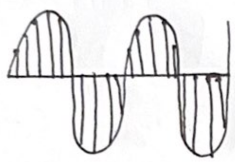
CSE 320 Date: 04/05/24

Chapter: 05

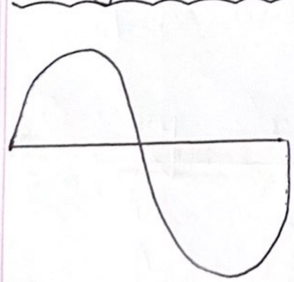
Analog Transmission



→ Analog treansmission
Continoous change

in this chapter our main priority will be, how to transmit digital data to analog

5.1 Digital to Analog conversion



Has 3 characteristies

→ Amplitude (Highest point) → Frequency → Phase (Starting point)

Digital to Analog conversion depends on the above 3 characteristics.

→ Digital to Analog conversion is the process of changing one of the characteristics of an analog signal based on the information in digital data.

D - A (Conversion)

→ Digital Data needs to be carried on an analog signal.

→ A carrier ~~freq~~ signal (frequency fc) performs the function of transporting the digital data in an analog waveform.

→ The analog carrier signal is manipulated to uniquely identify the digital data being carried.

Digital to Analog conversion

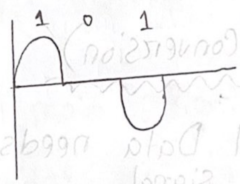
- Amplitude Shift keying (ASK)
- Frequency shift keying (FSK)
- Phase shift keying (PSK)

→ Quadrature Amplitude Modulation (QAM). ✗
এটি লাগবে না।

Amplitude Shift keying (ASK) or (OOK) same

→ Changing the amplitude of a carrier signal to reflect amplitude levels in the digital signal.

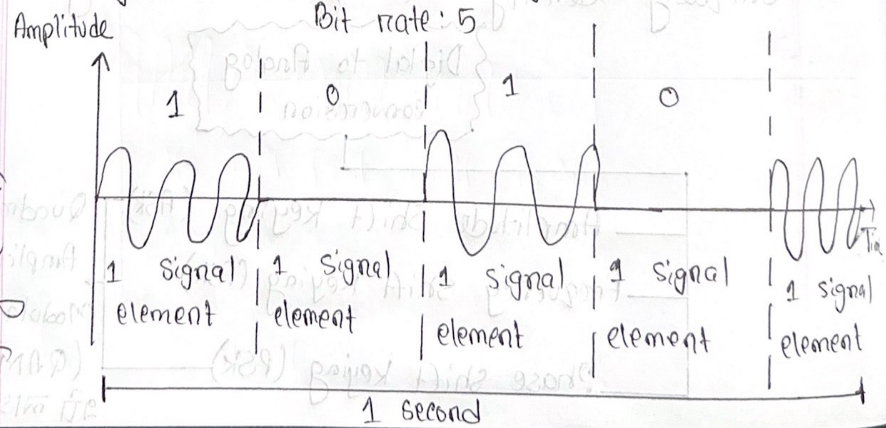
→ A digital '1' could not affect the signal, whereas '0' would.



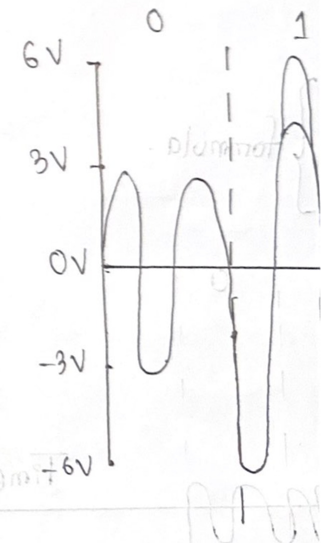
→ The line encoding will determine the values of the analog waveform to reflect the digital data being carried.

