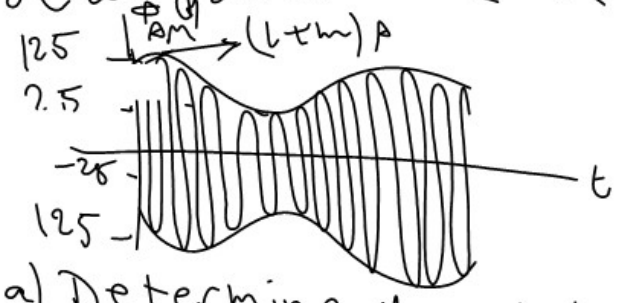
Ex For the sinusoidally modulated AM signal shown below, determine the following



a) Determine the modulation index
b) write a mathematical expression for the wave form shown
c) Sketch the line Spectrum of the waveform
d) Determine the amplitude of the additional Carrier that needs to be added in order to reduce the modulation index to 0.2

Solution

a) $m = \frac{V_{max} - V_{min}}{V_{max} + V_{min}}$

$= \frac{125 - 25}{125 + 25} = 0.667$

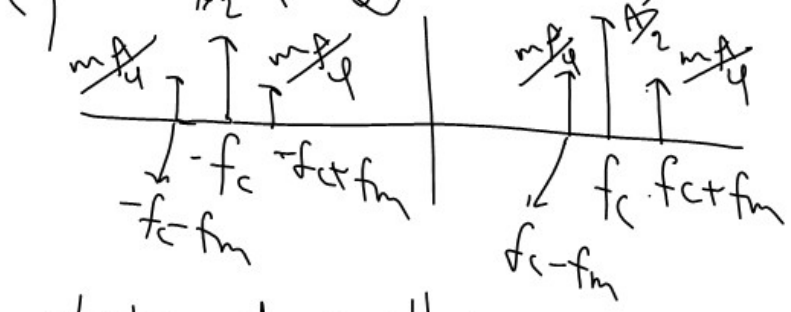
b) $\phi_{AM}(t) = A(1 + m\cos\omega_m t)\cos\omega_c t$

A can be found from either V_{max} or V_{min}

$V_{max} = (1+m)A = 125$

$= (1 + \frac{2}{3})A = 125 \Rightarrow A = 75V$

c)



Note that when we expand

$\phi_{AM}(t) = A\cos\omega_c t + mA\cos\omega_m t\cos\omega_c t$

The term $mA\cos\omega_m t\cos\omega_c t = \frac{mA}{2}\cos(\omega_c + \omega_m)t + \frac{mA}{2}\cos(\omega_c - \omega_m)t$

d) $m = \frac{|min(f(t))|}{A}$

$\frac{2}{3} = \frac{V_m}{75} \Rightarrow V_m = 75 \times \frac{2}{3}$

$= 50V$

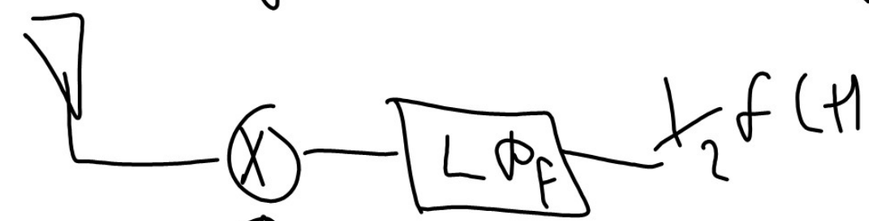
$m = \frac{V_m}{A}$

$0.2 = \frac{50}{A} \Rightarrow A = \frac{50}{0.2} = 250V$

5.2.3 Demodulation of DSB-LC Signals

* There are two ways to demodulate DSB-LC

a) By using coherent detector which is not prefered because of the synchronization problem



b) By using an envelope detector which is shown below