



Nhat Ho
105 355 311

a) We have $\omega = 2\pi f = 2\pi \times 1000 = 2000\pi \text{ (rad/s)}$

That maximize V_{out} at $1 \text{ kHz} \Rightarrow$ resonance

$$\Leftrightarrow \omega L = \frac{1}{\omega C} \Rightarrow \omega^2 LC = 1$$

$$\Leftrightarrow C = \frac{1}{\omega^2 L} = \frac{1}{(2000\pi)^2 \times 0.15 \text{ H}} = 0.169 \times 10^{-6} \text{ (F)}$$

$$\Leftrightarrow \boxed{C = 0.169 \times 10^{-6} \text{ (F)} = 0.169 \text{ (}\mu\text{F)}}}$$

b) We have $i_R = \frac{V_{out}}{R} \leq 10 \text{ mA}$

$$\Rightarrow R \geq \frac{V_{out}}{10 \text{ mA}} \quad \text{or} \quad i_R = \frac{V}{z_L + z_C + R}$$

At resonance $\Rightarrow \omega L = \frac{1}{\omega C}$ or $z_L + z_C = 0$

$$\Rightarrow i_R = \left| \frac{V}{R} \right| \Rightarrow R = \frac{V}{i_R}, \text{ also } i_R \leq 10 \text{ mA}$$

$$\Rightarrow \left| \frac{V}{R} \right| \leq 10 \text{ mA} \Rightarrow R \geq \left| \frac{V}{10 \text{ mA}} \right| = \left| \frac{10 \angle 35^\circ (\text{V})}{10 \text{ mA}} \right|$$

$$\Rightarrow R \geq \frac{10}{10 \times 10^{-3}} = 1000 (\Omega)$$

$$\Rightarrow \boxed{\text{max } R = 1 \text{ K } \Omega}$$