5.3 Binary Amplitude Shift keying

Also known as ON OFF keying (OOK)



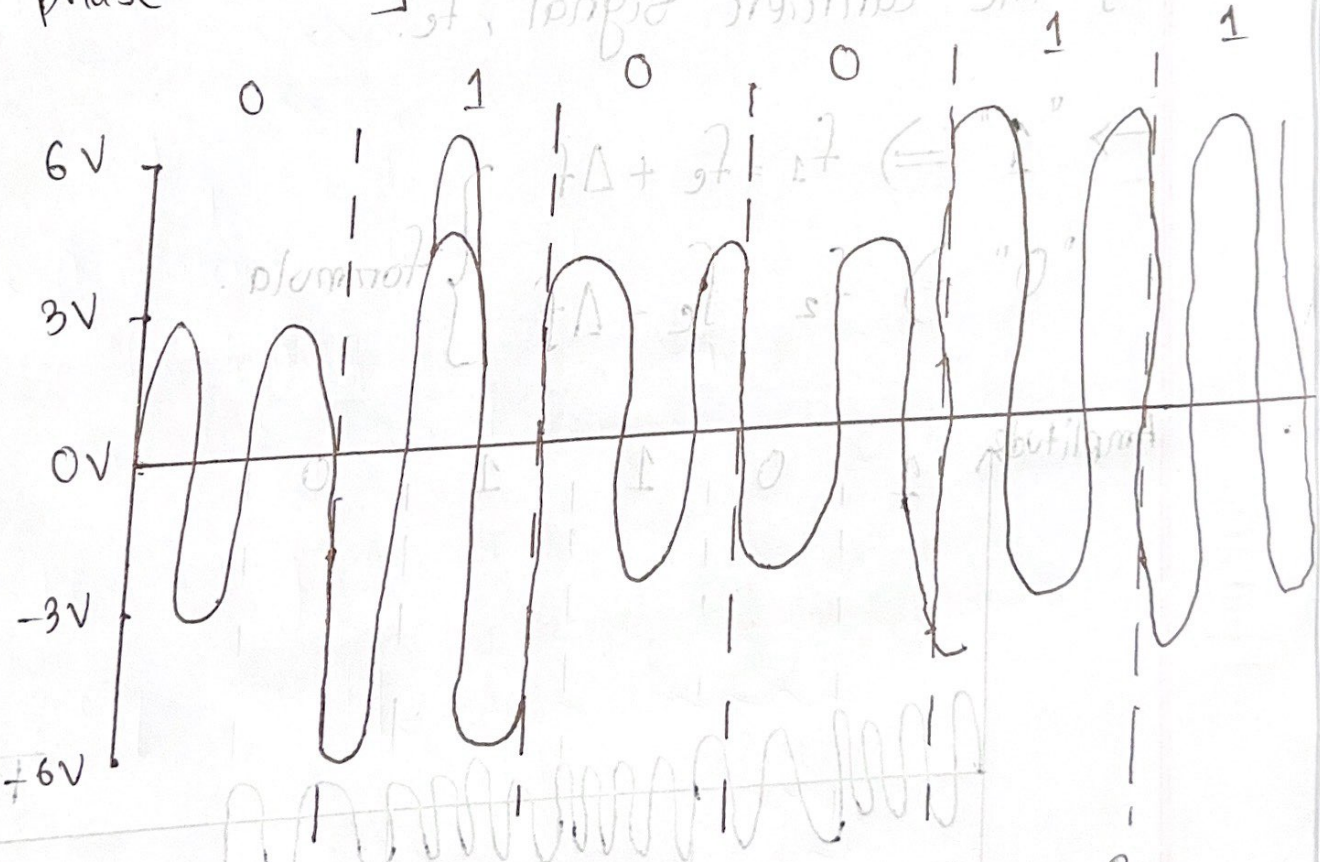
* Draw the analog sig
stream 010011 using
element with amplitu
signal ~~ement~~ element
[frequency = 2 for ea
phase 0 rad]



উপরের Question
না দেখা থাকলে
থাকবে।

* Draw the analog signal for the digital bit stream 010011 using Binary ASK where 0 means signal element with amplitude of 3V and 1 means signal ~~ement~~ element with amplitude 6 V.

