Exam 2  Th  10/29

AC Voltage pushes AC Current.

\[ V_{\text{rms}} = 2I_{\text{rms}} \]

\[ L \text{ Impedance} \]

Series Impedance \( Z = \sqrt{R^2 + (X_L - X_C)^2} \)

\[ X_L = 2\pi fL \quad \text{Inductor blocks high-f} \]

\[ X_C = \frac{1}{2\pi fC} \quad \text{Capacitor blocks low-f} \]

What is \( f_0 \)? \( X_L = X_C \)

\[ 2\pi f L = \frac{1}{2\pi f C} \]

\[ \left(2\pi f\right)^2 = \frac{1}{LC} \quad \Rightarrow \quad f_0 = \frac{1}{2\pi \sqrt{LC}} \]
Ex: \( L = 2 \ \text{nH} \)

\[ f_1 = \frac{1}{2\pi \sqrt{LC}} = 93.7 \ \text{MHz} \]

\[ f_2 = \frac{1}{2\pi \sqrt{LC}} = 106.5 \ \text{MHz} \]

\[ 2\pi f_2 = \frac{1}{2\pi f_1} \]

\[ C = \frac{1}{(2\pi f_1)^2 L} \]

\[ C_1 = 1.44 \times 10^{-9} \ \text{F} = 1.44 \ \text{nF} \]

\[ C_2 = 1.12 \times 10^{-9} \ \text{F} = 1.12 \ \text{nF} \]

\[ L = \frac{\mu_0 N^2 A}{2} \]

\[ C = \frac{3A}{a} \]
Filters

Low-F  High-F

Inductor  Passes  Blocks

Capacitor  Blocks  Passes

Noisy + \[ \overset{L}{\rightarrow} \] \[ R \] Device

Some const V.
L Passes DC \( I \),
blocks AC.

Some high-F \( V_{rms} \).

DC Current

Noisy + \[ \overset{AC}{\rightarrow} \] \[ R \]
\( B = 22 \text{ mT} \)

Energy = 730 eV = energy of electron after 730V

Electrons \( E = ? \) for velocity selector

\[ F_E = F_B \]

\[ \Delta PE = \Delta KE \]

\[ qE = q\nu B \]

\[ q\Delta V = \frac{1}{2}m\nu^2 \]

\[ (1.6 \times 10^{-19} \text{ C})(730 \text{ V}) = \frac{1}{2} m_e \nu^2 \]

Applied voltage accelerates electron to a velocity. Passes thru velocity selector if \( E \) is right.

\[ \text{ebeam} \]

\[ \theta \]

\[ \Delta V \]

\[ \theta \]

\[ \text{up} \]

\[ \text{down} \]

\[ F_{ek} = \text{(down)} \]

\[ \frac{F_{ek}}{E} = \text{(up)} \]
As the magnet arrives:
- $B$ was zero.
- $B$ will point \underline{Left}.
- Coil opposes change.
- Induced $B$ points \underline{right}.
- Bind caused by I going rightward thru $R$.

As the magnet leaves:
- $B$ was pointing \underline{Left}.
- $B$ is decreasing.
- Coil opposes change.
- Bind points \underline{Left}.
- Caused by I going left thru $R$. 