



6. RADIO CIRCUITS AND SYSTEMS

Chapter 6.4

Filters and Impedance matching

ARRL Amateur Extra Class



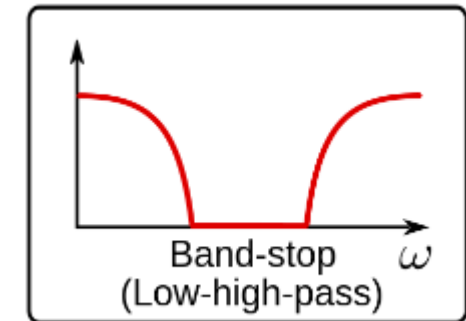
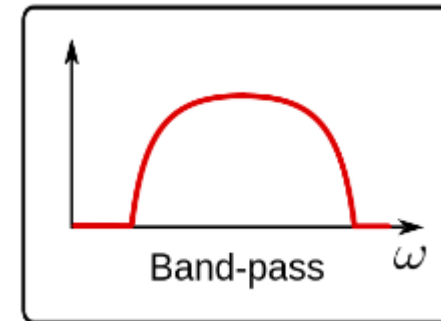
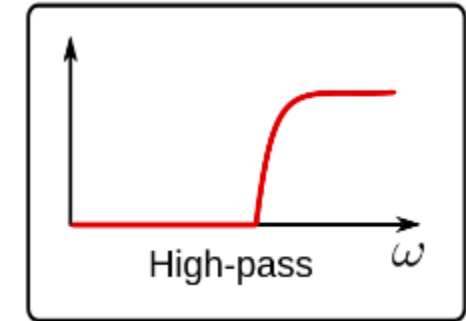
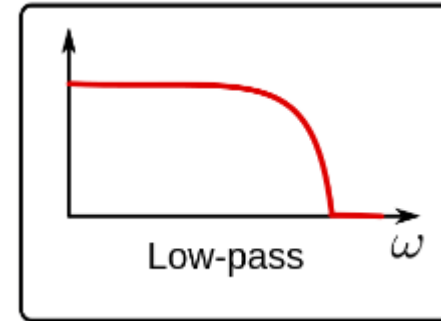


Section 6.4

Filters

4 (½) basic types

- Low pass
- High pass
- Band pass
- Band stop
- Notch
(band stop with very narrow passband)





