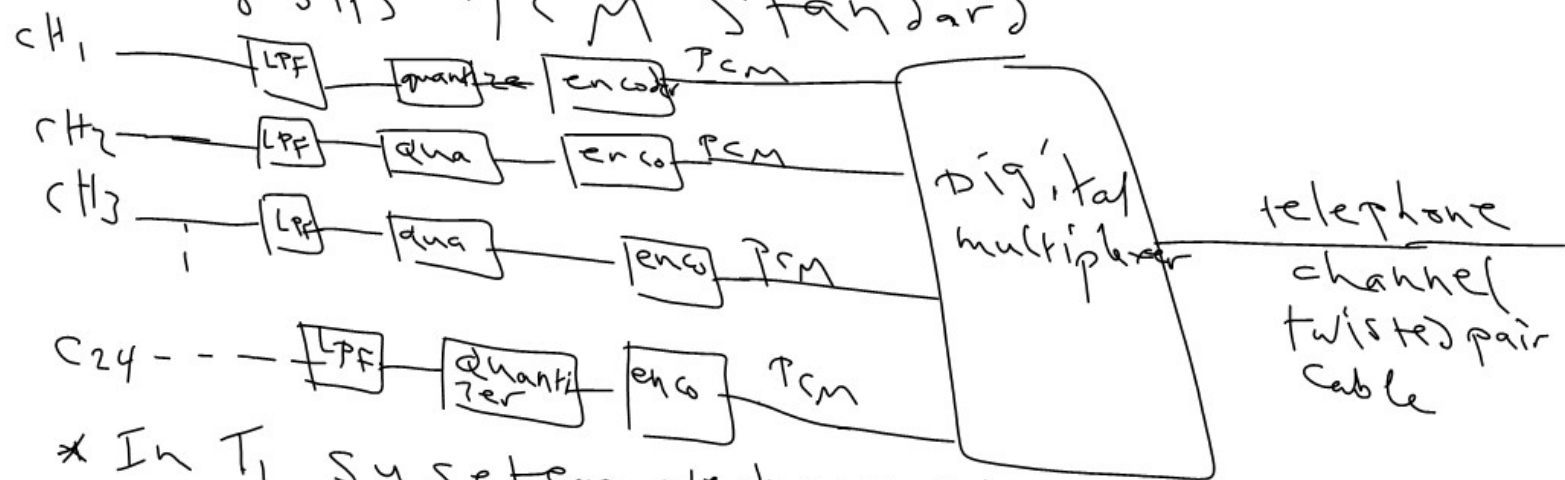


T₁ Standard

* In PCM telephone systems there are 24 voice channels are time division multiplexed

* each channel is quantized 8 bits PCM Standard



* In T₁ system we have 24 samples each sample is represented by 8 bits so the total number of bits per sample (frame) is equal $8 \times 24 = 192$ bits/frame

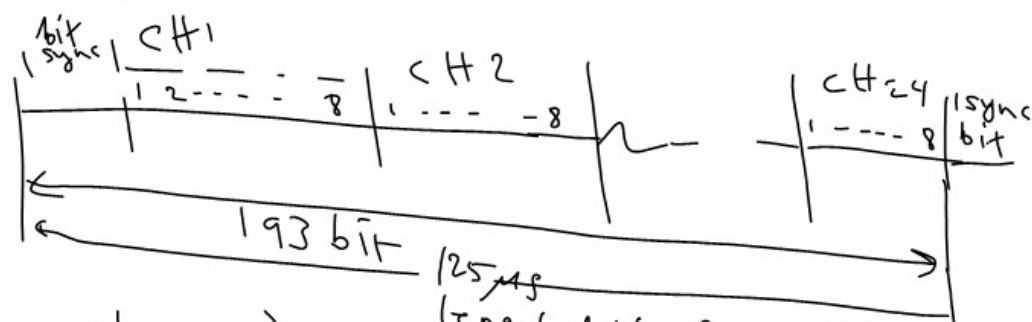
* The digital multiplexer adds one synchronization bit, so that the total number of bits/frame = 193 bits/frame

* Since sample the voice signals at a rate of 8000 sample/s in telephone communications then the total number of bits/s is given by $(193 \text{ bits/frame}) (8000 \text{ frame/s}) = 1.544 \text{ Mbits/s}$

* The bit duration in T₁ system is defined by $T_b = \frac{1}{R_b} = \frac{1}{1.544 \times 10^6} = 0.67 \mu\text{s}$

* The frame length is given by $\frac{1}{f_s} = \frac{1}{8000} = 125 \mu\text{s}$

* The above explanation of T₁ system can be best illustrated by the following diagram

