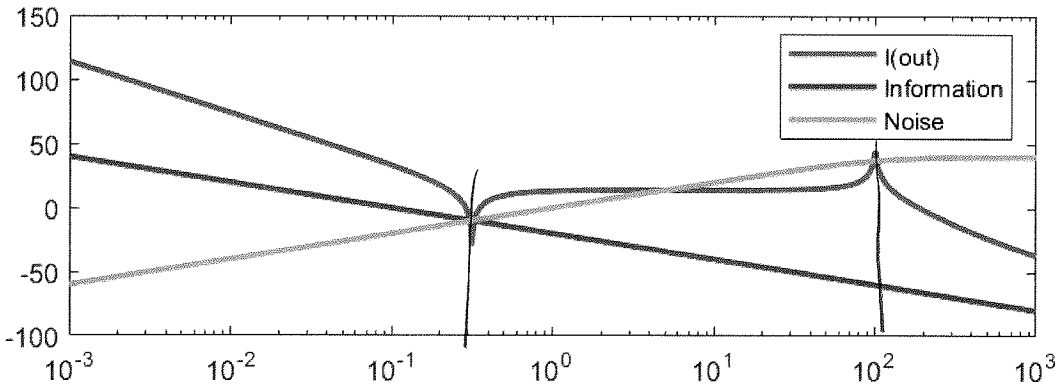
Homework 11

Problem 1

1.



amplifies

attenuates

2.

Problem 2

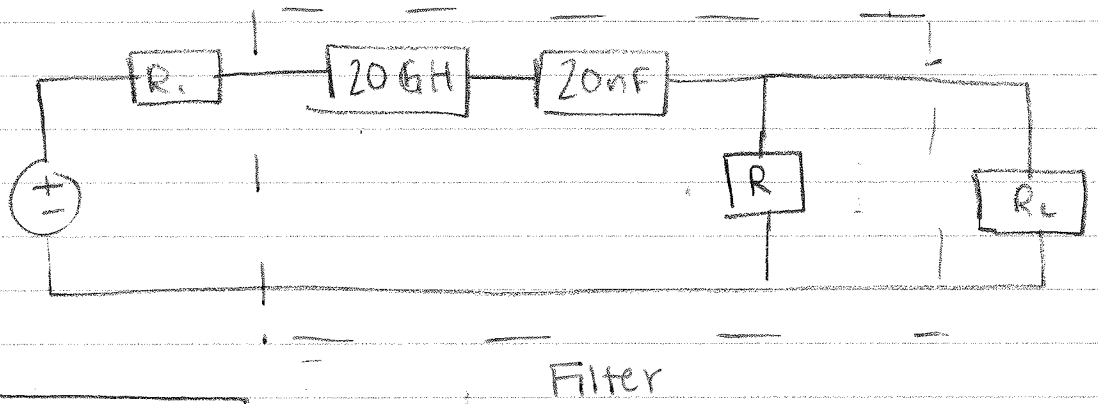
$Z_L = 80 + j0\ \Omega$ $\quad C = 20\ nF$ $\quad (Q) = 6.25$

$Z_s = 480 + j0\ \Omega$ $\quad \omega_0 = 50\ krad/sec$

1. $\omega_0 = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{L(20\cdot10^{-9})}} = 50\cdot10^3$

$(2\cdot10^{-5}) = \sqrt{L(20\cdot10^{-9})}$

$(4\cdot10^{-10}) = L(20\cdot10^{-9})$ $\quad L = 0.02$



Filter

2. $L = 20\ mH$
$C = 20\ nF$

$BW = \frac{R}{L}$ $\quad$ connected system: $R_c = R_i + (R \| R_L)$

$Q = \frac{\omega_0}{BW} = \frac{50\ krad/sec \cdot (20\cdot10^{-3})}{R} = 6.25$ $\quad R = 160\ \Omega$

$R_i = 80\ \Omega$
$R = 160\ \Omega$
$R_L = 480\ \Omega$

$R_c = 80 + \left(\frac{1}{1/160 + 1/480}\right) = 80 + 120$

$R_c = 200\ \Omega$

3. Quality Factor

$$Q = \sqrt{\frac{L}{CR_c^2}} = \sqrt{\frac{(20 \cdot 10^{-3})}{(20 \cdot 10^{-9})(200)^2}} = \sqrt{2}$$

$$\boxed{Q = 5}$$

4. Bandwidth

$$BW = \frac{R_c}{L} = \frac{200}{(20 \cdot 10^{-3})}$$

$$\boxed{BW = 10000 \text{ Hz}}$$