10.80 $A(S) = \dfrac{10^5}{1 + 5/100}$

$\text{Ang}(A) = -\tan^{-1}\dfrac{\omega}{100} - 2\tan^{-1}\dfrac{\omega}{10^4}$

at ω_{180} : Ang$(A) = -180°$ for $\omega_{180} >> 100$

$\Rightarrow 18° = 90° + 2\tan^{-1}\left[\dfrac{\omega_{180}}{10^4}\right]$

hence $\tan^{-1}\dfrac{\omega_{180}}{10^4} = \dfrac{90°}{2}$

i.e. $\dfrac{\omega_{180}}{10^4} = \tan(45°) = 1$

$\therefore \omega_{180} = 10^4 \text{ rad/s}$

$|A\beta| = \dfrac{10^5\beta}{\sqrt{1 + (10^4/10^2)^2}} \cdot \dfrac{1}{(\sqrt{1+1})^2} = 1$

$\Rightarrow \beta = 0.002$

$A_f(0) = \dfrac{10^5}{1 + 10^5(0.002)} \approx 500$ V/V

10.83 $A(S) = \dfrac{1000}{(1 + S/10^4)(1 + S/10^5)^2}$

and β is independent of frequency

$\text{Ang}(A) = -\tan^{-1}\dfrac{\omega}{10^4} - 2\tan^{-1}\dfrac{\omega}{10^5}$

try $\omega = 10^4$: θ 5 $45° + 2 \times 5.7 = 56.4°$

try $\omega = 10^5$: θ 5 $84.2° + 2 \times 45 = 174.2°$

Iteraction yields $\omega \approx 1.1 \times 10^5$ rad/s

For oscillations: $|AB(\omega_{180})| \geq 1$

$\dfrac{\beta\ 10^3}{(\sqrt{1 + 11^2})(\sqrt{1 + 1.1^2})} \geq 1$

$\Rightarrow \beta \geq 0.0244$

10.88 $A(f) = \dfrac{-K}{1 + j_f/10^5}$

for $\beta = 1$: $A\beta = \dfrac{K^3}{\left(1 + \dfrac{j_f}{10^5}\right)^3}$

For oscillations to occur : $|A\beta| \geq 1$ at

$\phi(A\beta) = 180°$

3tan^{-1}

$\left(\dfrac{f_{180°}}{10^5}\right) = 180° \Rightarrow f_{180°} = \sqrt{3} \times 10^5$ Hz

$f_{180°} = 173.2$ KHz

Amplifier is unstable if $|A\beta| \geq 1$ at $f_{180°}$

$\left[\dfrac{K}{\sqrt{1 + (\sqrt{3})^2}}\right]^3 \geq 1 \rightarrow K \geq 2$

10.92

$A(j_f) = \dfrac{10^5}{\left(1 + \dfrac{j_f}{10^5}\right)\left(1 + \dfrac{j_f}{3.16 \times 10^5}\right)\left(1 + \dfrac{j_f}{10^6}\right)}$

Assume β independent of frequency

For 45° *PM*: $\theta = 180 - 45$

$\tan.^{-1}\dfrac{f_1}{10^5} + \tan.^{-1}\dfrac{f_1}{3.16 \times 10^5} + \tan.^{-1}\dfrac{f_1}{10^6} = 135°$

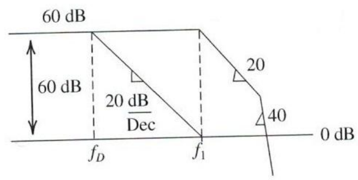
solve $\Rightarrow f_1 = 3.16 \times 10^5$ Hz

$|A\beta(f_1)| = 1 = \dfrac{10^5\beta}{\sqrt{1 + (3.16)^2} \cdot \sqrt{2} \cdot \sqrt{1 + (0.316)^2}}$

$\Rightarrow \beta = 49 \times 10^{-6}$

$Af(o) = \dfrac{10^5}{1 + 10^5(4.9 \times 10^{-6})} = 16.9 \times 10^3$

10.95



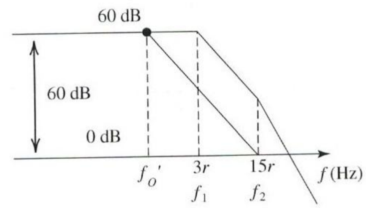
$f_1 = 3$ MHz

$A_O = 60 \text{ dB} \equiv 1000$

$\dfrac{60 \text{ dB}}{20 \text{ dB/Dec}} = 3$ Dec

$f_D = \dfrac{f_1}{10^3} = \dfrac{3 \text{ MHz}}{10^3} = 3$ KHz

10.96



$f_{P1} = 3$ MHz, $f_{P2} = 15$ MHz

$A_o = 60$ dB

$\dfrac{60 \text{ dB}}{20 \text{ dB/Dec}} = 3$ Dec

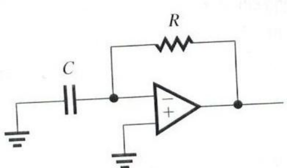
$f_D' = \dfrac{15\ \mu}{10^3} = 15$ KHz

if: $f_1 = \dfrac{1}{2\pi RC}$ and $f_D' = \dfrac{1}{2\pi RC_C}$

$\Rightarrow \dfrac{f_1}{f_D'} = \dfrac{3 \times 10^6}{15 \times 10^3} = \dfrac{C_C}{C} \Rightarrow 200 \times C = C_C$

C_c is increaed by a factor of 200 to shift the dominant pole from 3 MHz to 15 KHz

10.98



$A_O = 10^4$

Poles at 10^6, 10^7, 10^8 Hz

For $\beta = 1$, f_P must be kept 10^4 times lower than the lowest pole at 10^6 Hz

$f_P = \dfrac{10^6}{10^4} = 100$ Hz

Since: $f_P = \dfrac{1}{2\pi RC}$ and $R = 1\ \text{M}\Omega$

$\Rightarrow C = \dfrac{1}{2\pi \times 1\ \text{M} \times 100} = 1.59$ nF