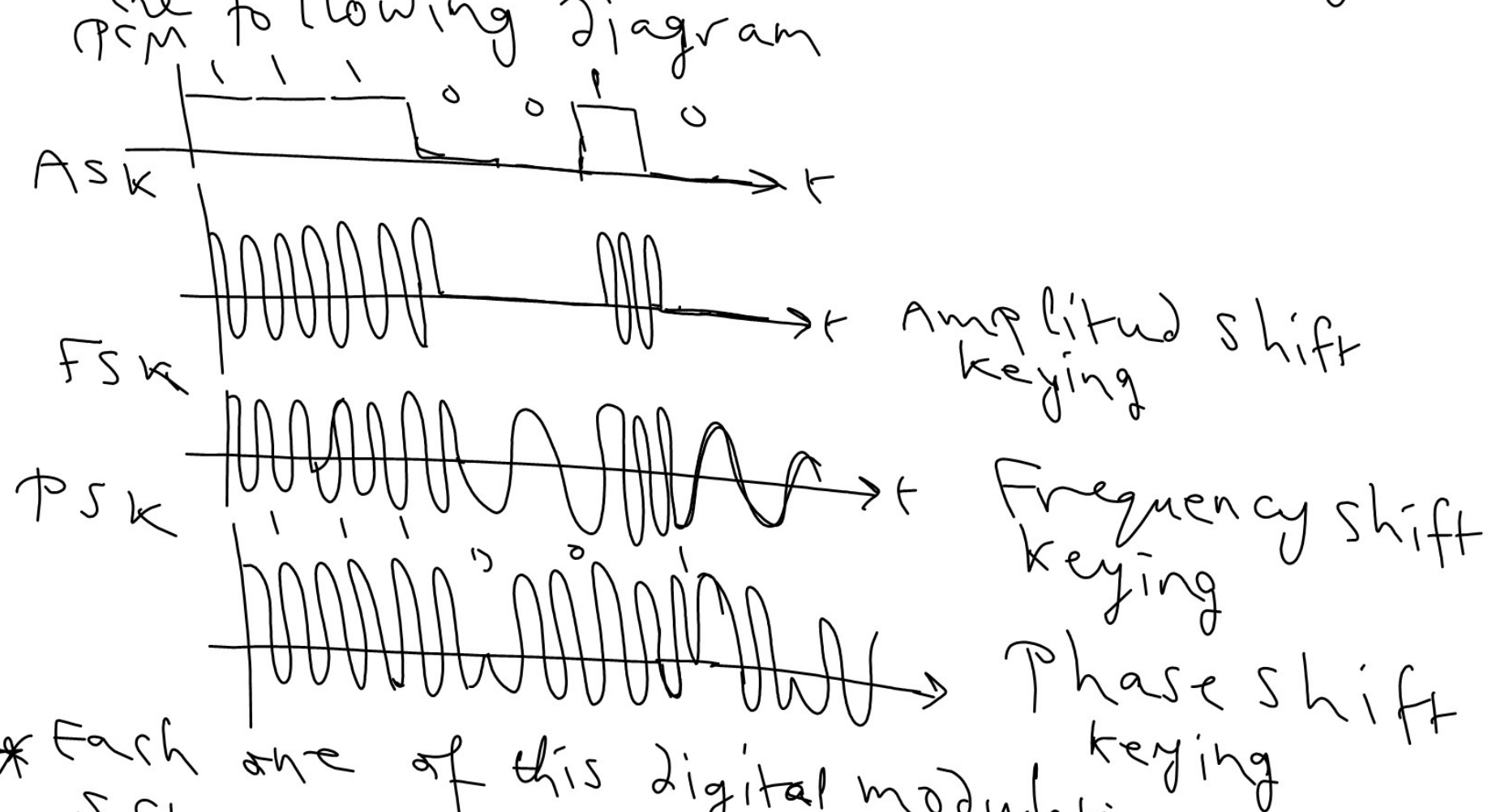


* Another advanced system were developed after T₁ system such as T₂ system which takes 4x T₁ system

* The total bit rate of T₂ system is 6.312 Mbits/s which is slightly higher than $4 \times 1.544 \text{ Mbits/s}$ because of the additional synchronization bits required by T₂ system

passband digital modulation schemes

- * In passband data communications, we take the binary bits resulting from PCM and use them to modulate either the amplitude, frequency or phase of the carrier as illustrated by the following diagram



- * Each one of this digital modulation schemes can be studied separately
- * Some times we might have a hybrid modulation scheme such as amplitude and phase modulation which is known as APK

ASK modulation

* In Amplitude Shift Keying ASK, the binary bits are used to modulate the amplitude of the carrier is given by this equation

$$\phi(t) = a(t) \cos 2\pi f_c t$$

ASK

$$f_c = \frac{n}{T_b}$$