# Coils, Caps Matching and Filters

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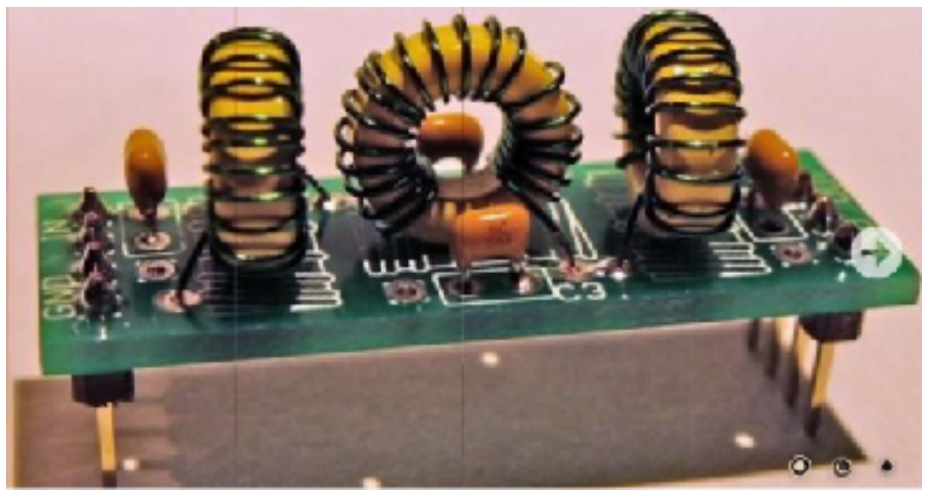



QRP-Labs LPFs $4.60

# Coils and Caps

Q = XL / R

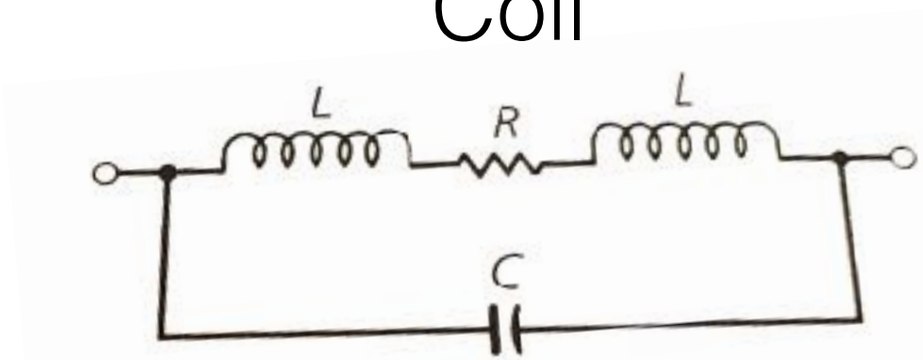
ESR = Effective Serial Resistance

Q = XC / ESR

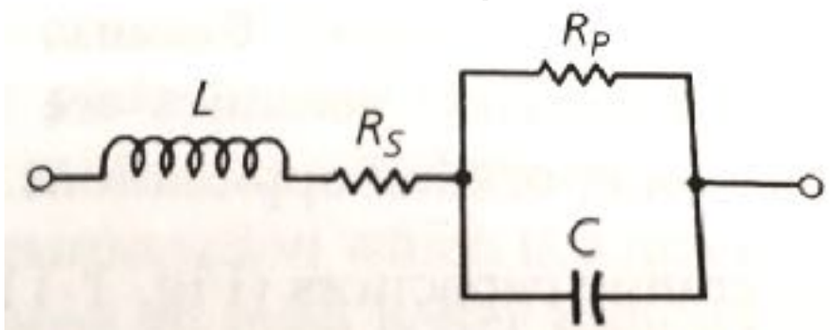
XL = 2*pi*L

XC = 1 / (2*pi*C)

Coil




Cap




Stray Cap & Ind = self resonance

# Heads-up XL & XC

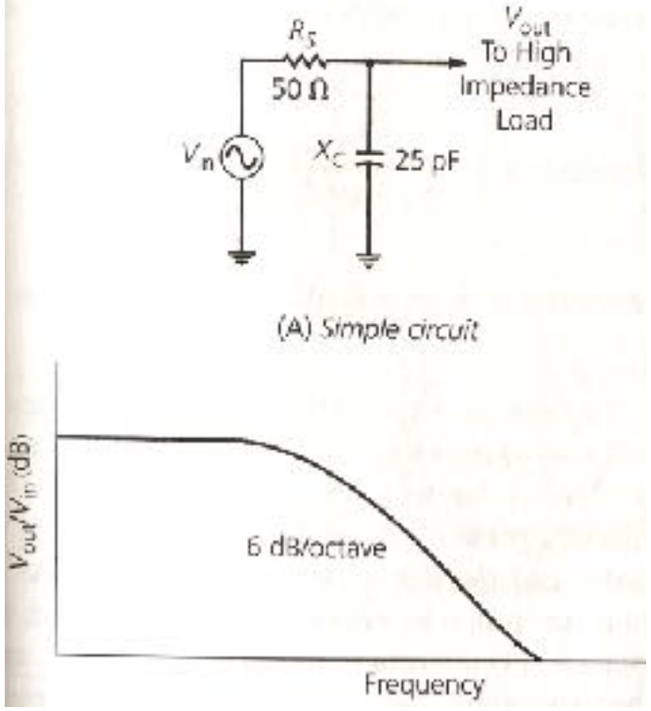
## Ohms

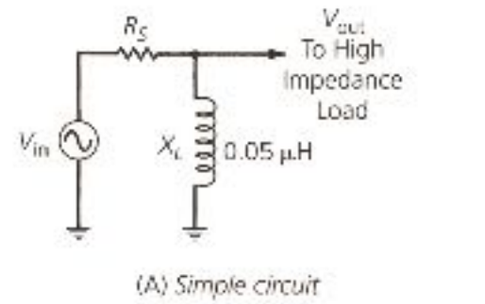
| | 80 | 40 | 20 |
|---|---|---|---|
| **1uH** | 22 | 44 | 88 |
| **10uH** | 220 | 440 | 880 |
| **100pF** | 450 | 230 | 114 |
| **1000pF** | 45 | 23 | 11 |
| **100nF** | 0.45 | 0.22 | 0.11 |

