$-10+24\times0.83$

$-5+0.99\times14$

$=8.86$

1021 Microelectronic Circuits I (Midterm)

$\frac{20-0.7}{6.15+14}=0.96mA$

$15-6.15\times0.96$

$\frac{15-(-5)}{6.15+14}$ I_{D2}

$=0.99mA$

date: 2012 / 11 / 07 (Thur)

time: 15:30 ~ 17:20

$\frac{8.16}{2k}=4.08\ mA$

ps. 試題可帶回，可使用計算機。

1. The diode has a constant voltage-drop of 0.7V when conducting. determine I_{D1}, I_{D2}, I_{D3}, and V_A for
   (a) R_3=14k, R_4=24kΩ; [5%]
   (b) R_3=3.3k ,R_4=5.2kΩ; [5%]
   (c) R_3=3.3k, R_4=1.32kΩ. [5%]

$I_{D4}=\frac{25}{6.15+24}=0.83\ mA$

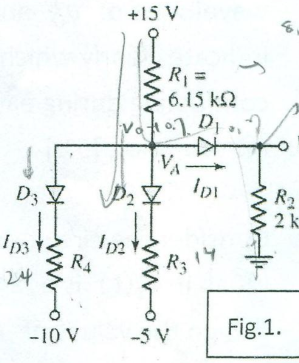

Fig.1.

2. Consider the Zener diode circuit shown in Fig.2. The Zener has a characteristic of V_Z=5.6V at I_Z=0.1mA. The incremental Zener resistance is r_Z=10Ω.
   (a) Determine V_O with no load (R_L=∞). [3%]
   (b) Find the change in the output voltage if V_{PS} changes by ±1V. [3%] $R_L\to\infty$
   (c) Find V_O if V_{PS}=10V and R_L=2kΩ. [4%]

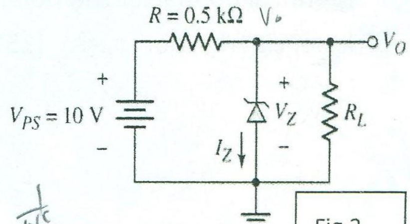

Fig.2.

3. In Fig.3. the OpAmp1 is ideal. R_L represents the loading effect from next-stage circuit.
   (a) Assuming R_L=∞, derive the transfer function $V_O(s)/V_I(s)$. [7 %]
   (b) From (a), let $R_1\times C_1 > R_2\times C_2$, plot the frequency response (|V_O/V_I| vs. ω). [6 %]
   (c) From (a), let $R_1\times C_1 = R_2\times C_2$, plot the frequency response (|V_O/V_I| vs. ω). [6 %]
   (d) If R_L is finite, please derive the transfer function $V_O(s)/V_I(s)$. [6 %]

$\frac{1}{j\omega C}$

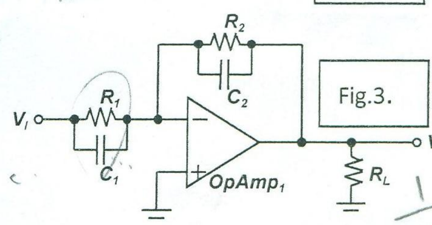

Fig.3.

4. The circuit as shown in Fig. 4 is a difference amplifier. Assume that the op amp has a dc gain of 80 dB and a 3-dB bandwidth of 100 Hz.
   (a) What's the CMRR of the difference amplifier? [5%]
   (b) For $R_2 = 2R_1$, find the 3-dB frequency of the differential gain. [10%]
   (c) If a 3-dB bandwidth of 10 kHz is needed, find the maximum differential gain of the difference amplifier. [10%]

10×10^3 $20\log$

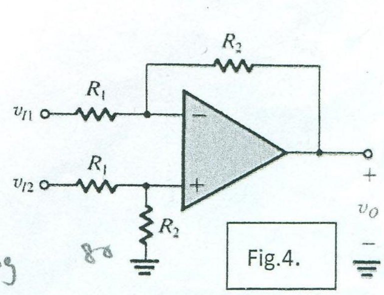

Fig.4.

$A_d=\frac{R_2}{R_1}$

$20\log\left|\frac{R_2}{R_1}\right|=80$

$\frac{R_2}{R_1}=10^4$

$G=V_{I1}\times\left(-\frac{R_2}{R_1}\right)+V_{I2}\times\frac{R_2}{R_1+R_2}\times\left(1+\frac{R_2}{R_1}\right)$

$20\log\frac{A_d}{A_{CM}}$ ∞

$=-2V_{I1}+\frac{2}{3}V_{I2}\times3=2V_{I2}-2V_{I1}=2(V_{I2}-V_{I1})$

5. Assume a 0.7-V drop across each conducting diode in Fig. 5.
   (a) If the magnitude of the average of each output is to be 15 V, find the required amplitude of the sine wave across the entire secondary winding. [5%]
   (b) Please sketch and label clearly the waveforms of v_O^+ and v_O^-. Also indicate clearly which diodes are conducting during each period of cycle on your plot. [5%]

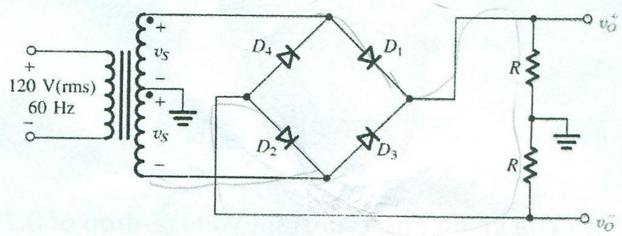

Fig.5.

6. Consider the circuit used for rectification in Fig. 6. Assume the Op-amp and diodes are ideal. If $v_i(t)$ is a $2\ V_{p-p}$ sinusoidal wave, please design the values of R_1, R_2, and R_3 so that $v_o(t)$ is a precision rectification. (i.e. v_o is identical no matter the polarity of v_i). Sketch and label clearly your $v_o(t)$. [15%]

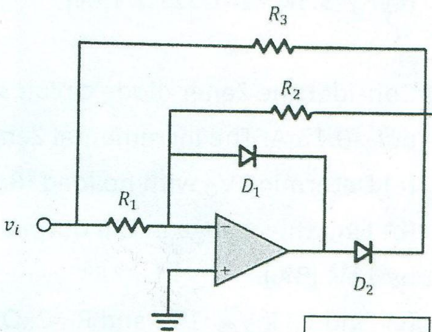

Fig.6.