Filter characteristics

Response curve

Cutoff frequency

-3 dB from passband

Sharpness / shape factor

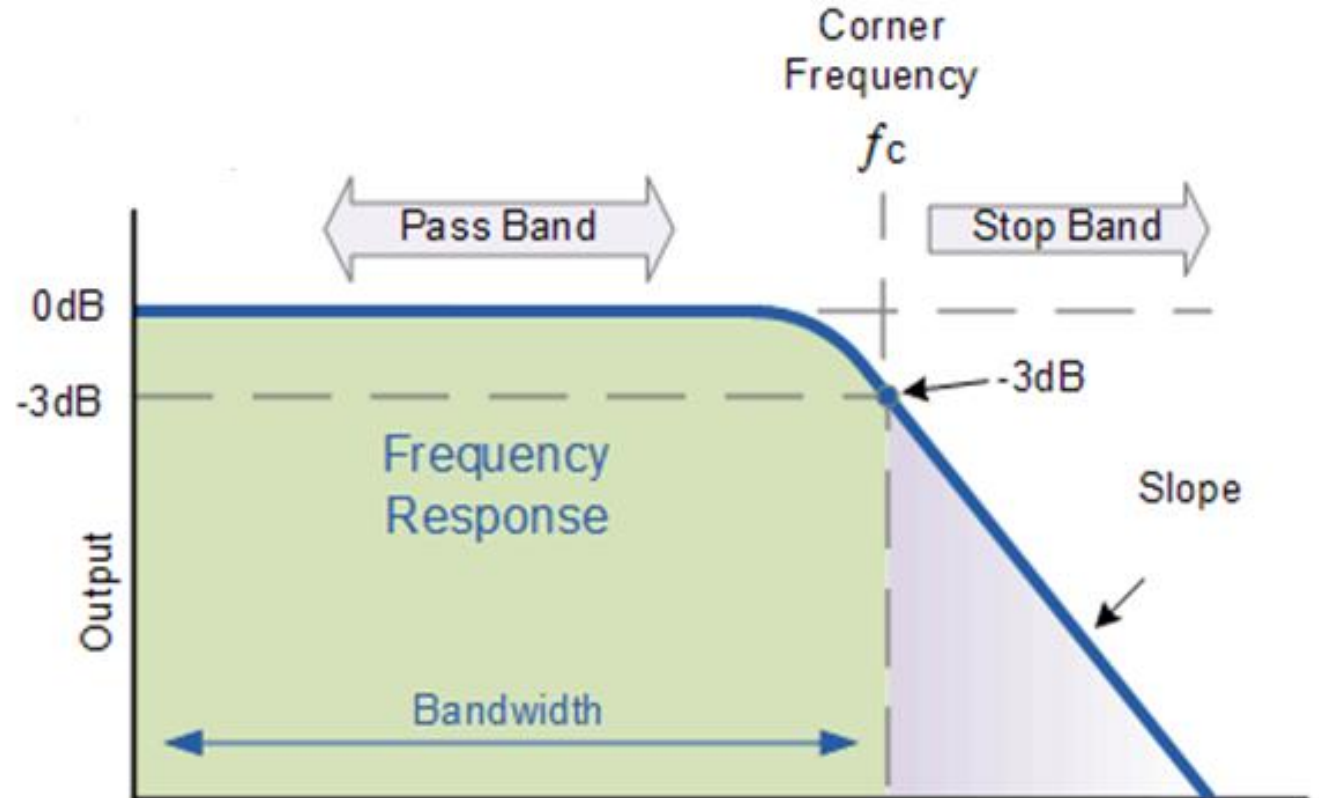
How steep from -6 to -60 dB

Design tradeoff

loss

ripple

shape





Filters

Butterworth

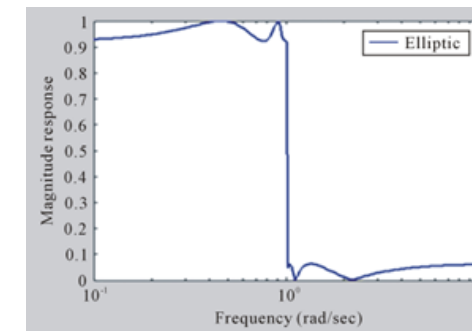
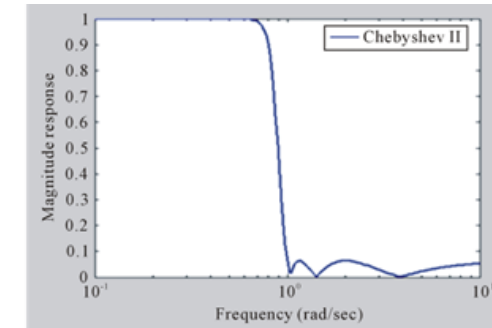
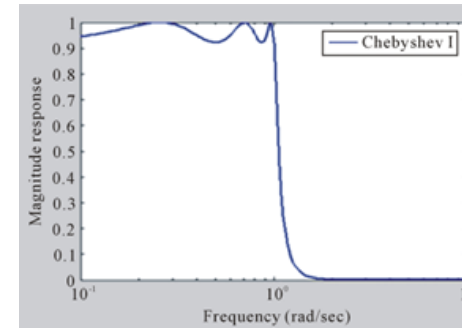
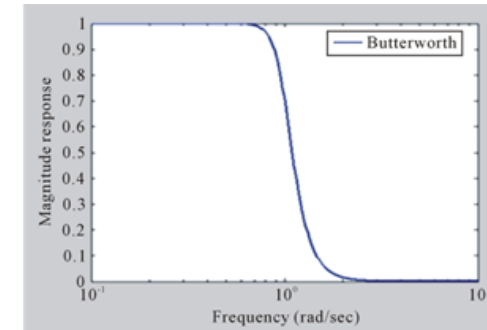
Smooth but not sharp

Chebyshev

Sharper but ripple in pass or stopband

Elliptical

Sharpest but ripple in both pass and stopband



Special Filters

Crystal filters

Very sharp passband

Can be connected in series (ladder)