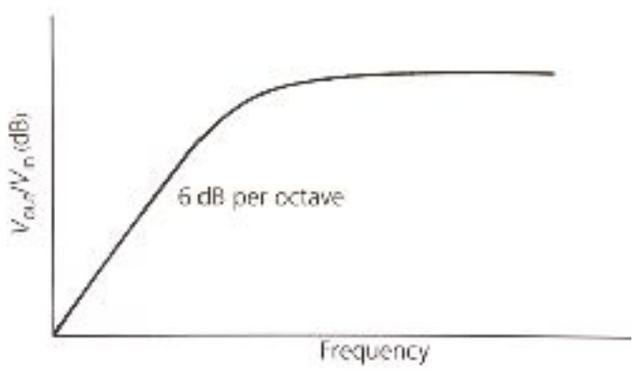
# CIRCUITS

XC = 1 / (2*pi*f)

XL = 2*pi*f

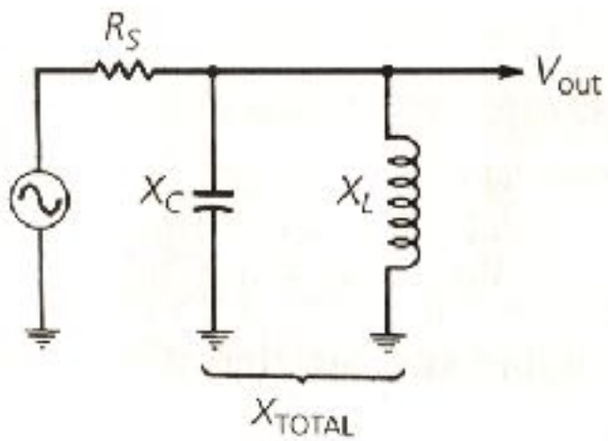


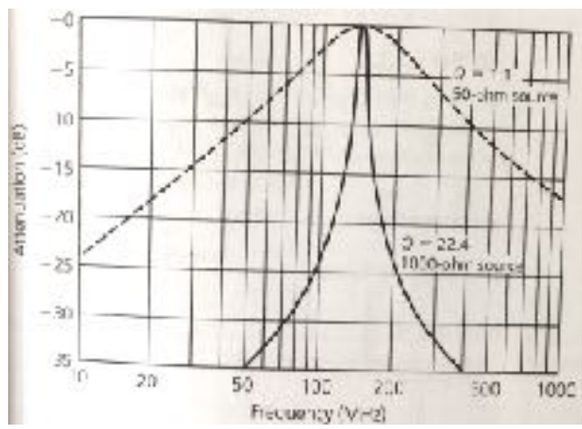




X = XC*XL / (XC + XL)

