** - one bit follows another, so only one channel is required.

Parallel Communication



e070.eps

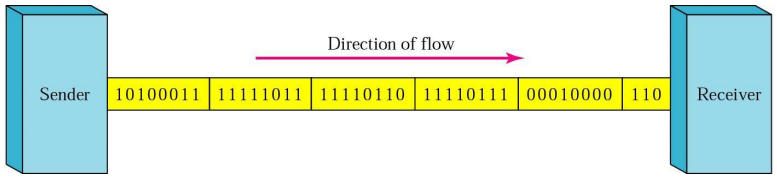
Serial Communication



e071.eps

Synchronous Serial Communication

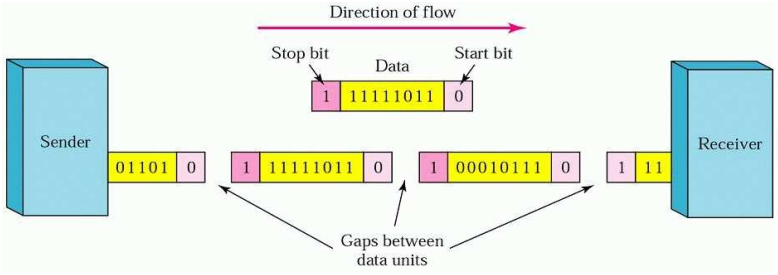
- Data are transmitted as an unbroken string of 1s and 0s, and the receiver separates that string into the bytes, or characters, it needs to reconstruct the information.
- Timing is very important, the accuracy of the received information is completely dependent on the ability of the receiving device to keep an accurate count of the bits as they come in.
- Synchronous transmissions are faster than asynchronous transmission.



e072.eps

Asynchronous Serial Communication

- Timing of a signal is unimportant, rather information is received and translated by agree-upon patterns.
- To alert the receiver to the arrival of a new group, **start bit**, usually a O, is added to the beginning of each byte.
- To inform the end of byte **stop bits**, usually 1s, are appended to the end of each byte.



e073.eps

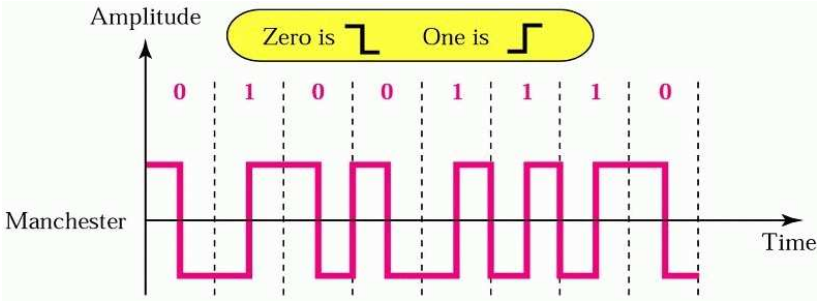
Data Conversion Methods

Transform data into signal to send from one place to another. Data conversion methods:

1. Digital-to-digital: e.g. Manchester encoding.
2. Analog-to-digital: e.g. Pulse-amplitude modulation (PAM)
3. Digital-to-analog: e.g. ASK, FSK, PSK
4. Analog-to-analog: e.g. AM, FM, PM

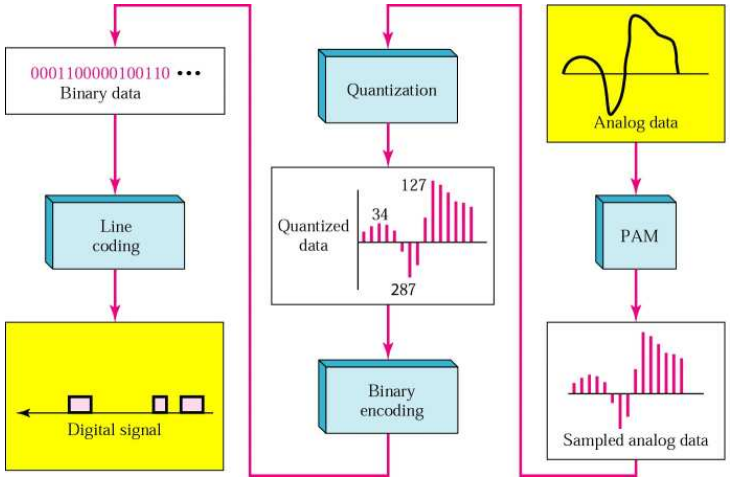
Digital-to-digital Encoding

In Manchester encoding, the bit information is included in the phase angle of the signal: a rising edge occuring in the middle of the bit time indicates 'high' state, while a trailing edge stands for 'low' state.



