AV314 - Assignment 2

1) The signal flow diagram of a DSB system is shown below
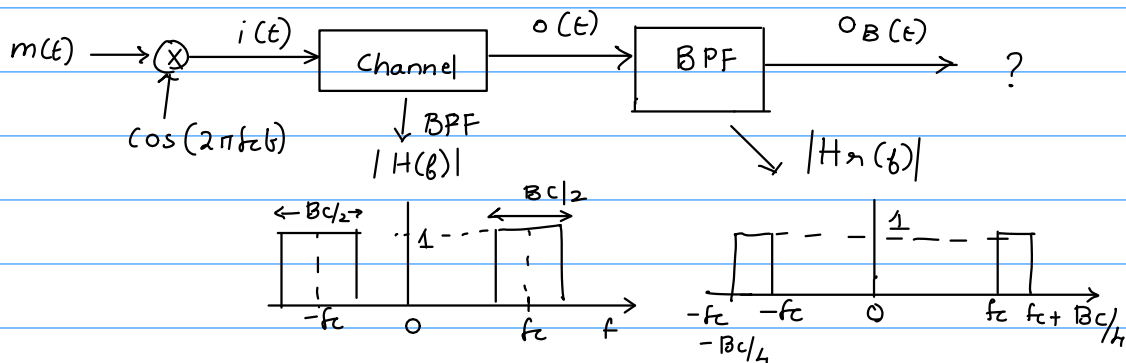
message signal $m(t)$ → X ②→ Channel ③→ X ⑤→ LPF ⑥→

① Local oscillator

④ Local oscillator
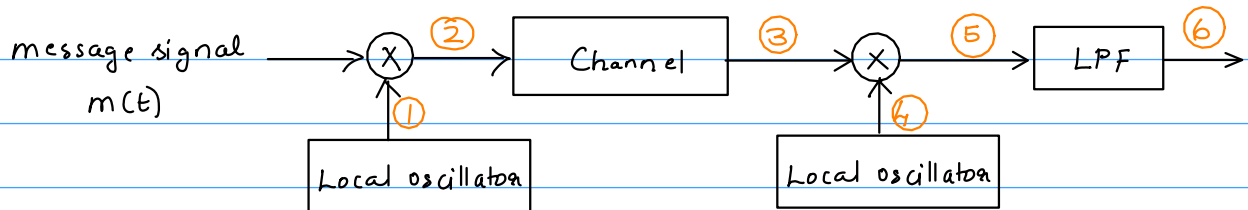
Suppose $m(t)$ has the spectrum

$|M(f)|$ with value 1, triangular, bandwidth B_M , $\angle M(f)$ through 0
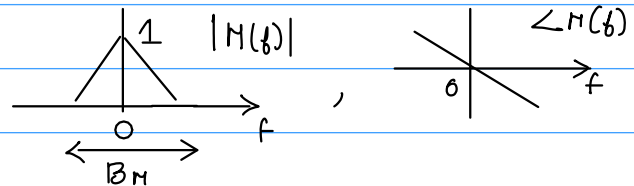
Draw the spectrum of the signals at ①,②,③,④,⑤ and ⑥ if the channel is a ideal BPF centered at f_c with a bandwidth $B_C \geqslant 2B_M$ and it is required that the signal at ⑥ is a replica of the signal $m(t)$.

2) Consider a DSB system as shown : $m(t)$ is the same signal as in Q1 ; $B_C \geqslant 2B_M$

$m(t)$ → X $i(t)$ → Channel $o(t)$ → BPF $o_B(t)$ → ?

$\cos(2\pi f_c t)$

Channel: ↓ BPF $|H(f)|$

$\leftarrow B_C/2 \rightarrow$ ... 1 ... $\overleftarrow{B_C/2}$, at $-f_c$, 0, f_c, f

BPF: $|H_2(f)|$

1 , $-f_c$, $-f_c$, $-B_C/4$, 0 , f_c , $f_c + B_C/4$

The channel and the bandpass filter have the freq responses shown by $|H(f)|$ and $|H_2(f)|$ (and linear phase response). Draw the spectrum of $o_B(t)$. How will you recover $m(t)$ from $o_B(t)$? Draw a signal flow diagram / block diagram which shows how this recovery is done.