High Rs = High Q
Add output Rl = lower Q



# CIRCUITS

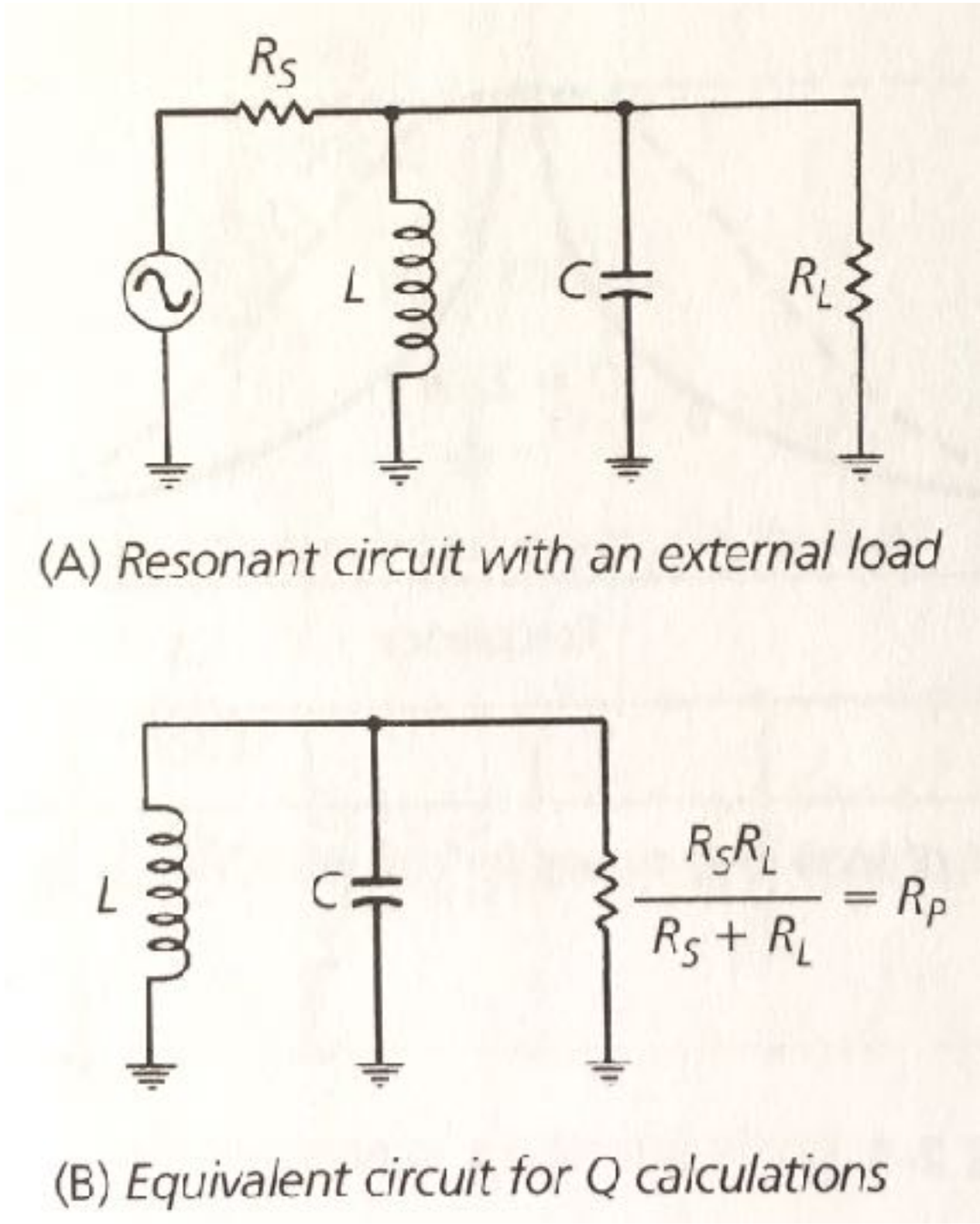
The source and load resistors

act in parallel on the circuit

and affect the Q

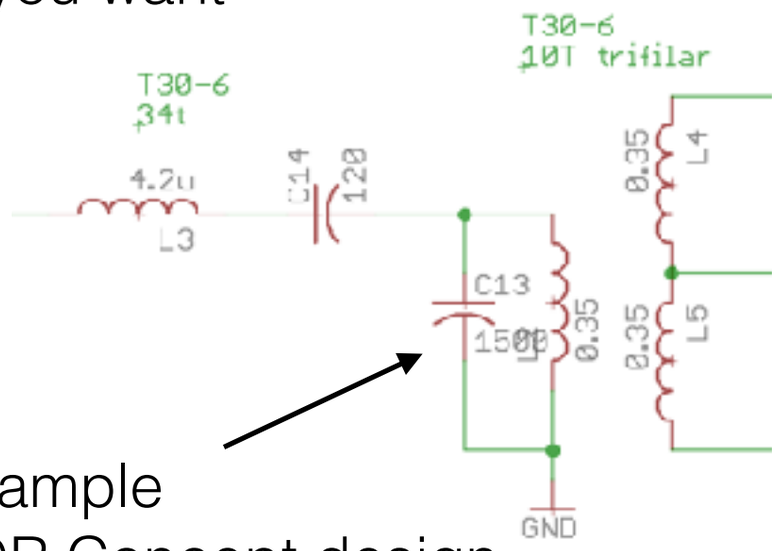
$R_p = R_s * R_l / (R_s + R_l)$

$Q = R_p / X_c = X_l / R_p$

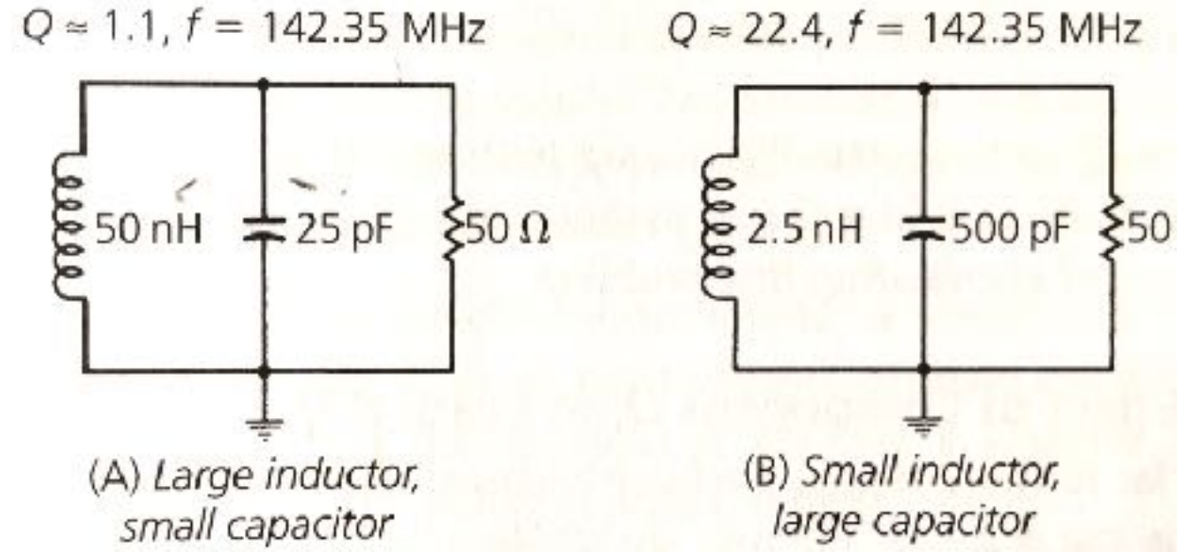


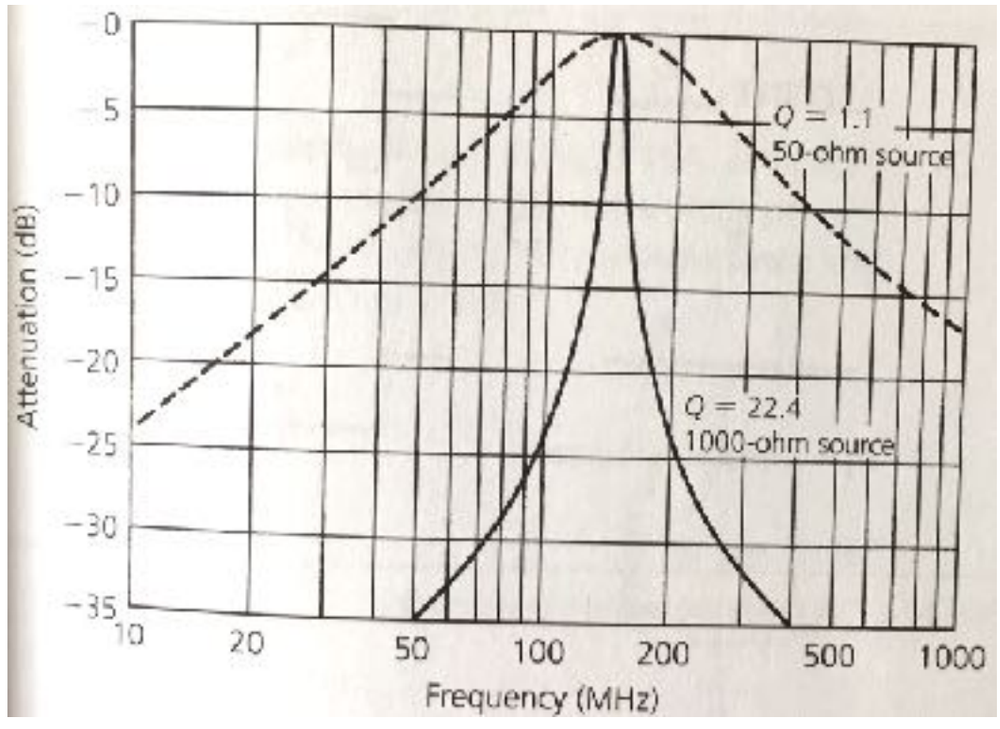
# Example

You can select the values of
L & C to get the response curve
you want




Example
SDR Concept design
Uses High Cap & Low Ind
To get high Q
at low impedance



