

FILTERS

FILTERS

- A filter is a circuit that passes certain frequencies and attenuates or rejects all the other frequencies.
- All communication system uses filters
- Types of filters:
 - Active Filter
 - Passive Filter

Active Filters

- Based on the configuration of Op-Amps
- Low Cost
- Useful below 1Mhz
- Easy to Tune

Passive Filters

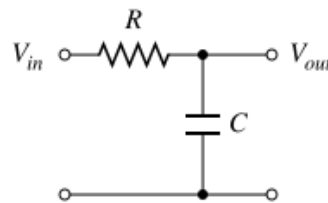
- Built with R,L, C
- Useful for frequencies above 1MHz
- Difficult to Tune
- High Cost

Passive Filter Types

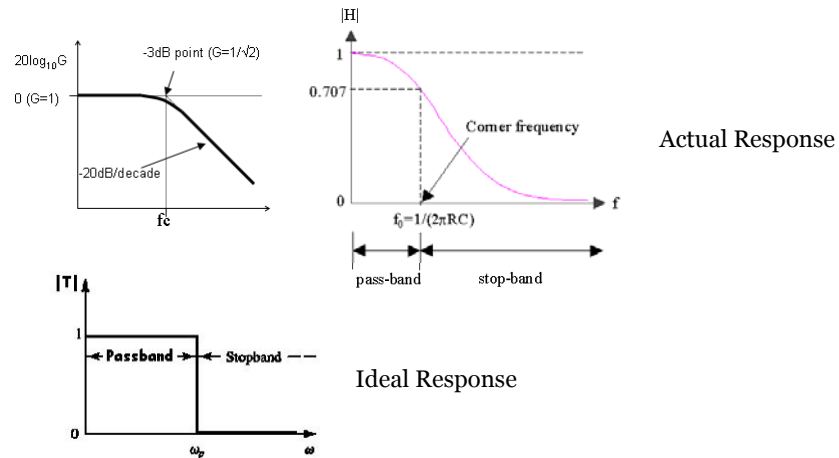
- Low Pass Filters
- High Pass filters
- Band Pass Filters
- Band Stop Filters

Low Pass Filters

- A low pass filter is one that passes all frequencies from 0 to f_c and significantly attenuates (Rejects) all above f_c
- The Critical frequency occurs when $X_c=R$
- $f_c = 1/(2\pi RC)$

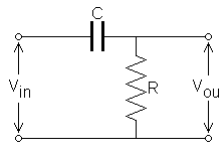


Response of Low pass filter

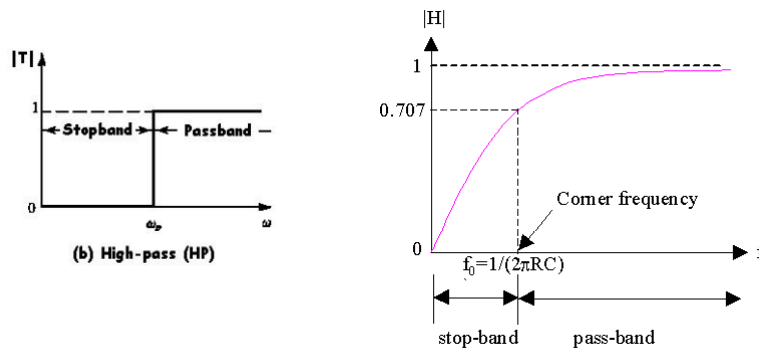


High Pass Filter

- A high pass filter is one that significantly attenuates or rejects all frequencies below f_c , and passes all frequencies above f_c .
- The critical frequency is the frequency at which the output is 70.7% of the input



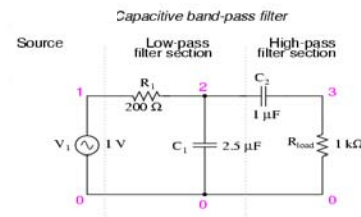
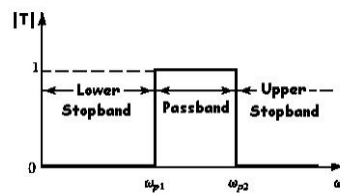
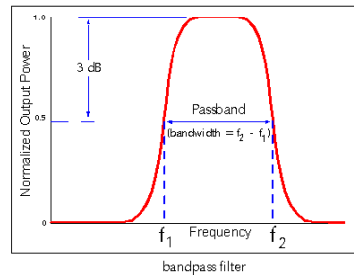
Response of RC High Pass Filter



