Chapter 9, Solution 85.

Let $\mathbf{Z}_1 = R_1$, $\mathbf{Z}_2 = R_2 + \frac{1}{j\omega C_2}$, $\mathbf{Z}_3 = R_3$, and $\mathbf{Z}_4 = R_4 \parallel \frac{1}{j\omega C_4}$.

$$\mathbf{Z}_4 = \frac{R_4}{j\omega R_4 C_4 + 1} = \frac{-jR_4}{\omega R_4 C_4 - j}$$

Since $\mathbf{Z}_4 = \frac{\mathbf{Z}_3}{\mathbf{Z}_1}\mathbf{Z}_2 \longrightarrow \mathbf{Z}_1\mathbf{Z}_4 = \mathbf{Z}_2\mathbf{Z}_3$,

$$\frac{-jR_4 R_1}{\omega R_4 C_4 - j} = R_3\left(R_2 - \frac{j}{\omega C_2}\right)$$

$$\frac{-jR_4 R_1(\omega R_4 C_4 + j)}{\omega^2 R_4^2 C_4^2 + 1} = R_3 R_2 - \frac{jR_3}{\omega C_2}$$

Equating the real and imaginary components,

$$\frac{R_1 R_4}{\omega^2 R_4^2 C_4^2 + 1} = R_2 R_3 \qquad (1)$$

$$\frac{\omega R_1 R_4^2 C_4}{\omega^2 R_4^2 C_4^2 + 1} = \frac{R_3}{\omega C_2} \qquad (2)$$

Dividing (1) by (2),

$$\frac{1}{\omega R_4 C_4} = \omega R_2 C_2$$

$$\omega^2 = \frac{1}{R_2 C_2 R_4 C_4}$$

$$\omega = 2\pi f = \frac{1}{\sqrt{R_2 C_2 R_4 C_4}}$$

$$\mathbf{f = \frac{1}{2\pi\sqrt{R_2 R_4 C_2 C_4}}}$$