

Mark:

EE3110 Analogue Electronic Circuits
Feedback Amplifier

Name: _____ Student Number: _____ Date : _____

1. The closed-loop gain of a feedback amplifier is $A_f = 80$, and the feedback transfer function is $\beta = 0.0120$. What is the value of the open-loop gain A ?

Given equation: $A_f = \frac{A}{1 + \beta A} \Rightarrow A = ??$

$$A_f(1 + \beta A) = A$$

$$A_f + \beta A A_f = A$$

$$A_f = A(1 - \beta A_f)$$

$$\Rightarrow A = \frac{A_f}{1 - \beta A_f} = \frac{80}{1 - (0.012)(80)} = 2000$$

2. The gain factors in a feedback system are $A = 5 \times 10^5$ and $A_f = 100$. Parameter A_f must not change more than ± 0.001 percent because of a change in A . what is the maximum allowable variation in A ?

$\beta = ?? \rightarrow$

Given equation: $\frac{dA_f}{A_f} = \frac{1}{1 + \beta A} \frac{dA}{A}$

$$A_f = \frac{A}{1 + \beta A} \Rightarrow \frac{1}{1 + \beta A} = \frac{A_f}{A}$$

$$\frac{dA_f}{A_f} = \frac{A_f}{A} \frac{dA}{A} < 0.001\%$$

$$\frac{100}{5 \times 10^5} \frac{dA}{A} < 0.001\%$$

$$\frac{dA}{A} < 5\%$$

max allowable variation of A

$$\Delta A = A \times 5\% = 5 \times 10^5 \times 5\% = 25000$$

3. In a feedback amplifier, the open-loop low-frequency gain is $A_0 = 10^6$ and the open-loop 3dB frequency is 8Hz. If the bandwidth of the closed-loop system is 250 KHz, what is the maximum allowable value of the closed-loop low-frequency gain?

Given equations:

$$A_f(0) = \frac{A_0}{1 + \beta A_0} \text{ and}$$

$$\omega_H' = \omega_H (1 + \beta A_0)$$

$$A_f(0) = \frac{A_0}{\left(\frac{\omega_H'}{\omega_H} \right)}$$

$$= \frac{10^6}{\left(\frac{250 \text{ K}}{8} \right)} = 32$$