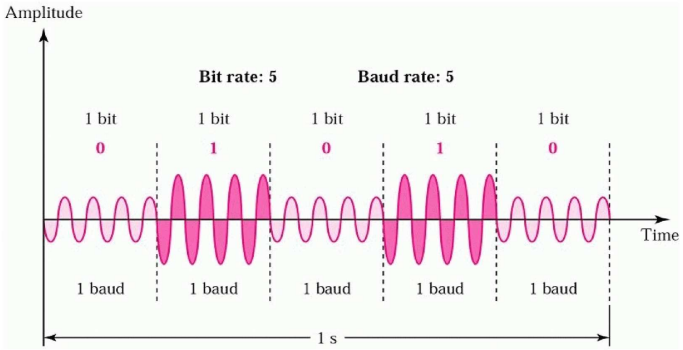
e074.eps

Analog-to-digital Encoding



e049.eps

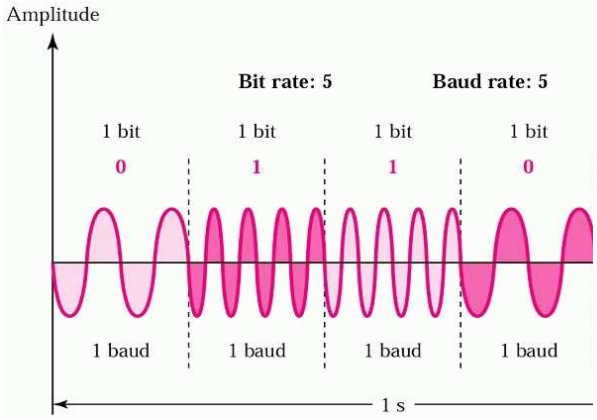
D/A Conversion: Amplitude Shift Keying (ASK)



e075.eps

Strength of the signal is varied to represent binary 1 or 0; both frequency and phase remain constant while the amplitude changes.

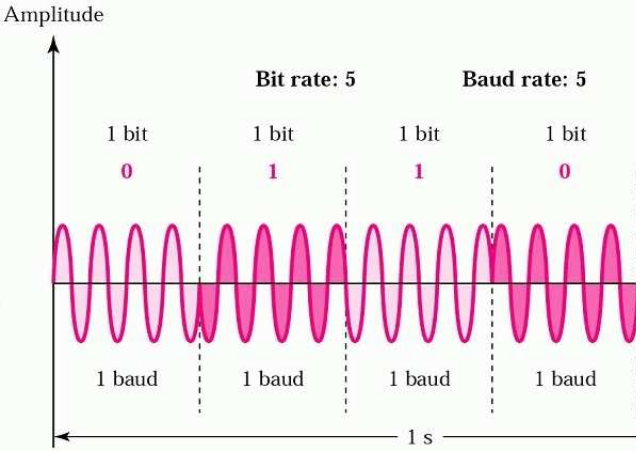
D/A Conversion: Frequency Shift Keying (FSK)



e076.eps

Frequency of the signal is varied to represent binary 1 or 0; both peak amplitude and phase remain constant.

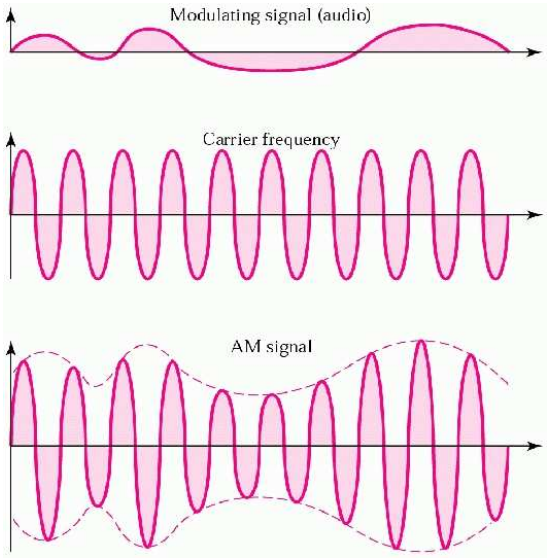
D/A Conversion: Phase Shift Keying (PSK)



