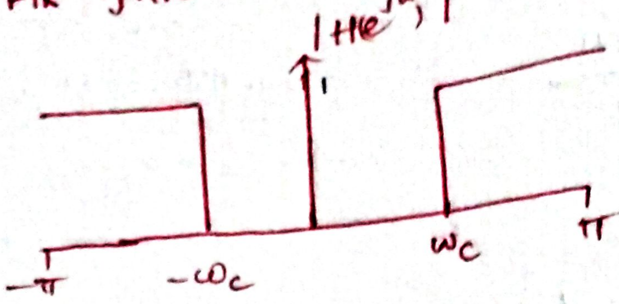
Design FIR filter:



IDTFT

$$h(n) = \frac{1}{2\pi}\int_{-\pi}^{\pi} H(e^{j\omega}) \cdot e^{j\omega n}\, d\omega$$

$$= \frac{1}{2\pi}\left[\int_{-\pi}^{-\omega_c} e^{j\omega n}\, d\omega + \int_{\omega_c}^{\pi} e^{j\omega n}\, d\omega\right]$$

$$= \frac{1}{2\pi}\left[\left.\frac{e^{j\omega n}}{jn}\right|_{-\pi}^{-\omega_c} + \left.\frac{e^{j\omega n}}{jn}\right|_{\omega_c}^{\pi}\right]$$

$$= \frac{1}{2\pi}\left[\frac{e^{-j\omega_c n}}{jn} - \frac{e^{-j\pi n}}{jn} + \frac{e^{j\pi n}}{jn} - \frac{e^{+j\omega_c n}}{jn}\right]$$

$$= \frac{1}{2\pi}\left[\left(\frac{e^{j\pi n} - e^{-j\pi n}}{jn}\right) - \left(\frac{e^{j\omega_c n} - e^{-j\omega_c n}}{jn}\right)\right]$$

$$= \frac{1}{2\pi}\left[\frac{2\sin\pi n}{n} - \frac{2\sin\omega_c n}{n}\right].$$

$$h(n) = \left[\frac{\sin\pi n}{\pi n} - \frac{\sin\omega_c n}{\pi n}\right] \quad \cancel{\text{for } n \neq 0}$$

For $n \neq 0$

$$h(n) = \frac{-\sin \omega_c n}{\pi n} \qquad \because \sin n\pi = 0, \text{ for any } n.$$

For $n = 0$

$$h(n) = 1 - \frac{\sin(\omega_c n)}{\pi n} \qquad \because \lim_{n \to 0} \frac{\sin n}{n} = 1.$$

$$h(n) = 1 - \frac{\omega_c}{\pi}$$

$$\boxed{h(n) = \begin{cases} 1 - \dfrac{\omega_c}{\pi} & \text{for } n = 0 \\ -\dfrac{\sin \omega_c n}{\pi n} & \text{for } n \neq 0. \end{cases}}$$