Cavity filter

High/Lowpass

Very high Q

Sized to wavelength – may be large

Used in repeaters



Stub filters

Notch filter

High Q





Active filters

Contains some active component

Transistor, OP-amp, Tube

Powered

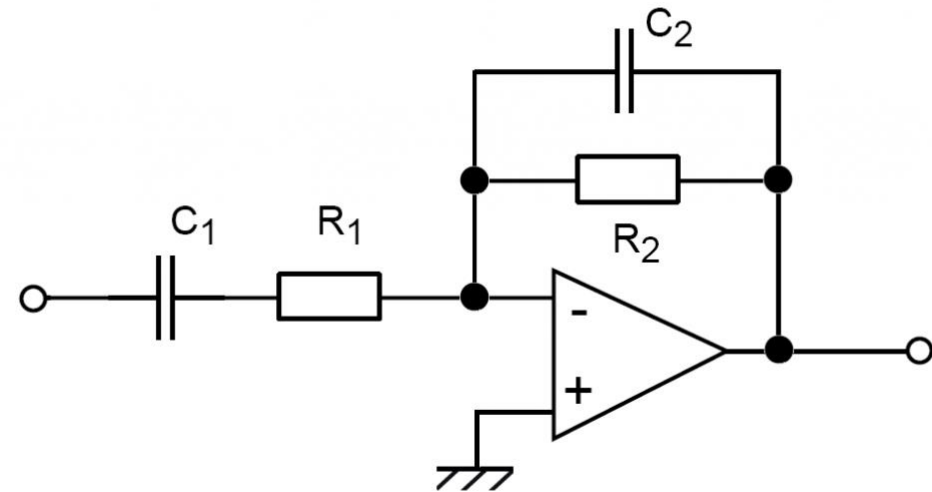
Compensates for Insertion Loss

Murphy's Law :

-"Amplifiers oscillate. Oscillators don't."

"Ringing" – Self oscillation

Reduce gain and/or Q (bandwidth)





Digital filters

DSP – high speed processing

Can have extreme characteristics

Very high Q, "brick wall"

Adaptive

IIR – Infinite Impulse Response

Low latency

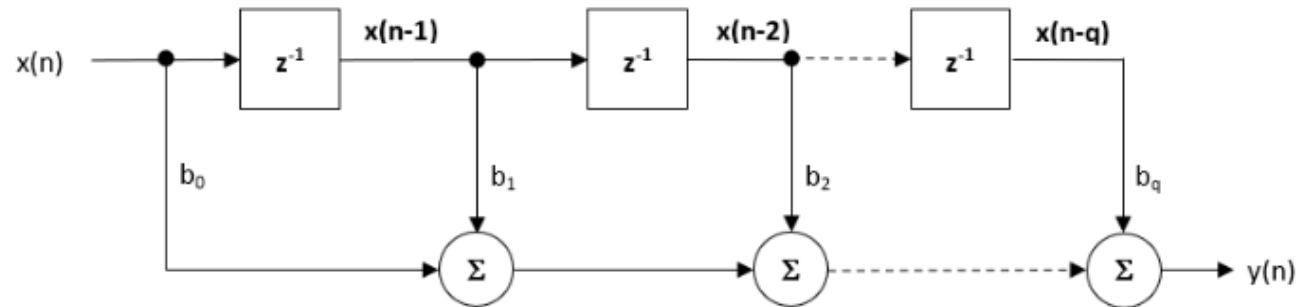
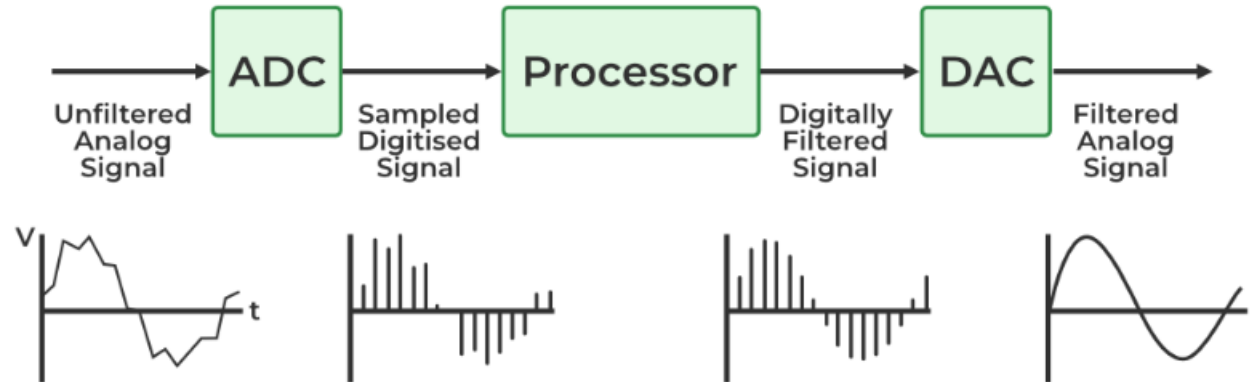
Mimics analog filters