e077.eps

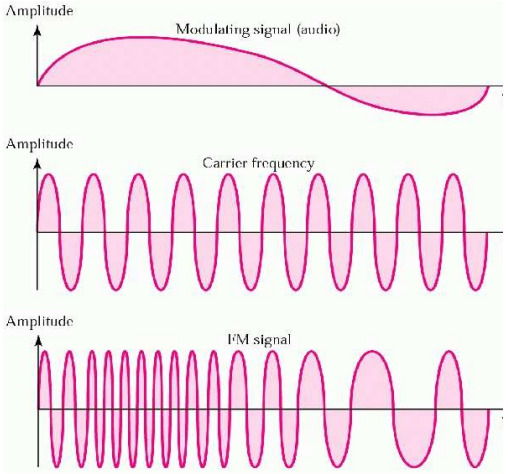
Phase of the signal is varied to represent binary 1 or 0; both frequency and peak amplitude remain constant.

A/A Conversion: Amplitude Modulation (AM)



e078.eps

A/A Conversion: Frequency Modulation (FM)

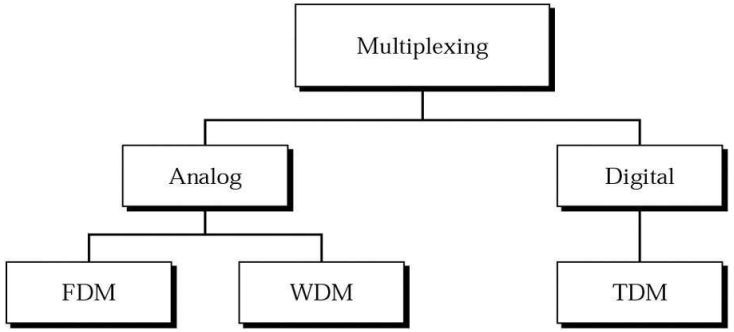


e079.eps

A/A Conversion: Phase Modulation (PM)

In PM transmission, the phase of the carrier signal is modulated to follow the changing voltage level (amplitude) of the modulating signal. The peak amplitude and the frequency of the carrier signal remain constant, but as the amplitude of the information signal changes, the phase of the carrier changes correspondingly. The analysis and the final result (modulated signal) are similar to those frequency modulation.

