SEAS Winter 2020
Semester-6
Digital Signal Processing

LAB 6

Objectives:

Understand different concepts of ideal digital Filters

Prerequisites:

- LTI Systems, DTFT-IDTFT, Sampling Theorem, Digital Frequency

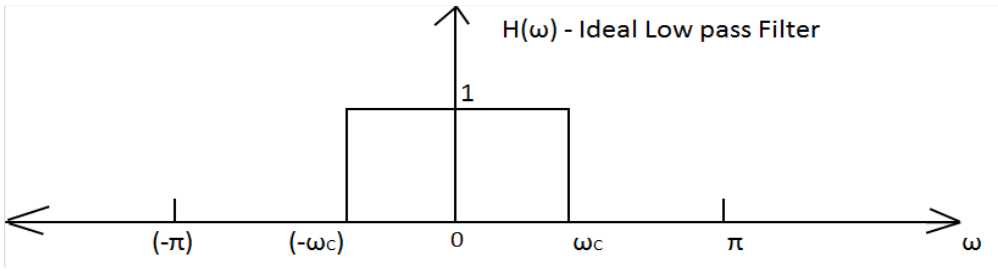
Important notes:

- Explore SINC function in Matlab, You need to use different Matlab function which you have already make like impulse, signal addition, convolution etc.

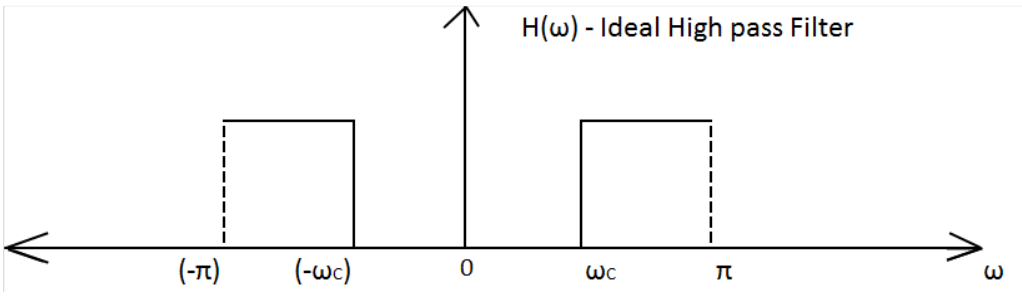
Problems

1. Obtain the impulse response of

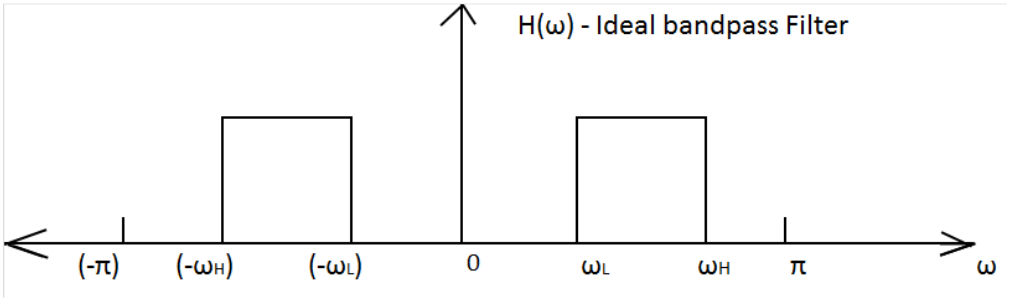
   a) Ideal Low pass filter – $H_{lp}(\omega)$



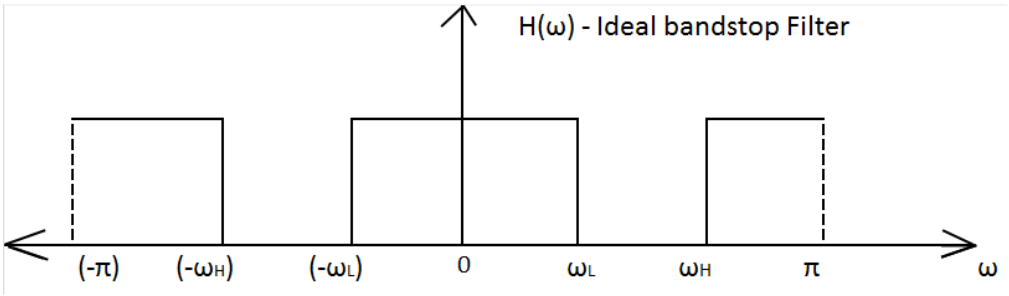
   b) Ideal High pass filter – $H_{hp}(\omega)$



c) Ideal Band pass filter- $H_{bp}(\omega)$



d) Ideal Band stop filter- $H_{bs}(\omega)$



Steps to obtain impulse response of ideal digital filters :

- Based on frequency response given above, obtains specifications for H(ω) for all four filters.
- After obtaining H(ω) for each filter. Take IDTFT for each filter type to obtain h(n)
- Adjust h(n) in terms of "SINC" function
- Create single matlab script and write h(n) equation for each filter type.
- Plot h(n) for each filter type. Take h(n) range from n=-20 to n=20 (Truncated response).
- Take f_c= 1/6 , f_L= 1/9, f_H= 1/3

2. Let input signal x(n) = $10\cos\left(\frac{2\pi n}{20}\right) + 5\cos\left(\frac{2\pi n}{8}\right)$ passes though ideal low pass and ideal high pass filter by determining f_{c1} and f_{c2}.

- Find y(n) (i.e. Convolution) in both case using your own function. Make sure that output response is same as equation. Take f_c= 1/12
- This is the application of convolution for signal filtering.