

Solution :

1. What is the “Capture Effect”? What will happen if the unwanted FM signal is equal or stronger than the desired FM signal at the FM receiver?

Sol:

Interference suppression in an FM receiver works well only when the interference is weaker than the desired FM input. When the interference is the stronger one of the two, the receiver locks onto the stronger signal and thereby suppresses the desired FM input. When they are of nearly equal strength, the receiver fluctuates back and forth between them. This phenomenon is known as the capture effect.

2. Please give a briefly description of the “Nyquist rate”?

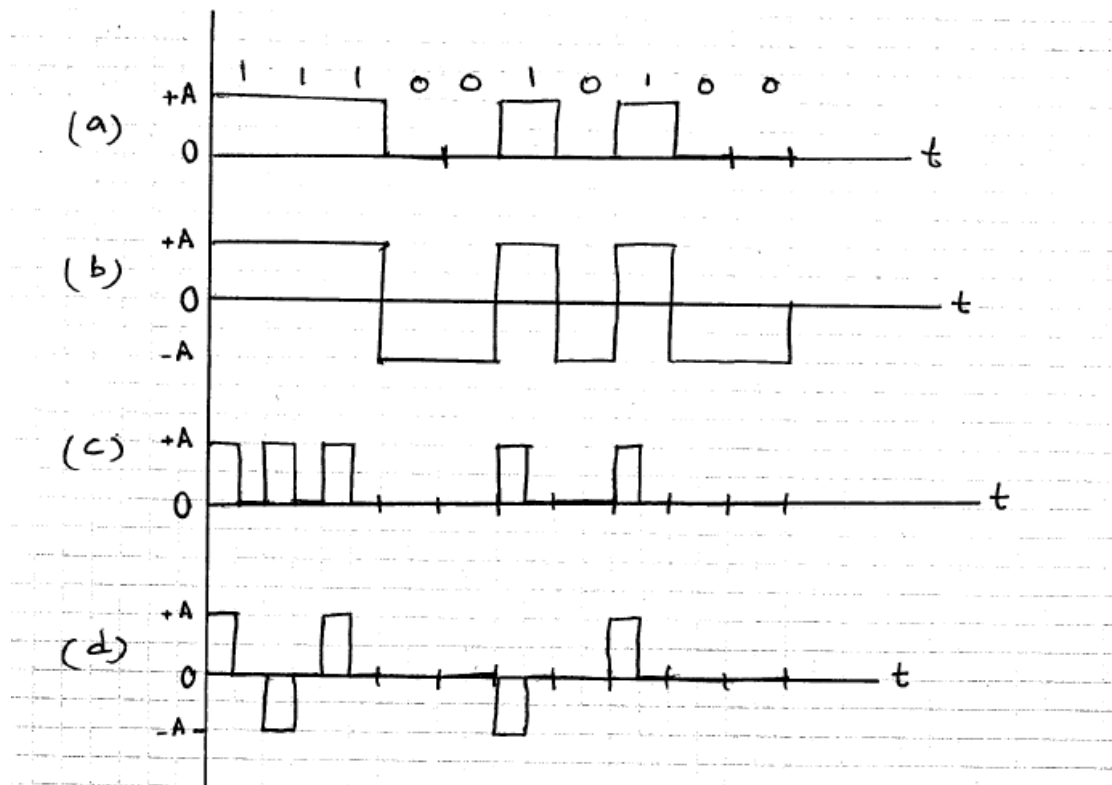
Sol:

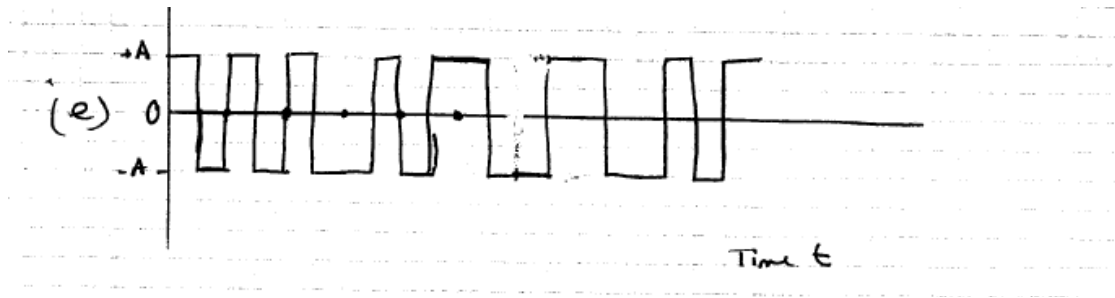
A band-limited signal of finite energy with bandwidth W can be completely described by its samples of sampling rate $f_s \geq 2W$.

$2W$ is commonly referred to as the *Nyquist rate*.

3.

Sol:





4.

Sol:

(a) Let the message bandwidth be W . Then, sampling the message signal at its Nyquist rate, and using an R -bit code to represent each sample of the message signal, we find that the bit duration is

$$T_b = \frac{T_s}{R} = \frac{1}{2WR}$$

The bit rate is

$$\frac{1}{T_b} = 2WR$$

The maximum value of message bandwidth is therefore

$$\begin{aligned} W_{\max} &= \frac{50 \times 10^6}{2 \times 7} \\ &= 3.57 \times 10^6 \text{ Hz} \end{aligned}$$

(b) The output signal-to-quantizing noise ratio is given by (see Example 2):

$$\begin{aligned} 10 \log_{10} (\text{SNR})_0 &= 1.8 + 6R \\ &= 1.8 + 6 \times 7 \\ &= 43.8 \text{ dB} \end{aligned}$$