Categories of Multiplexing



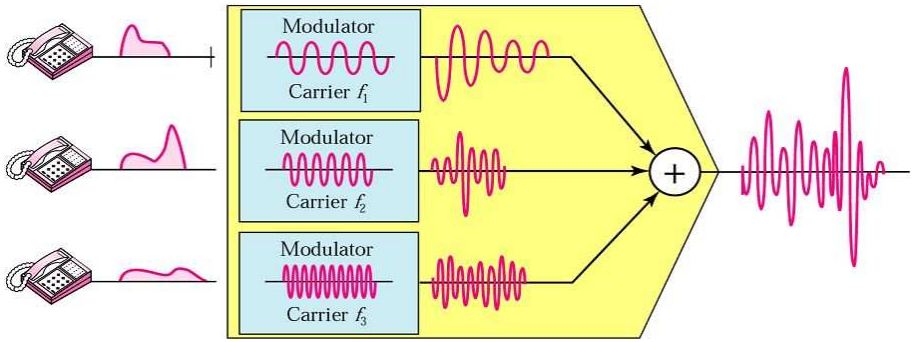
e080.eps

FDM - Frequency division multiplexing

TDM - Time division multiplexing

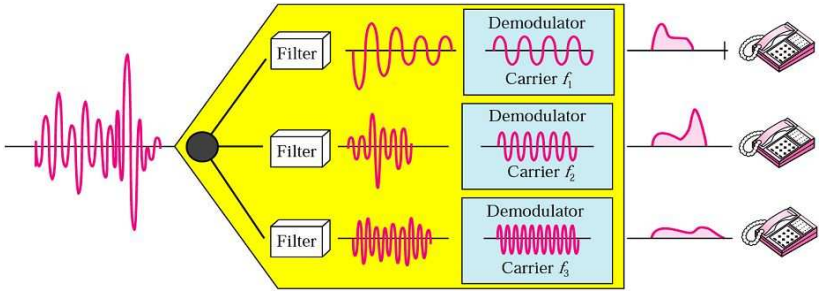
WDM - Wave division multiplexing

FDM Multiplexing, time domain



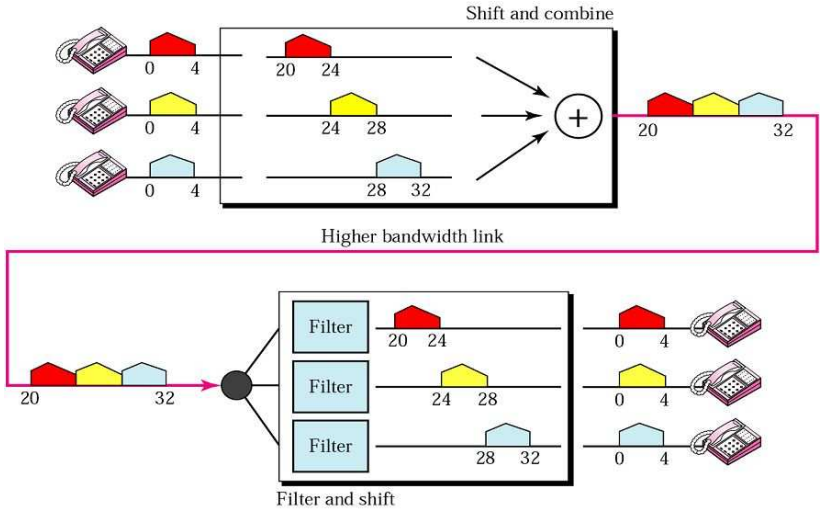
e081.eps

FDM de-Multiplexing, time domain



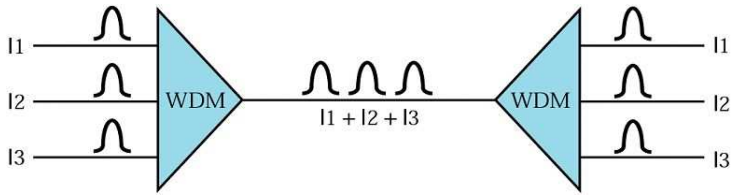
e082.eps

FDM, frequency domain

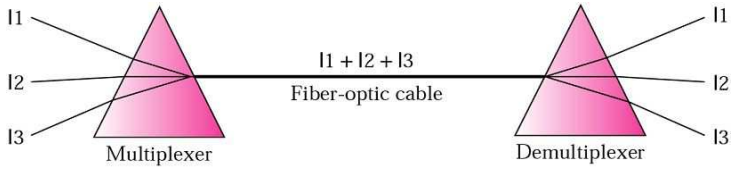


e083.eps

WDM Multiplexing and de-Multiplexing

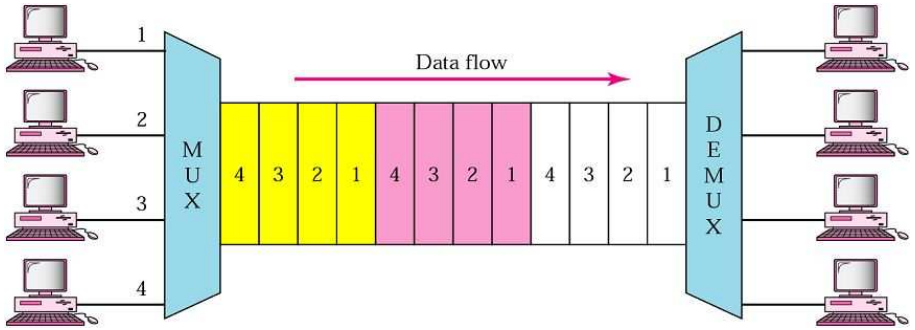


e084.eps



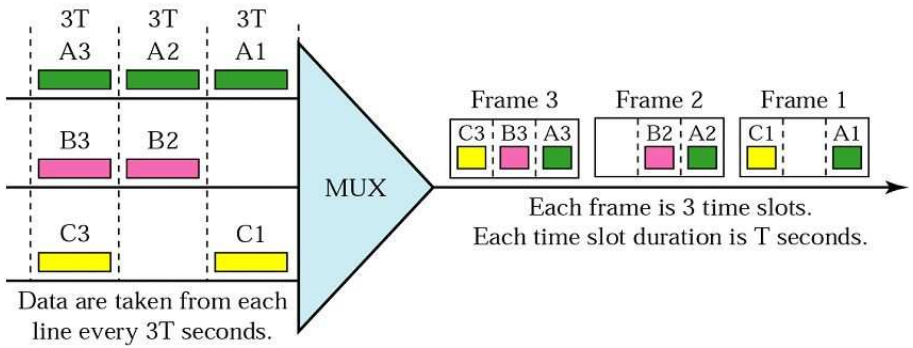
e085.eps

TDM Multiplexing



e086.eps

Synchronous TDM Multiplexing



e087.eps