HW #6 Sol'n

1. $A_f = \dfrac{A}{1+A\beta} = \dfrac{10{,}000}{1+10{,}000\beta} = 200$

$\therefore \dfrac{\left[\dfrac{10{,}000}{200} - 1\right]}{10{,}000} = \dfrac{10{,}000\beta}{10{,}000}$

$\Rightarrow \boxed{\beta = 0.0049}$

$A = 1{,}000 \Rightarrow A_f = \dfrac{1{,}000}{1+1{,}000(.0049)} \cong \boxed{169.5}$

not needed: $\dfrac{\Delta A_f}{A_f} = \dfrac{200-169.5}{200} \cong 15\%$ change in A_f due to A

2. Exercise 8.1, A = 200

(a) $\boxed{\beta = \dfrac{R_1}{(R_1+R_2)}}$

(b) $A_f = \dfrac{A}{1+A\beta} \Rightarrow \beta = \dfrac{\left[\dfrac{200}{10} - 1\right]}{200} = \boxed{0.095}$

$\dfrac{1}{\beta} \cong 10.5 = 1 + \dfrac{R_2}{R_1} \Rightarrow \dfrac{R_2}{R_1} \cong \boxed{9.5}$

(c) amount of feedback $\Rightarrow (1+A\beta) = 20$

$\therefore 20\log(20) \cong \boxed{26\text{dB}}$

(d) $V_s = 1$, $V_o = A_f \cdot V_s = \boxed{10V}$

$V_f = \beta V_o = 0.095 \cdot 10 = \boxed{0.95V}$

$V_i = V_s - V_f = 1 - 0.95 = \boxed{0.05V}$

(e) $A_f = 160/(1+160 \cdot 0.095) \cong 9.9V \Rightarrow$ decreased $\boxed{1\%}$ $\left[\dfrac{10-9.9}{10}\right]$

3. $\beta = \frac{R_1}{(R_1+R_2)} = \frac{1k}{20k} = \frac{1}{20} = 0.05$

$A_f = \frac{A_o}{1+A_o\beta} = \frac{10{,}000}{1+10{,}000(0.05)} \cong \boxed{20}$

$f_{H_f} = f_H(1+A_o\beta) = 200(1+10{,}000\cdot\frac{1}{20}) = \boxed{100{,}200\ Hz}$

or $\omega_{H_f} \cong 630\ krad/sec.$

(2nd)

3. $A_f = \frac{A}{1+A\beta}$

$\beta = \frac{\left[\frac{100{,}000}{100} - 1\right]}{100{,}000} = .00999$

$\therefore (1+A\beta) = \boxed{1{,}000}$

4. $f_{H_f} = f_H(1+A\beta) = 10k(1+1{,}000\cdot\beta)$

$A_f = \frac{A}{1+A\beta} \Rightarrow \beta = \frac{\left[\frac{A}{A_f} - 1\right]}{A} = \frac{\left[\frac{1{,}000}{100} - 1\right]}{1{,}000} = 9m$

$f_{H_f} = 10{,}000(1+1{,}000(.009)) = \boxed{100kHz} \cong 628\ krad/sec.$

$f_{L_f} = \frac{f_L}{(1+A\beta)} = \frac{150}{(1+1{,}000\cdot 9m)} = \boxed{15Hz} \approx 94\ rad/sec$

5. (See Fig. 8.8) $\Rightarrow -V_i - V_f + V_s = 0 \quad \therefore V_i = V_s - V_f = 200m - 95m = 105m$

$V_o = AV_i \Rightarrow A = \frac{V_o}{V_i} = \frac{9}{105m} \cong \boxed{86\ V/V}$

$V_f = \beta V_o \Rightarrow \beta = \frac{V_f}{V_o} = \frac{95m}{9} \cong \boxed{10.6\times10^{-3}\ V/V}$

6. (See Fig. 8.22) $\Rightarrow I_s = I_i + I_f \quad \therefore I_i = I_s - I_f, \quad AI_i = I_o$

$\therefore A = \frac{I_o}{I_s - I_f} = \frac{9m}{150\mu - 95\mu} \cong \boxed{164\ A/A}$

$I_f = \beta I_o \quad \therefore \beta = I_f/I_o = 95\mu/9m \cong \boxed{10.6m\ A/A}$

7. (see Fig. 8.13)

$\therefore I_o = AV_i \Rightarrow V_i = V_s - V_f = 200m - 95m = 105m$

$A = \frac{9mA}{105mV} \cong \boxed{86\times10^{-3}\ A/V} \qquad V_f = \beta I_o$

$\therefore \beta = V_f/I_o = 95m/9m \cong \boxed{10.6\ V/A}$