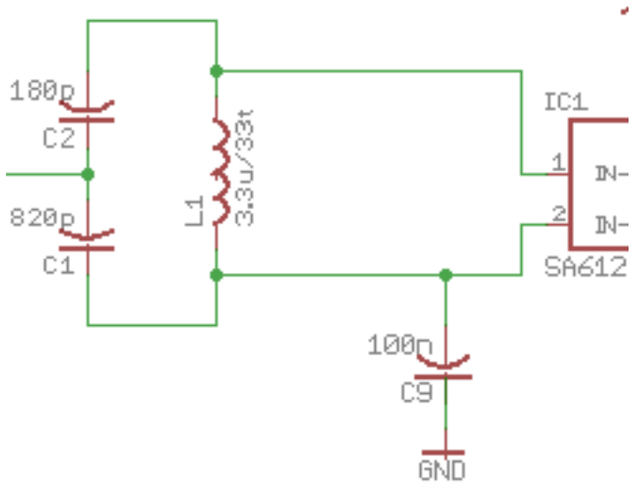



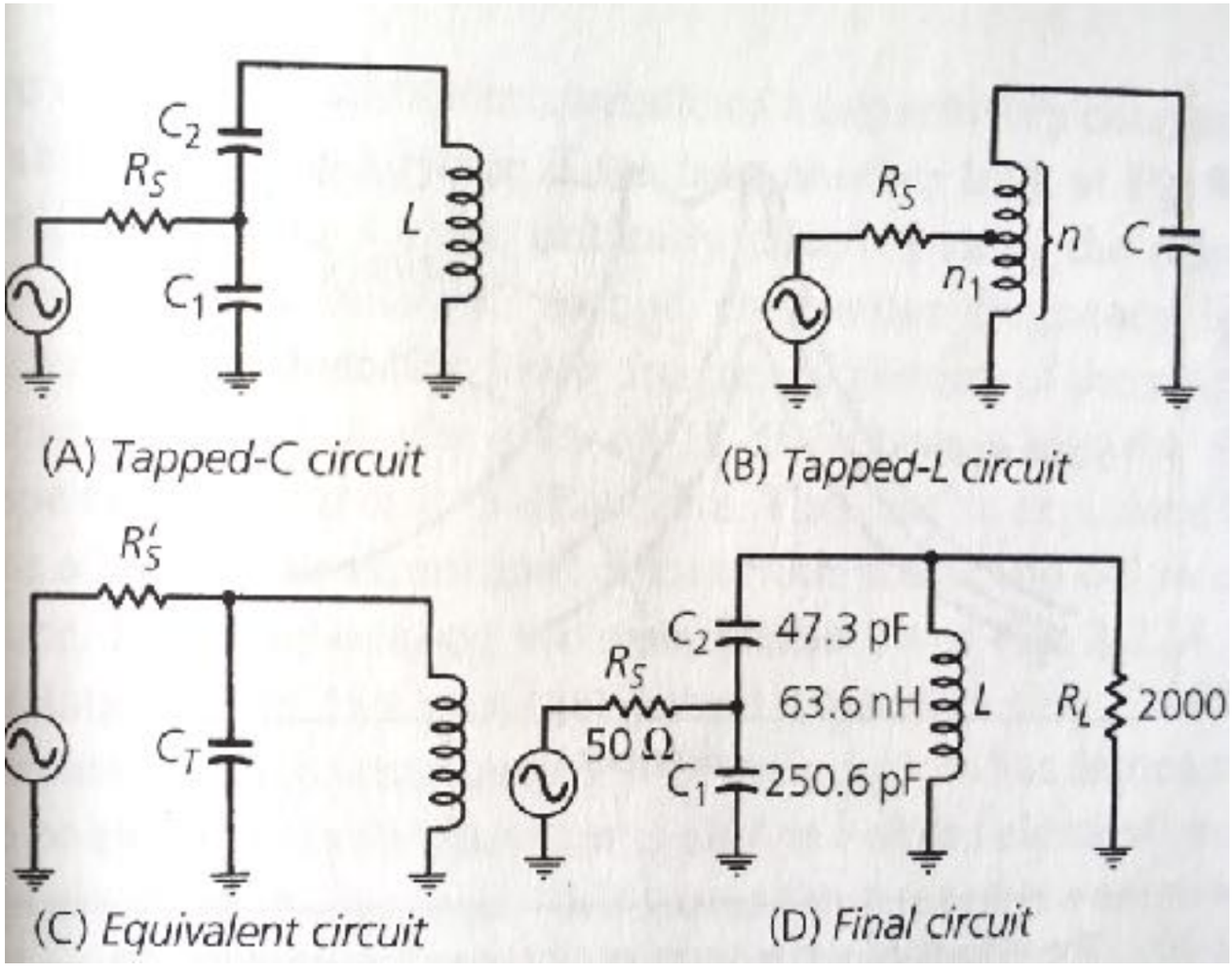
# Example

You can split the capacitors into two to get the matching and Q you want

E.G to match 50R input to
1k5 input of SA612 mixer IC

As I did for my DCRX 40m design

