Alexandria Institute of Technology
Electronics Section

Course: Analog Integrated Circuit
Instructor: Prof. M. El-Banna
Term: Winter

Sheet 4:
Electronics Section
Time: SAT 12:00-2:00pm

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1. Consider the use of an op amp with a unity-gain frequency f_t in the realization of:
   a- an inverting amplifier with a dc gain of magnitude K.
   b- a noninverting amplifier with a dc gain of K.

   In each case find the 3-dB frequency and the gain bandwidth product (GBP=$|G| \times f_{3dB}$). Comment on the results.
2. **a-** Show that the transfer function of a Miller integrator realized using an internally compensated op amp with a unity-gain frequency ω_t is given approximately by:

$$\frac{V_0}{V_i} \cong -\frac{1}{j\omega CR}\frac{1}{1+j(\omega/\omega_t)}$$

   where it has been assumed that ω_t is much higher than the integrator frequency ω_o (ω_o=1/CR).

   b- What is the "excess phase" that the integrator has due to the op amp ω_t at ω_t/100? Is the excess phase of the lag or lead type?
3. A differential amplifier for which the input signal are:

$$v_1 = 10.00\sin(2\pi 60t) + 0.01\sin(2\pi 1000t)$$

   and

$$v_2 = 10.00\sin(2\pi 60t) - 0.01\sin(2\pi 1000t)$$

   has an output

$$v_o = 0.1\sin(2\pi 60t) + 5\sin(2\pi 1000t)$$

   For this situation, calculate the common-mode gain, the difference-mode (or differential) gain, and the CMRR both as a ratio and in dBs.

4. In somewhat more complex situation than prevail in problem 18, the major (common) interfering signals may be not totally balanced at the two inputs. Such is the case in which :

$$v_1 = 10.00\sin(2\pi 60t) + 0.04\sin(2\pi 1000t)$$

$$v_2 = 10.01\sin(2\pi 60t) - 0.04\sin(2\pi 1000t)$$

   and

$$v_o = \sin(2\pi 60t) + 4\sin(2\pi 1000t)$$

   Calculate the difference-ode gain, the common-mode gain and the CMRR.