Band Pass Filter Response

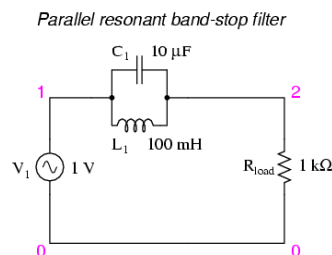
- A band Pass filter passes all signals lying within a band between a lower frequency limit and an upper frequency limit, and essentially rejects all other frequencies that are outside that specific band.
- The bandwidth is defined as the difference between the upper cutoff frequency (f_{c2}) and the lower cutoff frequency (f_{c1})
 - $B.W = f_{c2} - f_{c1}$

Response of Band Pass Filter

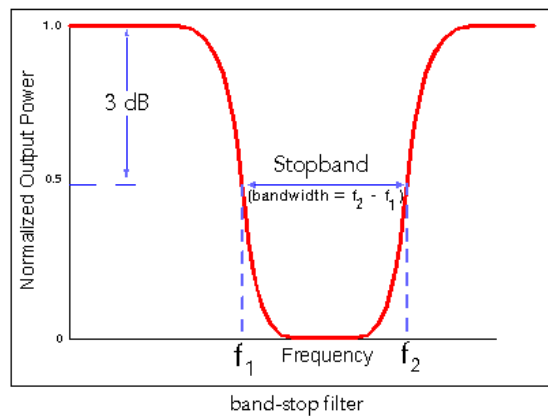


Band Stop Filter

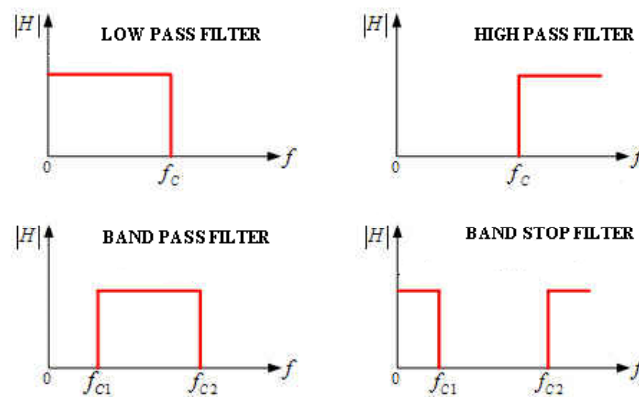
- Band stop filter has opposite function of band pass filter
- Frequencies within the certain bandwidth are rejected and frequencies outside the bandwidth are passed



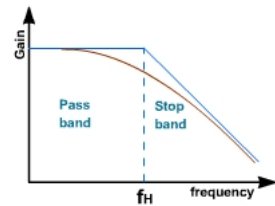
Response of Band Stop Filter



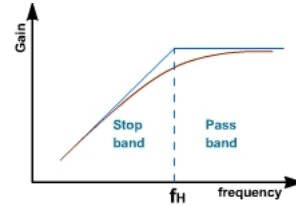
IDEAL RESPONSES OF FILTERS



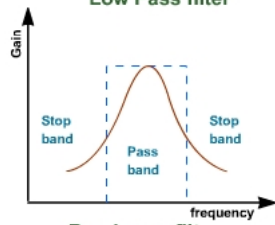
ACTUAL RESPONSE OF FILTERS



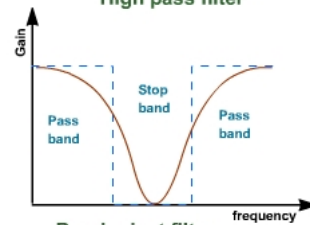
Low Pass filter



High pass filter



Band pass filter



Band reject filter