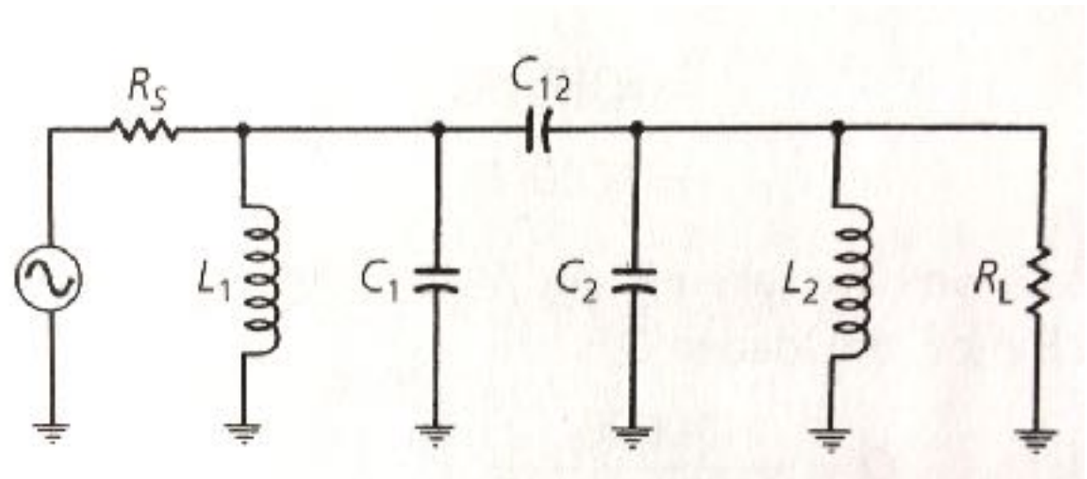


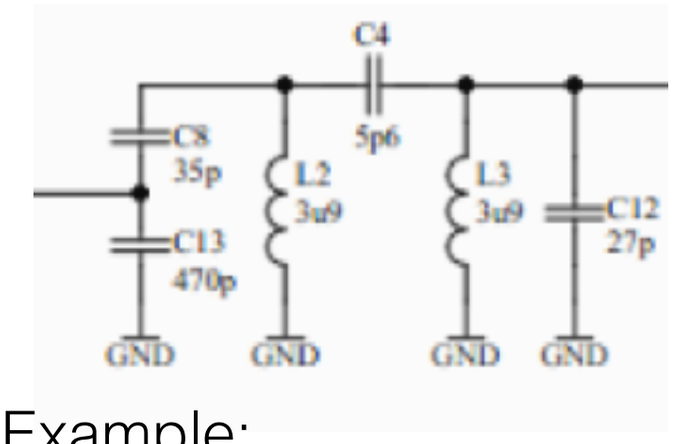
# Example

Coupled tuned circuits give various responses

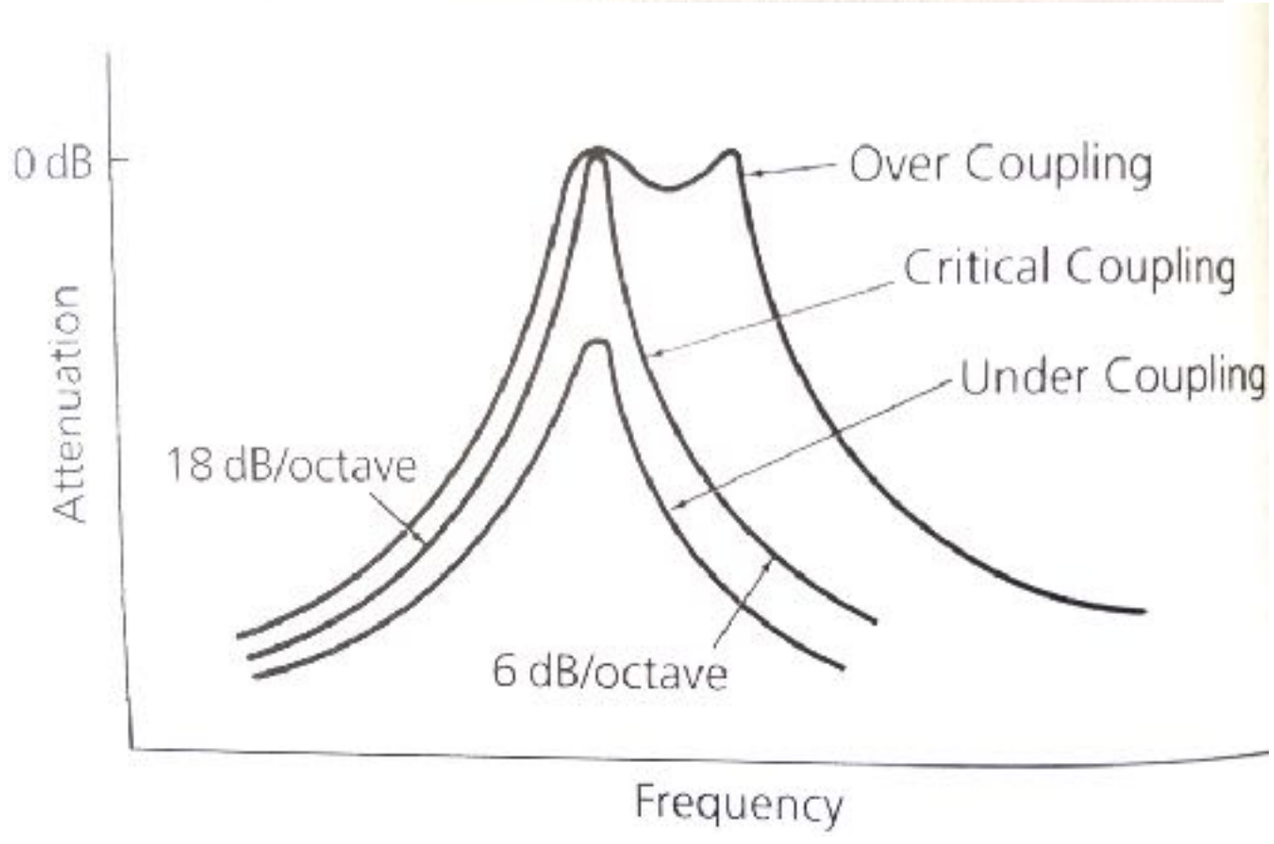
Depends on the coupling cap C12
Big = Over coupled
Small = under coupled