[frequency = 2 for each signal element and phase 0 rad]



উপরের Question এ frequency = 2 দেয়া ছিল,
না দেয়া থাকলে carrier frequency দেয়া
থাকবে।

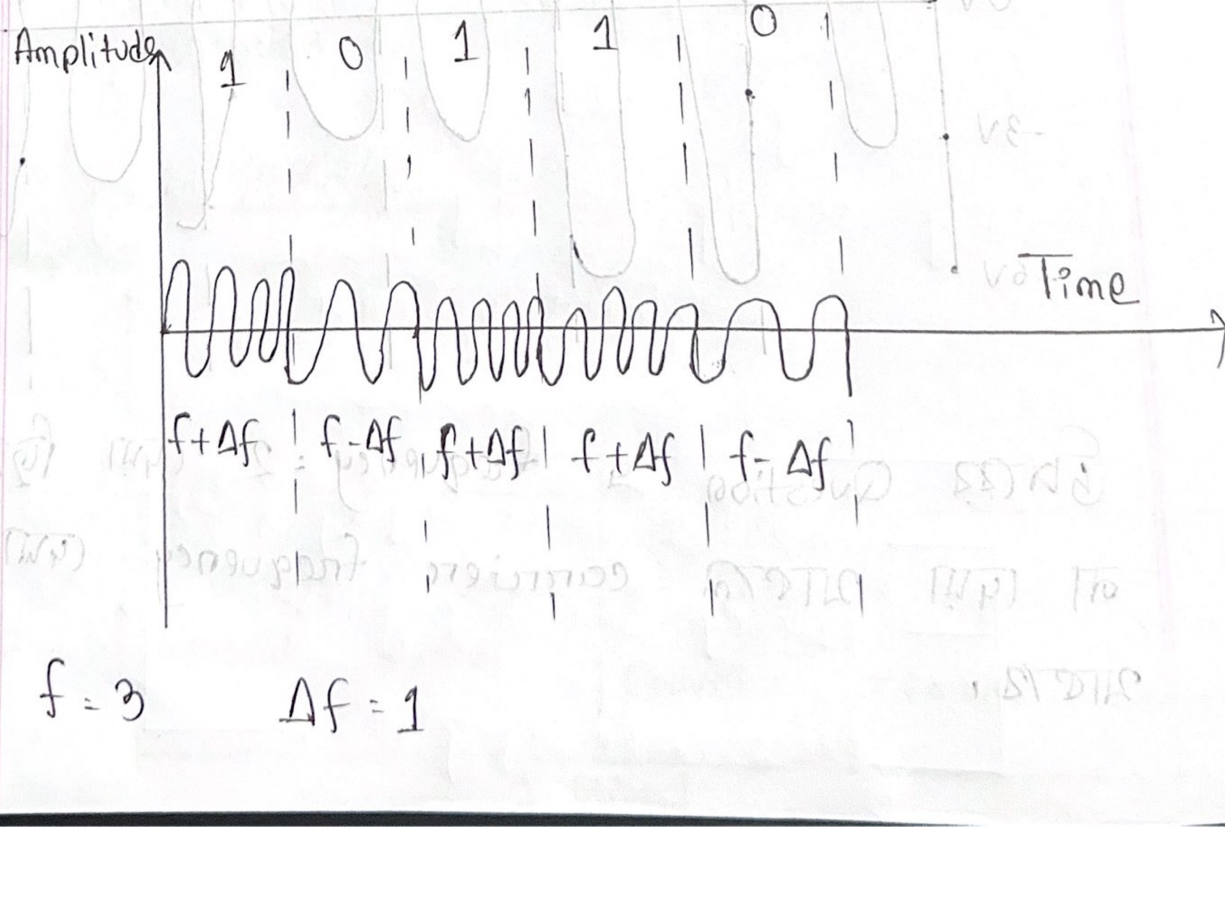
→ ASK can use multiple bits per signal element. *

Frequency Shift Keying (FSK)

→ the digital data stream changes the frequency of the carrier signal, f_c.

→ "1" ⟹ $f_1 = f_c + \Delta f$
"0" ⟹ $f_2 = f_c - \Delta f$

$\Big\}$ formula.