FIR – Finite Impulse Response

Higher latency

Compute-heavy

Arbitrary frequency response





Section 6.4

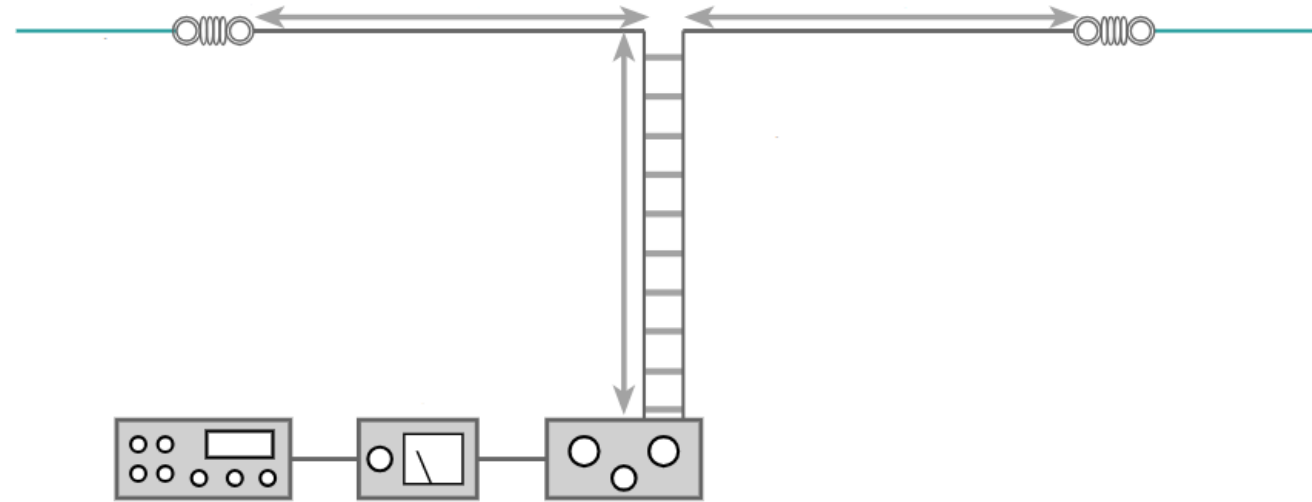
Impedance matching

All about POWER TRANSFER

Mismatch means power reflected

Matching network

"tuner"





Matching networks

Impedance matching circuits

Cancel the reactive part
Transforms to 50 Ohm

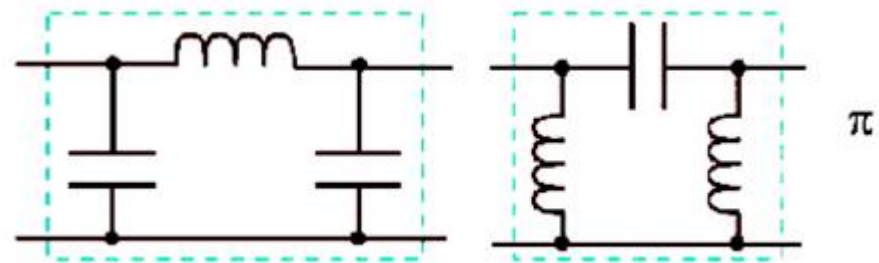
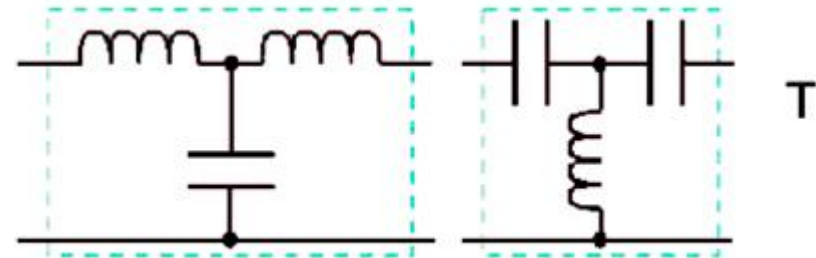
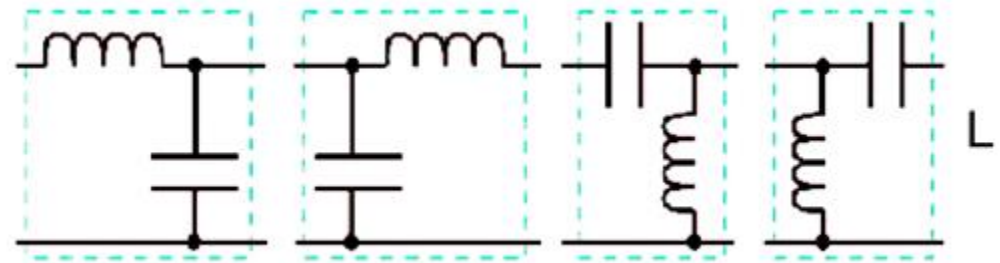
3 types: L, T and Pi

L : Simplest

T : Wider range

Pi : Widest range

Can be combined





QUESTIONS?

ONLINE EXAM REVIEW AND PRACTICE QUESTIONS:

<http://www.arrl.org/examreview>