2.108

Eq. 2.25:

$$A = \frac{A_O}{1 + jw/w_b} \Rightarrow |A| = \frac{|A_O|}{\sqrt{1 + \left(\frac{f}{f_b}\right)^2}}$$

$A_O = 80$ dB, $A = 40$ db @ $f = 100$ kHz

$$20 \log \sqrt{1 + \left(\frac{f}{f_b}\right)^2} = 20 \log \frac{|A_O|}{|A|} = 20 \log A_O - 20 \log A$$

$$= 86 - 40 = 46 \text{ dB}$$

$$1 + \left(\frac{100 \text{ kHz}}{f_b}\right)^2 = (199.5)^2 \Rightarrow f_b = 0.501 \text{ kHz}$$

$f_b = 501$ Hz

$$f_t = A_O f_b = \underbrace{1.995 \times 10^4}_{86 \text{ dB}} \times 501$$

$$= 9.998 \text{ MHz} \simeq 10 \text{ MHz}$$

2.110

we have:

$A_O(\text{db}) = 20\text{ dB} + A(\text{db})$

$20\text{ db} = 20\log 10 \Rightarrow A_O = 10A$

a) $A_O = 10 \times 3 \times 10^5 = 3 \times 10^6$ Hz V/V

$$A = \frac{A_O}{1 + jf/f_b} \Rightarrow \left|1 + j\frac{f}{f_b}\right| = \frac{A_O}{A} = 10 \Rightarrow$$

$$\frac{6 \times 10^2}{f_b} = \sqrt{99}$$

$\Rightarrow f_b = 60.3$ Hz

$f_t = A_O f_b = 3 \times 10^6 \times 60.3 = 180.9$ MHz

b)

$A = 50 \times 10^5 \times 10$ V/V $\Rightarrow A_O = 10 \times 50 \times 10^5$

$= 50 \times 10^6$ V/V

$$\left|1 + \frac{jf}{f_b}\right| = \frac{A_O}{A} = 10 \Rightarrow \frac{10\text{ Hz}}{f_b} = \sqrt{99} \Rightarrow f_b = 1\text{ Hz}$$

$f_t = A_O f_b = 50$ MHz

c) $A = 1500$ V/V $\Rightarrow A_O = 1500$ V/V

$$\left|1 + \frac{jf}{f_b}\right| = 10 \Rightarrow \frac{0.1 \times 10^9}{f_b} = \sqrt{99} \Rightarrow f_b = 10\text{ kHz}$$

$f_b = 15000 \times 10\text{ K} = 150$ MHz

d) $A_O = 10 \times 100 = 1000$ V/V

$$\left|1 + \frac{jf}{f_b}\right| = 10 \Rightarrow \frac{0.1 \times 10^9}{f_b} = \sqrt{99} \Rightarrow f_b = 10\text{ MHz}$$

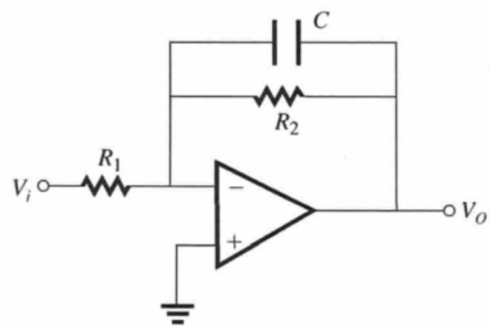
$f_t = 1000 \times 10\text{ MHz} = 10$ GHz

e) $A = 25\text{ V/mV} \times 10 = 25 \times 10^4$ V/V

$$\left|1 + \frac{jf}{f_b}\right| = 10 \Rightarrow \frac{2.5\text{ kHz}}{f_b} = \sqrt{99} \Rightarrow f_b = 2.51\text{ kHz}$$

$f_t = A_O f_b = 25 \times 10^4 \times 2.51 \times 10^3 = 627.5$ MHz

2.86



Let $Z_2 = R_2 \parallel \frac{1}{SC}$ and $Z_1 = R_1$

$$\frac{v_o}{v_i} = -\frac{Z_2}{Z_1} = -\frac{Y_1}{Y_2} = -\frac{1/R_1}{\frac{1}{R_2} + SC}$$

$$= -\frac{(R_2/R_1)}{1 + sCR_2}$$

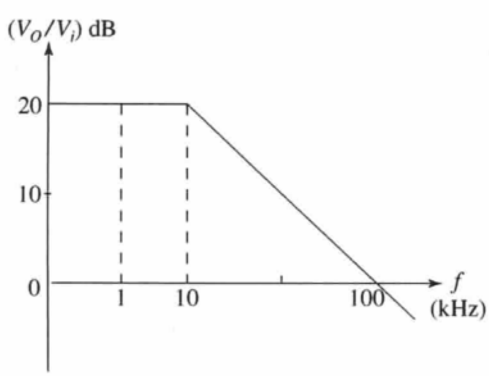
This function is of a STC, low pass circuit having a dc gain of $-\frac{R_2}{R_1}$ and 3-dB frequency

$$\omega_o = \frac{1}{CR_2}$$

$R_{in} = R_1 = 10\text{ k}\Omega$

dc gain = 20 dB = 10

$$\therefore 10 = \frac{R_2}{R_1} \Rightarrow R_2 = 10\ R_1 = 100\text{ k}\Omega$$



3dB frequency at 10 kHz

$$\therefore \omega_o = 2\pi \times 10 \times 10^3 = \frac{1}{CR_2}$$

$$C = \frac{1}{2\pi \times 10 \times 10^3 \times 100\text{ K}} = 0.5\text{ nF}$$

Unity gain frequency at 100 kHz