$f = 3$ $\Delta f = 1$

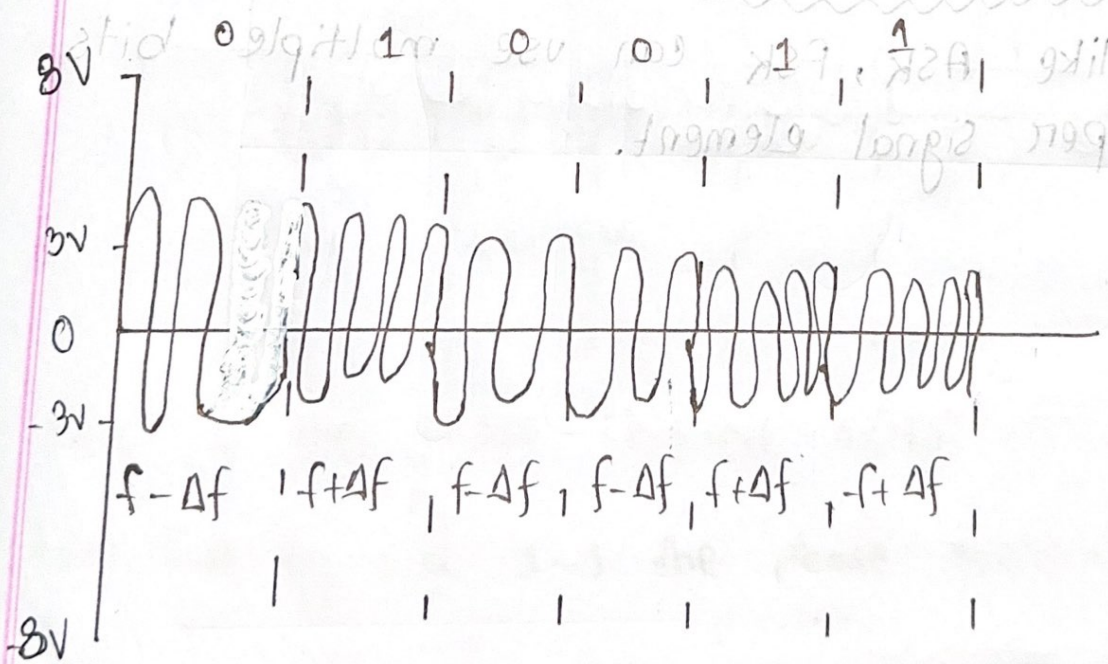
* Draw the analog signal for the digital bit stream: 010011 using Binary FSK where 0 means signal element with frequency 2 and 1 means signal element with frequency 4.

[Amplitude = 3V and phase = 0 rad]

Solution:

$\Delta f = 1$

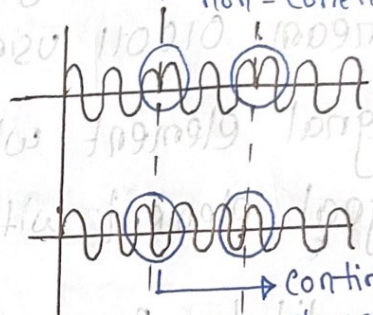
$f = 3$



FSK has two schemes:-

i) non-coherent FSK

ii) Coherent FSK



→ Multilevel FSK:

