**EET-200/210 Problem set for Gain Calculations Name** _____

1) Determine the voltage, current and power gain, as a ratio and in dBs, of an amplifier with the following input/output characteristics:

   Vin = 25 mV Vout = 4.4 V
   Iin = 600 µA Iout = 85 mA

2) An amplifier has a +30 dB voltage gain and an input voltage of 1 mV. Determine the output voltage (in volts).

3) A 5 Vp 400 MHz signal is input into 500 feet of cable (RG-6/U) which has an attenuation of -4 dB/100 feet. Determine the gain of the repeater (amplifier) needed at the end of this cable so that:

   a. The signal is restored to 5 Vp.

   b. The signal is increased to 10 Vp.

4) A student makes the following measurements on a differential amplifier using a 500 mVp input source:

   $V_{out\ (DM)}$ = Differential Mode Output Voltage =10 Vp
   $V_{out\ (CM)}$ = Common Mode Output Voltage = 75µ Vp

   a. Determine the Differential Mode Gain as a ratio & in dBs.

   b. Determine the Common Mode Gain as a ratio & in dBs.

   c. Determine the Common Mode Rejection Ratio (CMRR) as a ratio and in dBs.

5) A differential amplifier has an input consisting of 10 mVp of 250 Hz signal and 100mVp of 60 Hz noise. The amplifier has a differential gain of +40 dB with a C.M.R.R. of +71.5 dB. Determine the following:

   a. The input S/N ratio. (This is the signal to noise ratio, it is the ratio of the signal voltage to the noise voltage.) Express this as a ratio and in dB. (Hint: S/N = 0.1 as a ratio for the input.)

   b. The differential and common mode gains expressed in dB and ratio form. (Hint: $A_{CM}$ = -31.5 dB)

   c. The signal and noise amplitudes at the output of the amplifier.

   d. The S/N ratio at the output of the amplifier expressed as a ratio and in dB. (Hint: S/N = +51.5 dB)

   e. Studying your answers for part a. and part d., How could the output S/N ratio (in dB's) be easily determined knowing the input S/N and the C.M.R.R?

6) An instrumentation amplifier (an improvement over the differential amplifier) has a C.M.R.R. of +120 dB. The input of this amplifier is a 50 µVp signal swamped with 1.5 Vp of noise (this corresponds to a -89.5 dB Signal-to-Noise ratio). If the differential gain of the instrumentation amplifier is +30 dB, determine:

   a. The common mode gain of the amplifier in dB.

   b. The peak voltages of the signal and noise at the output of the amplifier.

   c. The S/N ratio at the output in dBs.