(PTO).

3) Suppose I have two baseband signals $m_1(t)$ and $m_2(t)$ with spectra as shown:

$|M_1(f)|$ B_{M_1} $|M_2(f)|$ B_{M_2}

$\angle M_1(f)$ f $\angle M_2(f)$ f
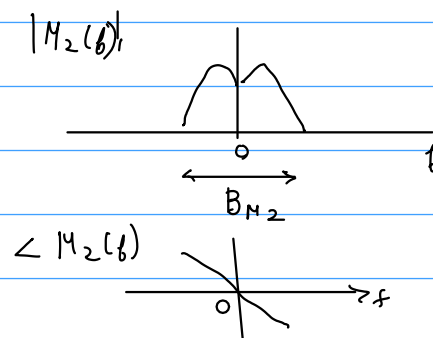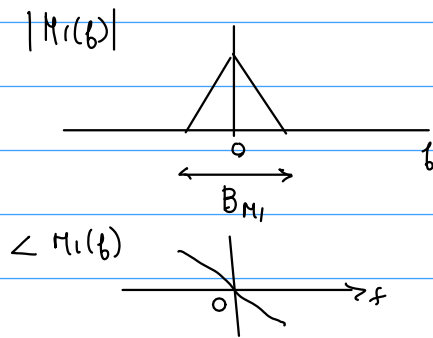
Write down the functions (input → output map) of the blocks marked by ? in the following signal flow diagram. Write down what the signals are at ①, ②, ③, ④, ⑤ ⑥. What should be the freq responses of Ⓑ and Ⓛ?
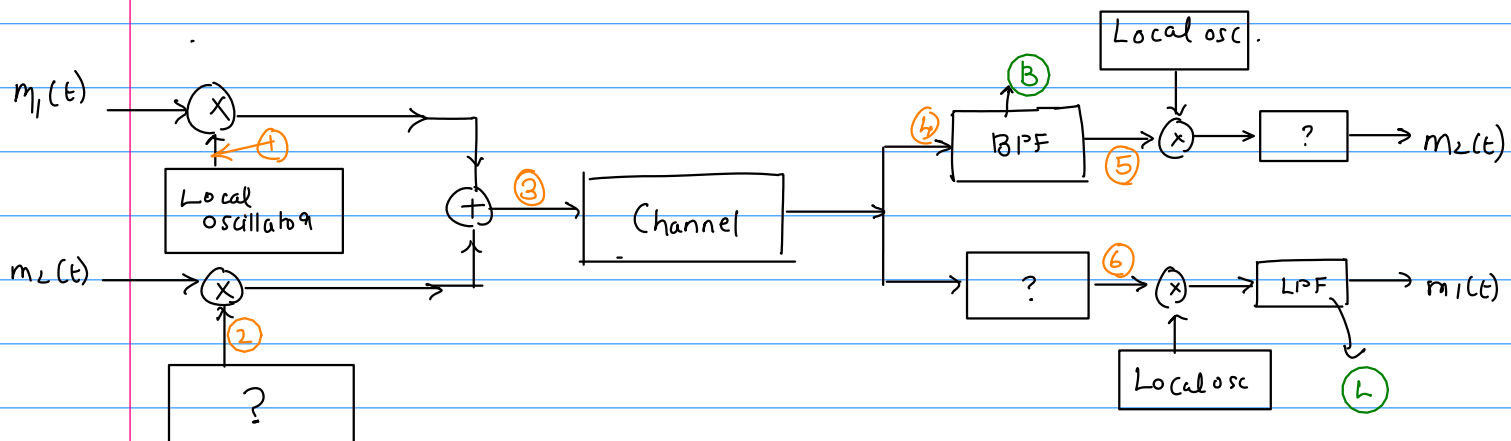
Assume that the channel has the following freq response.

$B_c/2 \geq B_{M_1} + B_{M_2}$