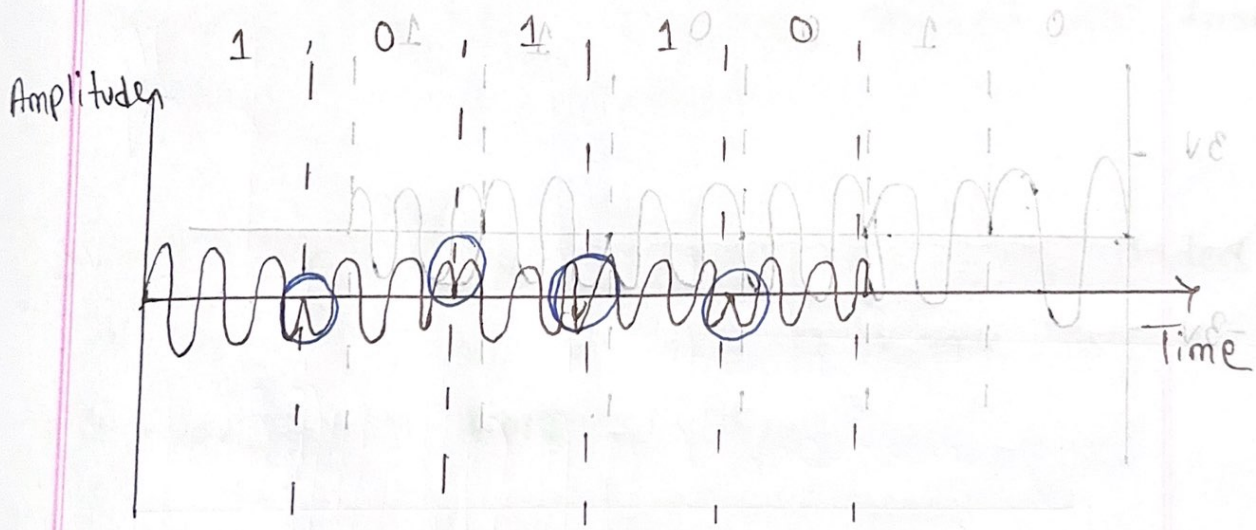
like ASK, FSK can use multiple bits per signal element.

Problem

Phase Shift Keying

→ Vary the phase shift of the carrier signal to represent digital data.

→ PSK is much more robust than ASK as it is not that vulnerable to noise, which changes amplitude of the signal.

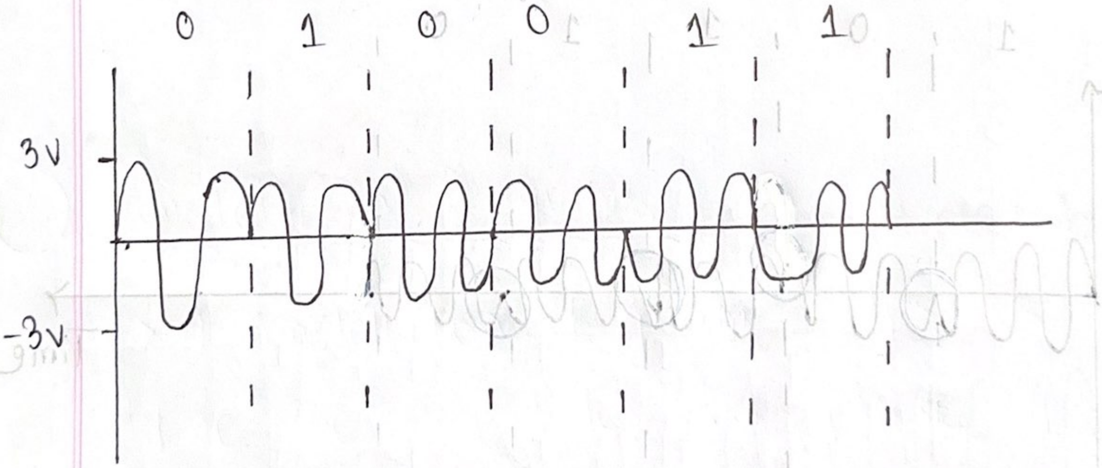


For, 0 the phase shifted. π/180°

For, side by side 1-1 the phase continued. 0°

* Draw the analog signal for the digital bit stream 010011 using Binary PSK where 0 means signal element with phase of 0 rad and 1 means signal element with phase π rad.

[Amplitude = 3V ; frequency = 2]



0 → 0°

1 → 180° / π

A → 3V

f → 2.

Quadrature PSK

→ to increase the bit rate we can code 2 or more bits onto one signal element.

→ in QPSK, we parallelize the bit stream so that every two incoming bits are split up and PSK a carrier frequency. One carrier frequency is phase shifted 90° from the other - in quadrature.

→ the two PSKed signals are then added to produce one of the 4 signal signal elements. L = 4 here.

