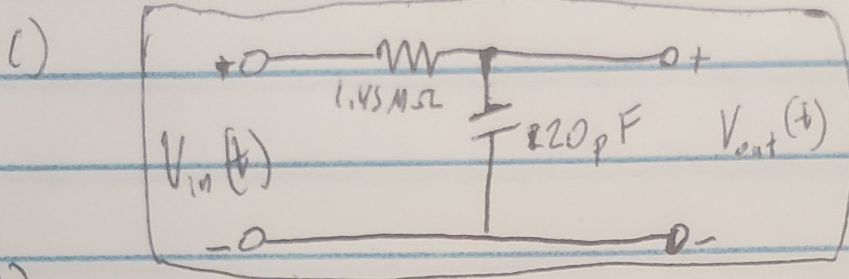1. RC low-pass $f_c = 500$ Hz $C = 220 \text{ pF}$

a) $500 \cdot 2\pi = \boxed{1000\,\pi \text{ rad/s}}$

b) $f_c = \dfrac{1}{2\pi RC} \rightarrow R = \dfrac{1}{2\pi f_c C} = \boxed{1.45 \text{ M}\Omega}$

c)
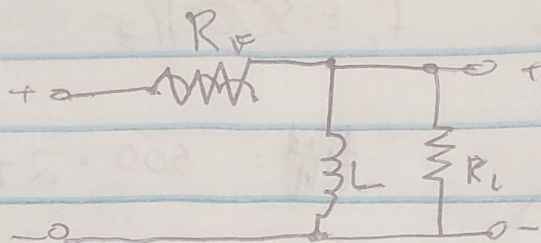

d) $H(s) = \dfrac{a}{s+a} = \dfrac{1/RC}{s + 1/RC} = \boxed{\dfrac{1000\pi}{s + 1000\pi}}$

e) $H(s) = \boxed{\dfrac{1/RC}{\dfrac{R_2 \cdot R}{R R_2 C} + s}} = \dfrac{1000\pi}{s + \boxed{6283 \text{ rad/s}}}$

f)

2. RL R_F High-pass

$$H(s) = \frac{Z}{Z+R} \qquad Z = L \| R_L = \frac{R_L \cdot Ls}{R_L + Ls}$$

$$H(s) = \frac{\frac{R_L Ls}{R_L + Ls}}{\frac{R_L Ls}{R_L \cdot Ls} + R} = \frac{\frac{R_L Ls}{R_L + Ls}}{\frac{R_L Ls + RR_L + RLs}{R_L + Ls}}$$

$$= \frac{R_L Ls}{R_L Ls + RR_L + RLs} \cdot \frac{1/s}{1/s} = \frac{R_L L}{R_L L + \frac{RR_L}{s} + RL} \cdot \frac{1/RR_L}{1/RR_L}$$

$$= \frac{1/R}{1/R + \frac{1}{s} + 1/R_L}$$

$$\frac{R_L Ls}{R_L Ls + RR_L + RLs} = \frac{R_L Ls}{s(R_L L + RL) + RR_L} \cdot \frac{1/R_L L + RL}{1/R_L L + RL}$$

a) $$= \frac{s\left(\frac{R_L Ls}{R_L L + RL}\right)}{s + \frac{RR_L}{R_L L + RL}} = \boxed{\frac{s\left(\frac{R_L}{R_L + R}\right)}{s + \frac{RR_L}{R_L L + RL}}}$$

$$\left\| H(j\omega) \right\|_{\omega=0} = \frac{j\omega\left(\frac{R_L}{R_L + R}\right)}{j\omega + \frac{RR_L}{R_L L + RL}} = \frac{0}{\frac{RR_L}{R_L L + RL}}$$

b) $\boxed{\omega = \infty}$

c) $\boxed{U_{max} = 1}$ $\frac{H_{max}}{\sqrt{2}} = \frac{1}{\sqrt{2}} = 0.707$

d) $\boxed{\omega_c = 0.707 \text{ Hz}}$