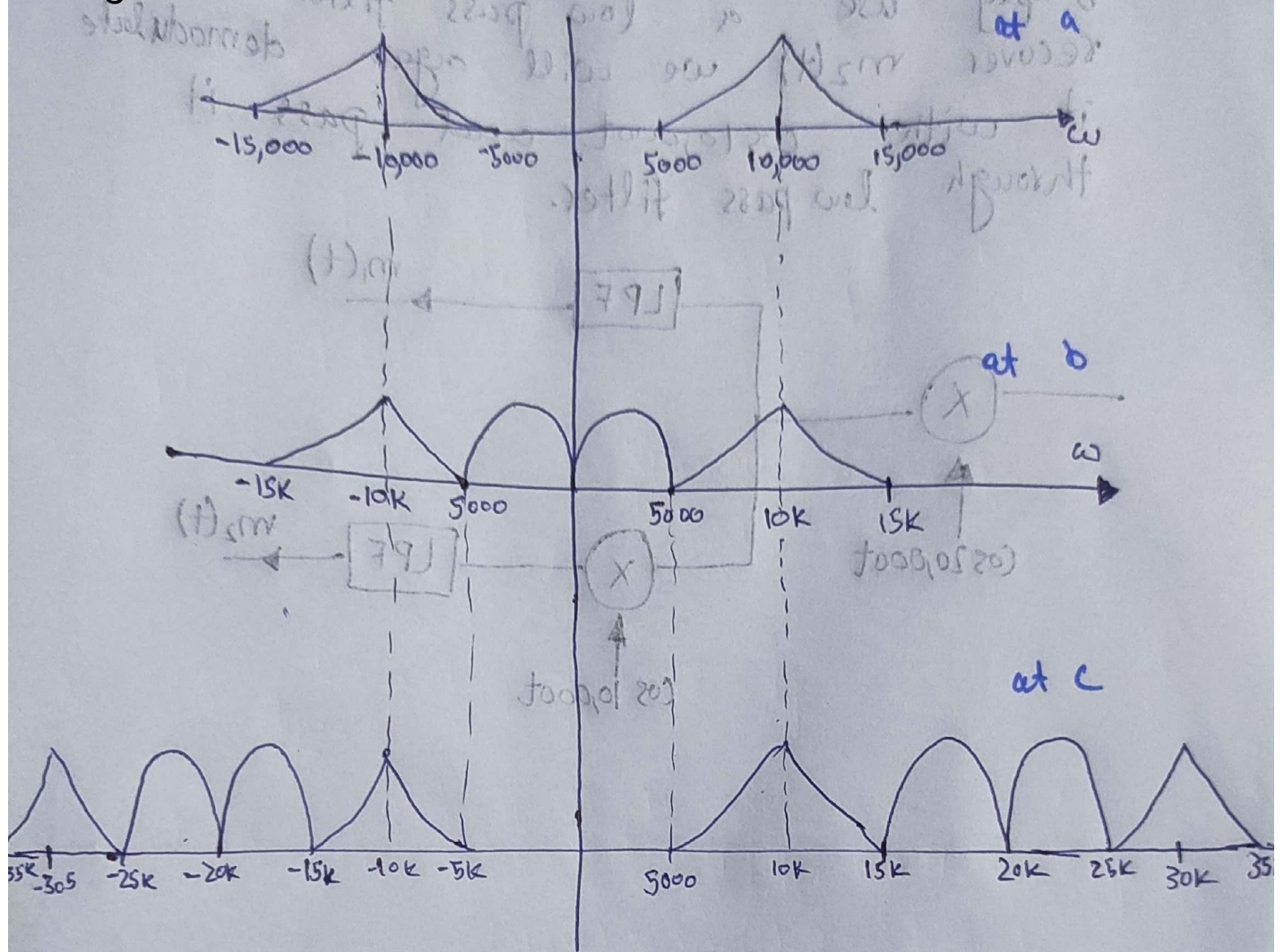


## Assignment 2 Q2

Spectra at a, b and c.