Often used slightly over-coupled to give bandpass response



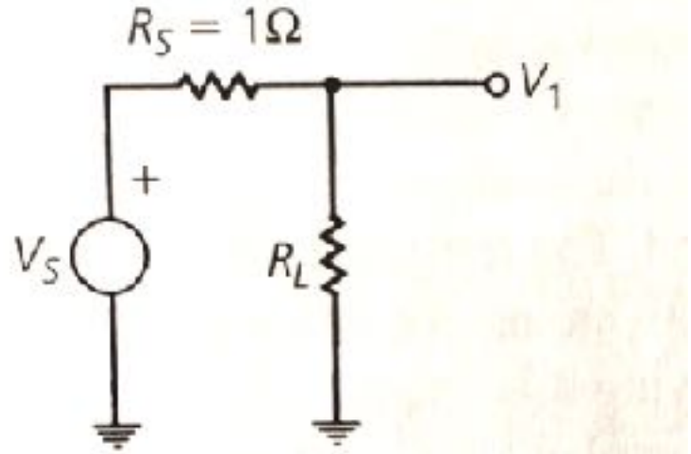

Example:
two techniques combined



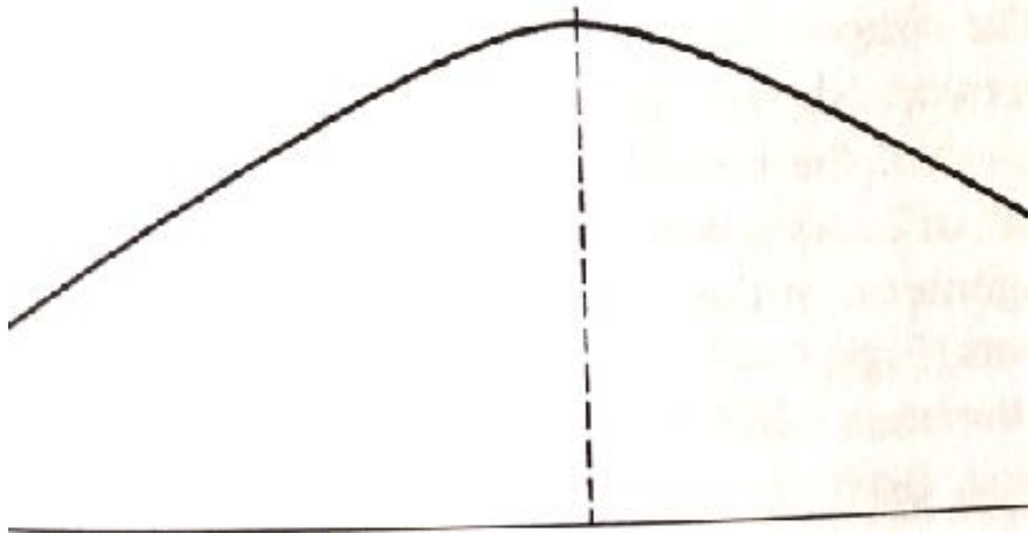
# MATCHING

Maximum Power transferred when

Rload = Rsource




(A) *Circuit*



# MATCHING

Four matching L networks are commonly used.

