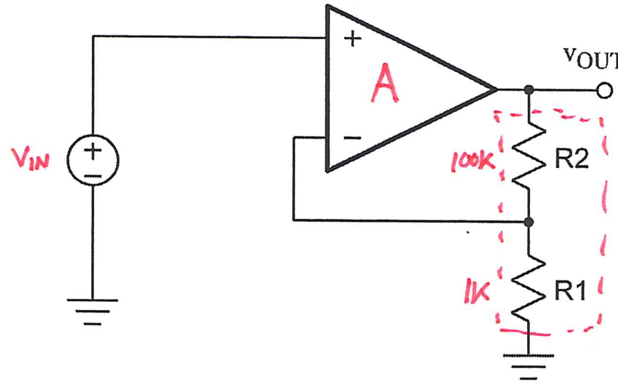
ECE3204 Lecture 6

Bandwidth Limit (2.7)
Gain-bandwidth product relationship

Handouts:
Bode plot form

Online:
Lab 1
Lab Information

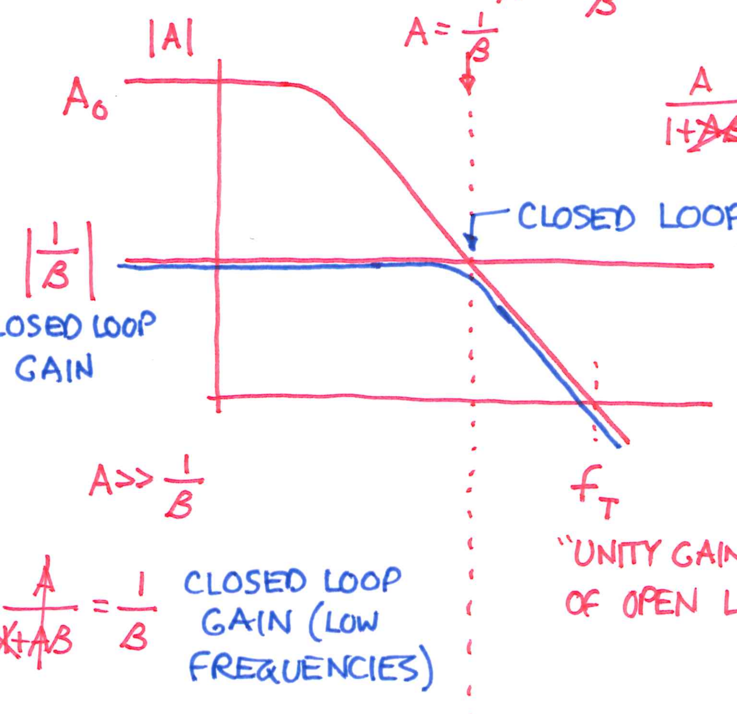
OPEN LOOP GAIN A



β "FEEDBACK FACTOR"

"CLOSED LOOP GAIN" $\left\{ \frac{V_{OUT}}{V_{IN}} = \frac{A}{1+A\beta} \approx \frac{1}{\beta} \right.$ IF $\underbrace{A\beta >> 1}_{\text{RESTATE AS } A >> \frac{1}{\beta}}$

GOAL: KEEP A LARGE
CLOSED LOOP GAIN
DEPENDS ONLY ON β



CLOSED LOOP GAIN (HIGH FREQUENCIES)

$\frac{A}{1+\cancel{A\beta}} = A \quad A << \frac{1}{\beta}$

$A\beta << 1$

"UNITY GAIN FREQUENCY" OF OPEN LOOP OP-AMP

$A >> \frac{1}{\beta}$

$\frac{\cancel{A}}{\cancel{1}+A\beta} = \frac{1}{\beta}$ CLOSED LOOP GAIN (LOW FREQUENCIES)

MEASURED				CALCULATED			
FREQ	AMPLITUDE		DELAY	GAIN	GAIN (dB)	PERIOD	PHASE
f	v_{in} mV p-p	v_{out} V p-p	t_d	$\frac{v_{out}}{v_{in}}$	$20 \cdot \log\left(\frac{v_{out}}{v_{in}}\right)$	$T = \frac{1}{f}$	$-360° \cdot \left(\frac{t_d}{T}\right)$
100 Hz	100	10.1	0	101	+40.1 dB	10 msec	0°
1k Hz	100	10.0	20µs	100	+40.0dB	1 msec	-7°
10KHz	100	6.24	14.8µs	62.4	+35.9dB	100 µsec	-53°
100KHz	100	0.776	2.44µs	7.76	+17.8 dB	10 µsec	-87°
1MHz	100	78mV	280ns	0.78	-2.2 dB	1 µsec	-100°