11/02/20 TUE

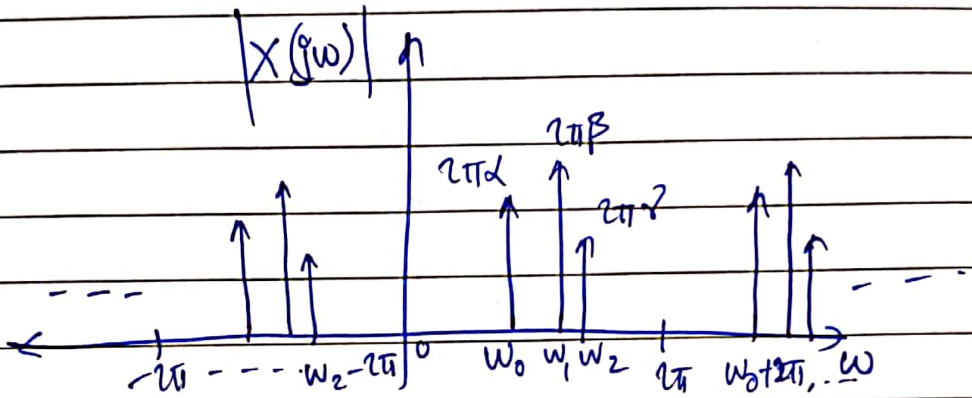
GROUP-17

QUESTION 8 TUT-5

Q8) Given, $x[n] = \alpha e^{j\omega_0 n} + \beta e^{j\omega_1 n} + \gamma e^{j\omega_2 n}$

$$\text{DTFT}\{e^{j\omega_0 n}\} = 2\pi \sum_{k=-\infty}^{\infty} \delta(\omega-\omega_0-2\pi k)$$

Therefore, $$\text{DTFT}\{x[n]\} = 2\pi \sum_{k=-\infty}^{\infty} \{\alpha\delta(\omega-\omega_0-2\pi k) + \beta\delta(\omega-\omega_1-2\pi k) + \gamma\delta(\omega-\omega_2-2\pi k)\}$$



We require $x[n] * h[n] = 0$

i.e. $X(j\omega) H(j\omega) = 0$

Therefore, choose $H(j\omega) = \begin{cases} 1, & 0 \le |\omega| \le a \\ 0, & a < |\omega| \le \pi \end{cases}$ ~~otherwise~~

where $H(j\omega)$ is periodic with period 2π

★ without loss of generality assume $0 < \omega_0 < \omega_1 < \omega_2 < 2\pi$

Note: here $a < \min(\omega_0, 2\pi - \omega_2)$

Thus, $h[n] = \text{Inverse DTFT}\{H(j\omega)\}$

$$= \frac{a}{\pi} \text{sinc}\left(\frac{an}{\pi}\right)$$

length of impulse response $h[n]$ is infinite in time.