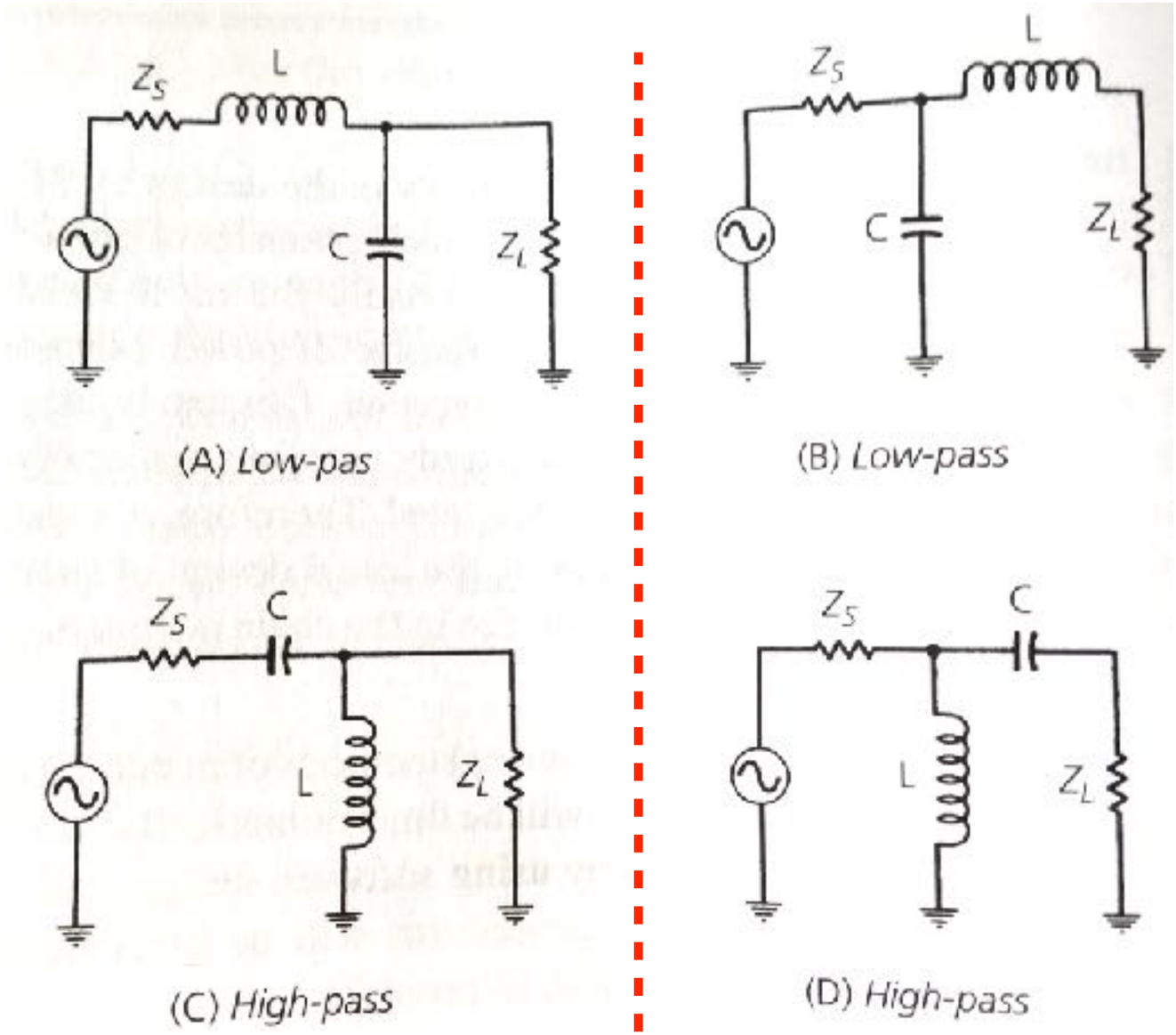
Low and High Pass

A & C
Low to High impedance

B & D
High to Low impedance

=====

These are NOT wide band matching, for that use a transformer



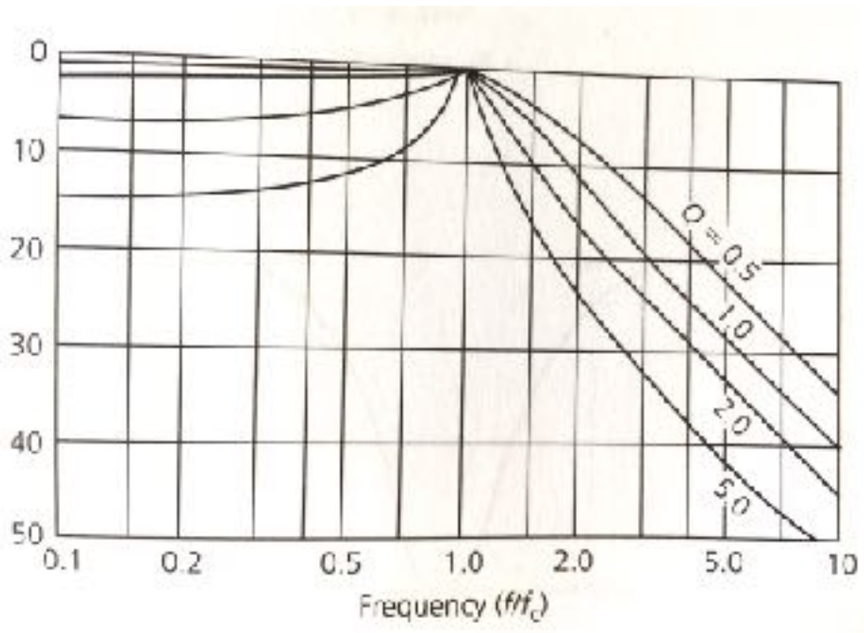
# FILTERS

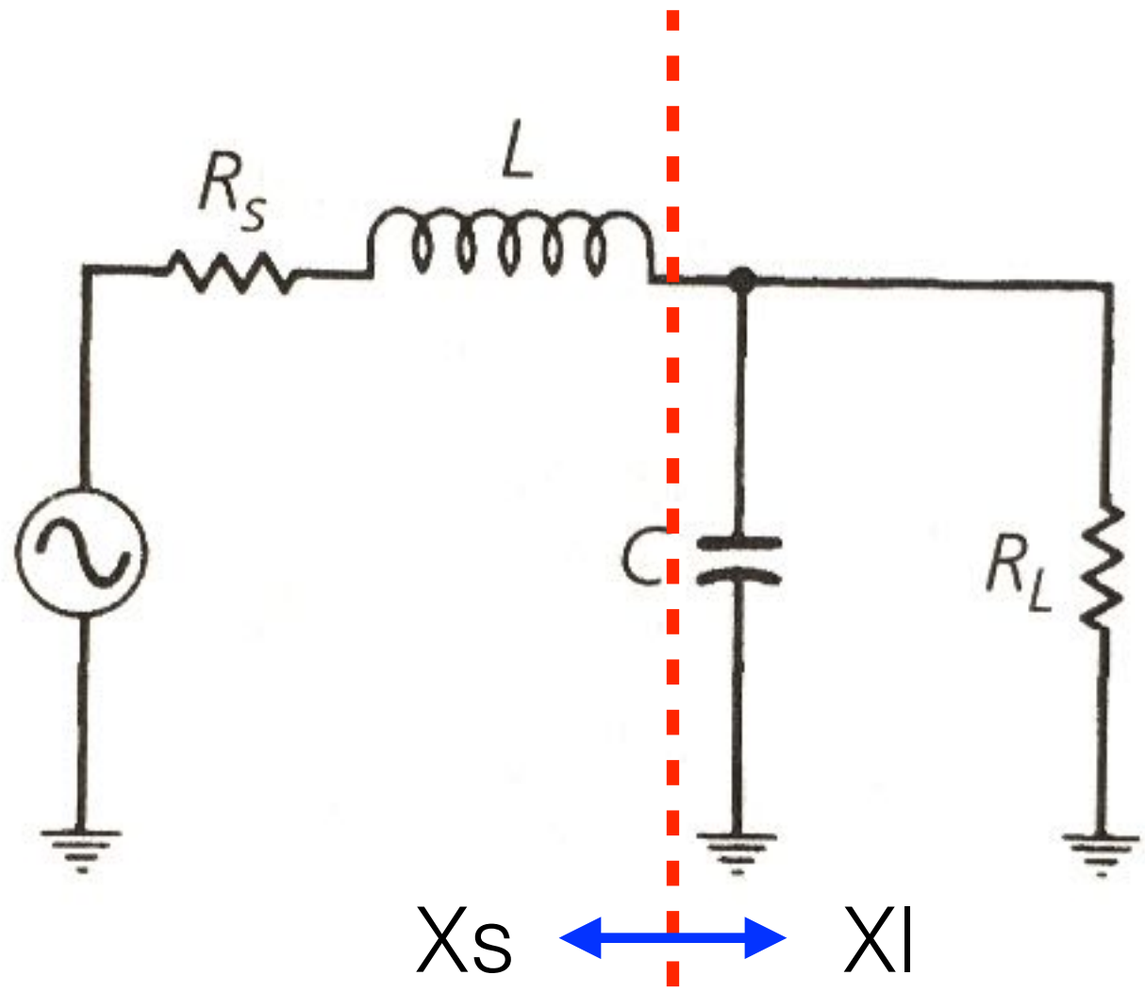
fc = 1 / 2*pi*sqrt(L*C)

