

NAME:

STUDENT NO.:

University of Puerto Rico
Electrical and Computer Engineering Department
INEL 4202 - Electronics II - Spring 2001 - Exam 2a - Prof. M. Toledo
THERE ARE THREE PROBLEMS - BE CLEAR OR LOOSE POINTS

1. An ideal current amplifier with $A_f = 400$, $R_i = 100\Omega$ and $R_o = 100k\Omega$ is connected in a negative feedback loop. The feedback network is ideal and has a $\beta = 0.01$. Find A_{if} , R_{if} and R_{of} . Assume ideal source and load. (30 points)

$$D = 1 + \beta A = 1 + .01(400) = 5$$

$$A_{if} = \frac{400}{5} = 80$$

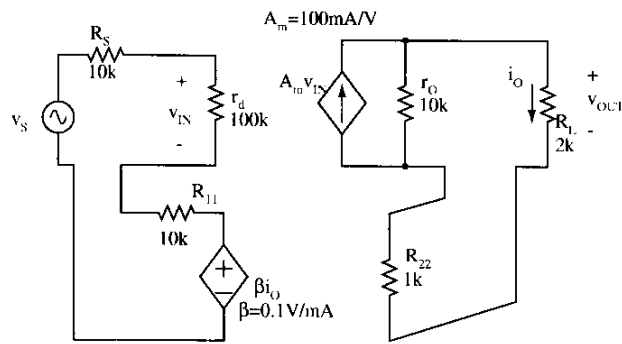
$$R_{if} = \frac{R_i}{D} = \frac{100}{5} = 20$$

$$R_{of} = D R_o = 5(100k\Omega) = 500k\Omega$$

NAME:

STUDENT NO.:

2. The sketch below shows a model of a negative feedback amplifier. Find A_f , R_{if} and R_{of} . Specify the appropriate units for A_f , if any. All resistors are expressed in ohms, with k denoting kilo. (40 points)



$$R_i = 120 \text{ k}\Omega$$

$$R_o = 13 \text{ k}\Omega$$

$$i_o = \frac{(100 \text{ mA/V})(10 \text{ k})}{13 \text{ k}} v_{in}$$

$$v_{in} = \frac{100}{120} v_s = \frac{10}{12} v_s$$

$$\therefore G_m = \frac{i_o}{v_s} = \frac{10}{13} \frac{10}{12} \frac{100 \text{ mA}}{\text{V}}$$

$$G_m = 64 \text{ mA/V}$$

$$D = 1 + \beta G_m$$

$$= 1 + (0.1 \text{ V/mA})(64 \text{ mA/V})$$

$$= 7.4$$

$$G_{mf} = \frac{64 \text{ mA/V}}{7.4} = 8.65 \text{ mA/V}$$

$$R_{if} = D R_i = 7.4 (120 \text{ k}\Omega) = 888 \text{ k}\Omega$$

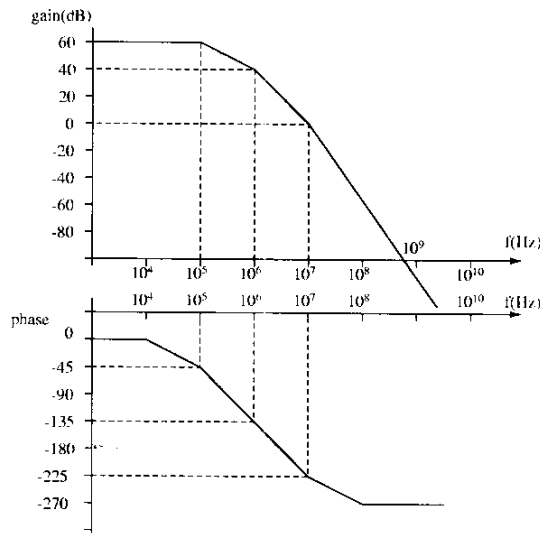
$$R_{of} = R_o D = 7.4 (13 \text{ k}\Omega) = 96.2 \text{ k}\Omega$$

NAME:

STUDENT NO.:

3. The following diagram shows the bode plot of the gain A of a non-feedback amplifier, which will be used in a negative feedback amplifier. The non-feedback amplifier dc-gain is 60 dB and has poles at 10^5 , 10^6 and 10^7 Hz. Find

- (a) the maximum value of the feedback's network β that can be used without driving the feedback amplifier unstable. (15 points)
- (b) the phase and gain margins if the negative feedback's $\beta = 0.01$. (15 points)



(a) about $20 \text{ dB} = 20 \log \frac{1}{\beta} \rightarrow \beta = 0.1$

(b) $20 \log \frac{1}{\beta} = 40 \text{ dB} \rightarrow \phi_m = 45^\circ$
 $g_m \approx 20 \text{ dB}$