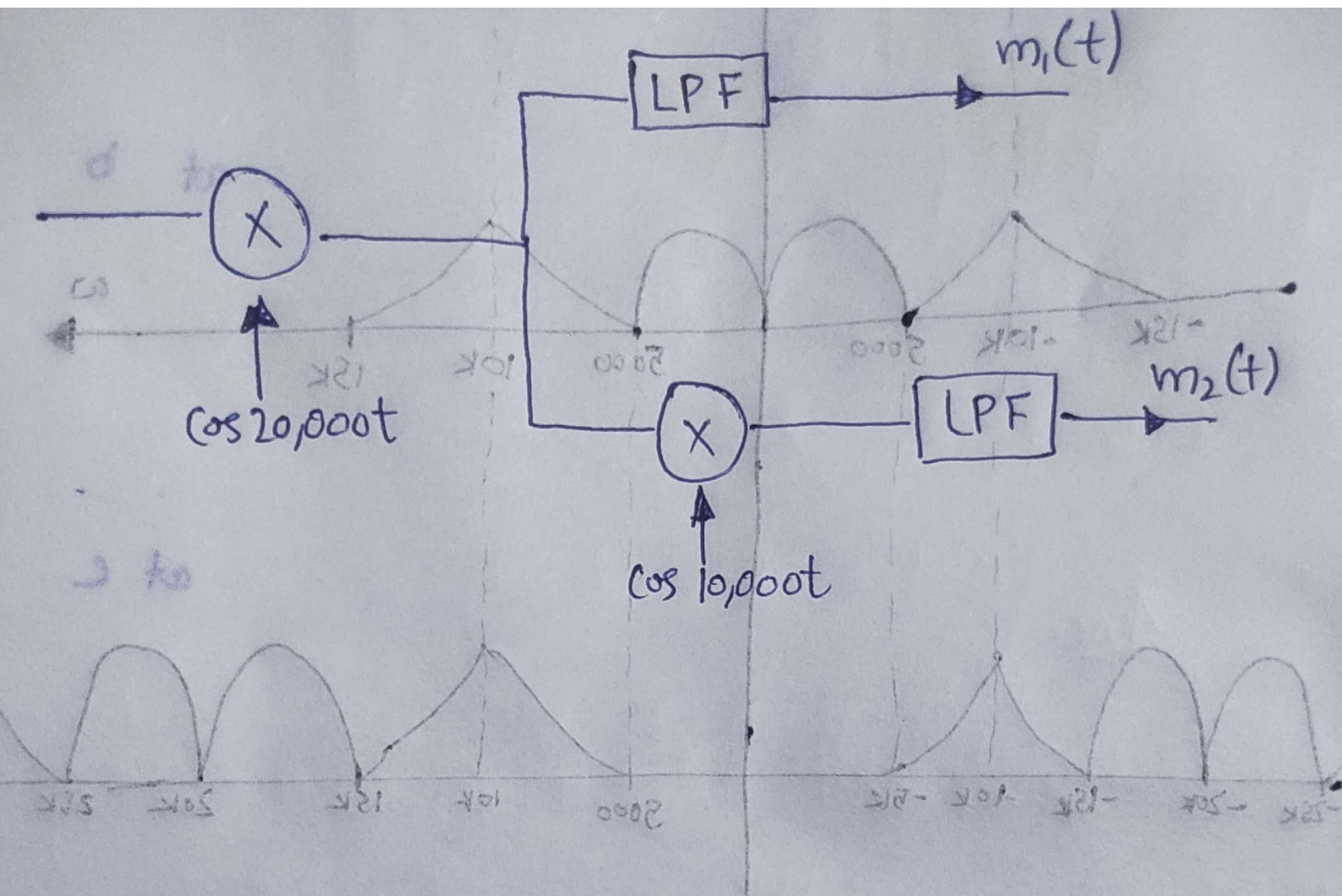
Part b:-

The bandwidth of channel must be at least  $30,000 \text{ rad/s}$  i.e. from  $5,000$  to  $35,000 \text{ rad/s}$ .

Part c:-

At receiver's end, we will perform the inverse operation of Modulation i.e. Demodulation. So, first we will demodulate the output at c by  $\cos 20,000t$  then we will get the spectra of (b) and some high frequency





Part D:-

The bandwidth of channel must be at least 30,000 Hz from 2000 to 38,000 Hz.

Part C:-

At receiver's end, we will perform the inverse operation of modulation i.e. demodulation. So first we will calculate the carrier frequency of the received signal. Then we will compare it with the carrier frequency of the transmitter. If they are same, then we will get the original signal.



Q2:- Ans:-  $\omega_c = 2\pi \times 10^6$

For Q1, See Book and Notes

$$\phi_{EM}(t) = 10 \cos(\omega_c t + 0.1 \sin 2000\pi t)$$

$\omega_i(t)$

### Assignment 3 Q2

(a) Power:-

$$P_{EM} = \frac{10^2}{2} = 50 \text{ Watts}$$

(b)  $\Delta f$ :-

$$\omega_i(t) = \frac{d}{dt} (\omega_c t + 0.1 \sin 2000\pi t)$$

$$\omega_i(t) = \omega_c + 200\pi \sin 2000\pi t$$

$$\Delta\omega = 200\pi \times (\text{Max value of } \sin 2000\pi t)$$

$$\Delta\omega = 200\pi \times 1$$

$$\Delta\omega = 200\pi$$

$$\Delta f = \frac{200\pi}{2\pi} = \boxed{100 \text{ Hz}}$$

(c)  $\Delta\phi$ :-

$$\Delta\phi = \cancel{\omega_c} (0.1) (\text{Max value of } \sin 2000\pi t)$$

$$\boxed{\Delta\phi = 0.1}$$

(d)  $B_{EM}$ :-

$$B_{EM} = 2(100 + 1000)$$

$$B_{EM} = 2(1100) = \boxed{2200 \text{ Hz}}$$