Resonant Circuit and Filter Review

1 mH 25 nF 100V

a. Determine the resonant frequency for the circuit above.
b. Determine the Quality Factor.
c. Determine the Bandwidth
d. Determine the cut-off frequencies.

\[ f_s = \frac{1}{2\pi \sqrt{L/C}} = \frac{1}{2\pi \sqrt{(1 \times 10^{-3})(25 \times 10^{-9})}} \]
\[ f_s = 31.83 \text{ KHz} \]

\[ Q = \frac{X_L}{R} = \frac{2\pi f_s L}{R} = \frac{2\pi (31.83 \times 10^3)(1 \times 10^{-3})}{10} \]
\[ Q = 20 \]

\[ 13\omega = \frac{f_s}{Q} = \frac{31.83 \text{ KHz}}{20} = 1.5915 \text{ KHz} \]

\[ \omega_c = f_s - \frac{13\omega}{2} = 31.035 \text{ KHz} \]
\[ f_2 = f_s + \frac{13\omega}{2} = 32.627 \text{ KHz} \]
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a. What type of filter is the above circuit?
b. Determine the value of the cutoff frequency.
c. Determine the approximate gain, \( A_v = \left| \frac{V_{out}}{V_{in}} \right| \) in the pass band.
d. Determine the approximate gain in the stop band.

\[ f_c = \frac{1}{2\pi RC} = \frac{1}{2\pi (10)(25e^{-s})} \]
\[ f_c = 636.62 \text{ KHz} \]

\[ A_v \approx 1 \]

\[ V_{out} \approx 0 \]