Q1 = XL/RS
Q2 = RL/XC

Q = Q1*Q2/(Q1 + Q2)

Optimum power transfer
when Q1 = Q2



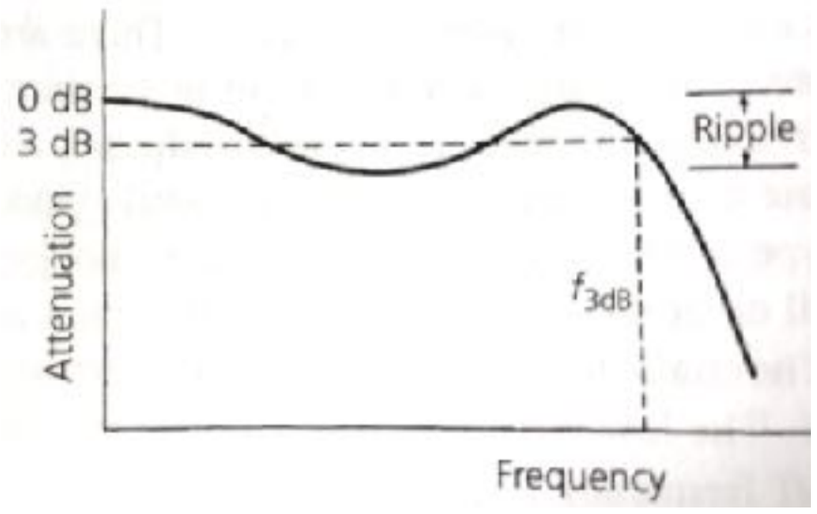



# LPF

Filter design can have
RS different from RL

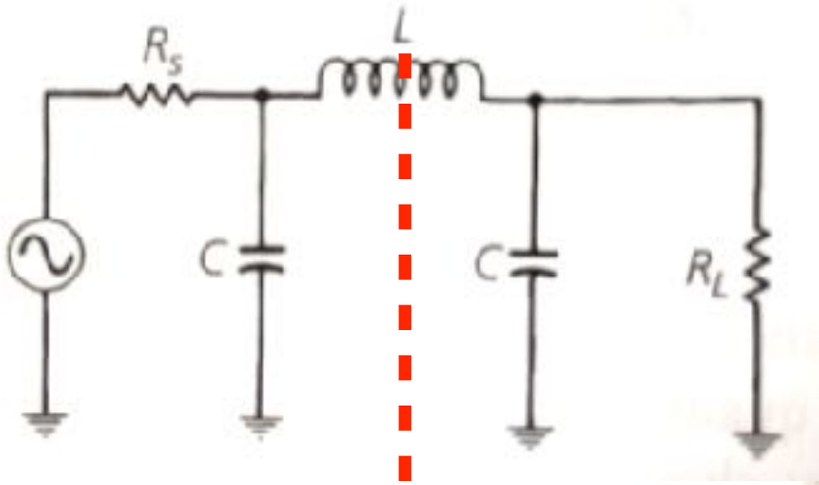
Ripple in the response

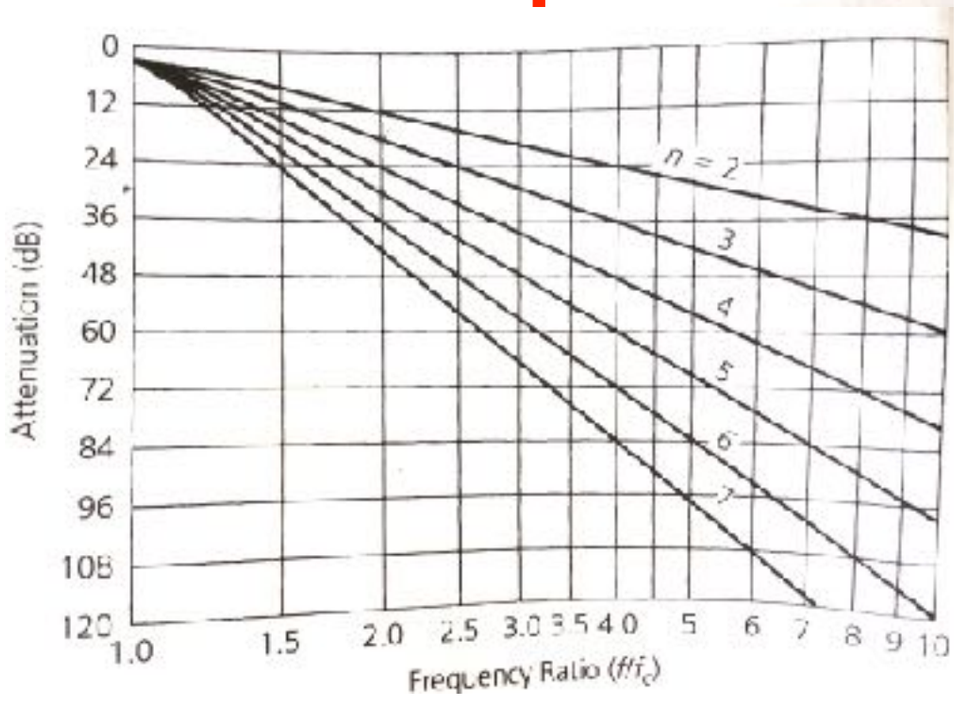
No. of peaks = No. of elements **- 1**




3 element LPF

Effectively is 2 filters, joined




No. elements vs. Attenuation