Figure

Problem

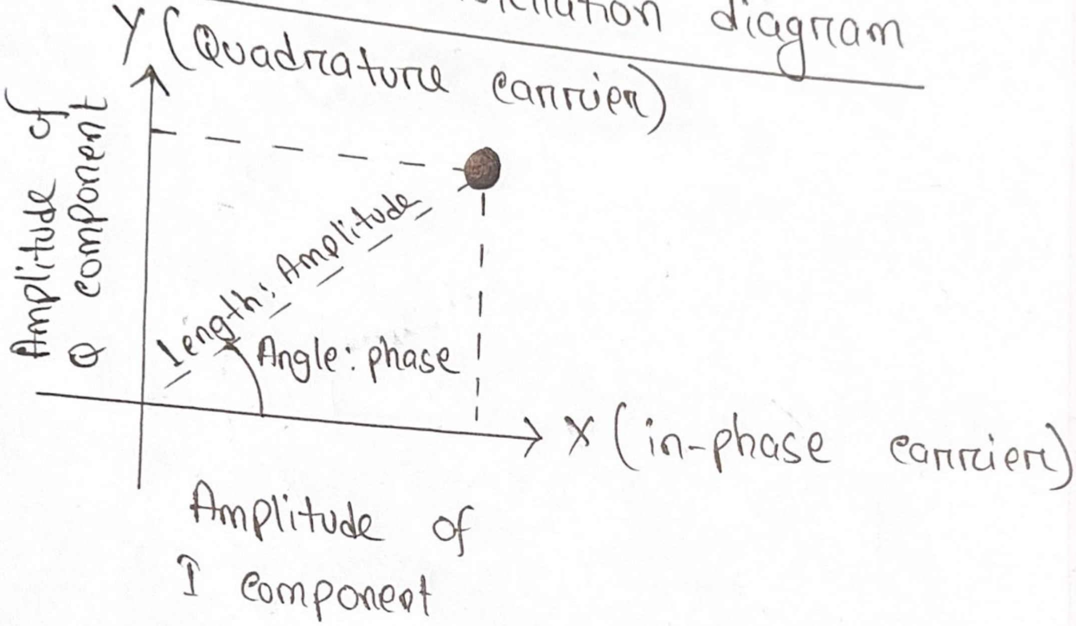
Constellation Diagrams

→ A constellation diagram helps us to define the amplitude and phase of a signal when we are using two carriers, one in quadrature of the other.

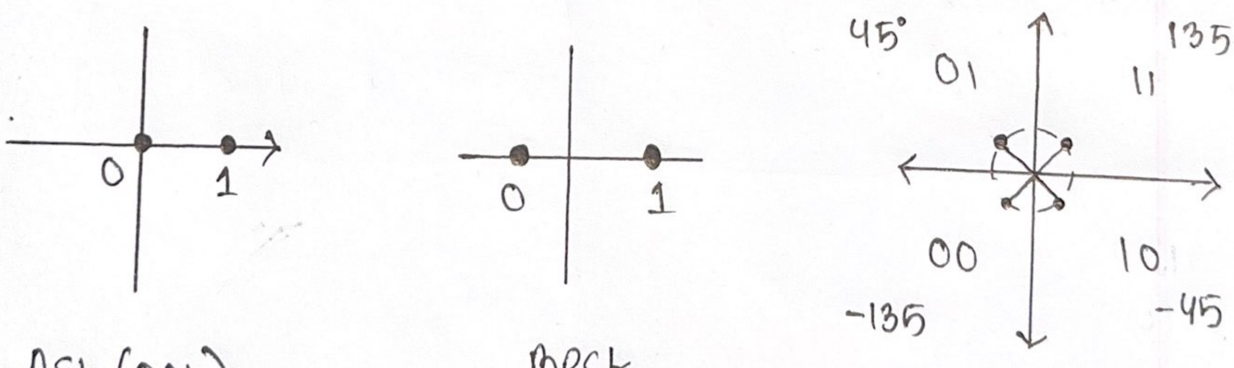
→ The x axis represents the in-phase carrier and the Y-axis represents the quadrature carrier (out of phase).

important

Concept of a constellation diagram



Constellation diagram of ASK(OOK), BPSK and QPSK.



ASK (OOK)   BPSK   QPSK