編號： 127

國立成功大學 107 學年度碩士班招生考試試題

系　　所：工程科學系

考試科目：電子電路

考試日期：0206，節次：1

※ 考生請注意：本試題可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Mark each of the following statements True (T) or False (F). (Need NOT give reasons.) (20 pt.)

(a) MOS is a symmetric device.

(b) BJT is also a symmetric device.

(c) For the CS circuit, when v_I increases from 0 to V_{DD} volt, the operation region of the MOS changes from cutoff, then triode, finally to saturation regions.

(d) Small-signal input is used to ensure that the BJT always operates in active mode.

(e) To guarantee the linear amplification of a MOSFET, we only have to design its DC operating point in the saturation region.

(f) The voltage drop of a current mirror can reduce the maximum output swing.

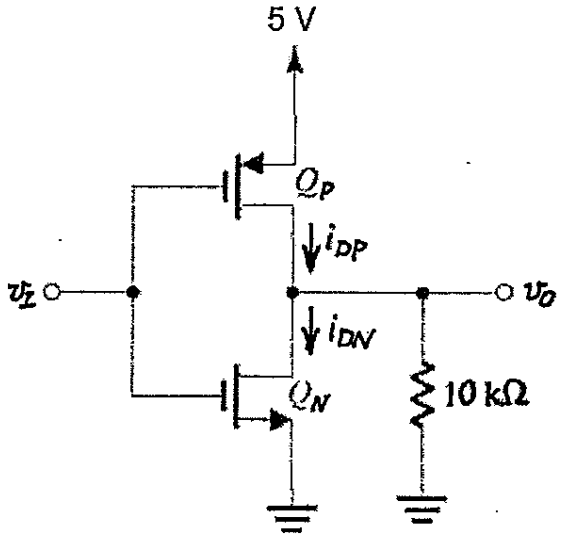
(g) The ideal current buffer has the properties: $R_{in}=\infty$, $R_{out}=0$, and the current gain $A_i=0$.

(h) The output resistance of a current mirror as an active load can reduce the voltage gain.

(i) For the IC amplifier design, it does not matter if the channel length modulation of MOS is neglected.

(j) The CG amplifier can be used for the current buffer, which ideally has $R_{in}=0$, $R_{out}=\infty$, and the current gain $A_i=\infty$.

2. The NMOS and PMOS are matched with $k_n'\left(W/L\right)_n=k_p'\left(W/L\right)_p=1\ \text{mA/V}^2$, $V_{tn}=-V_{tp}=1\ \text{V}$, and $\lambda=0$. Find i_{DN}, i_{DP}, and v_O for v_I=0 V and 5 V, respectively. (20 pt.)



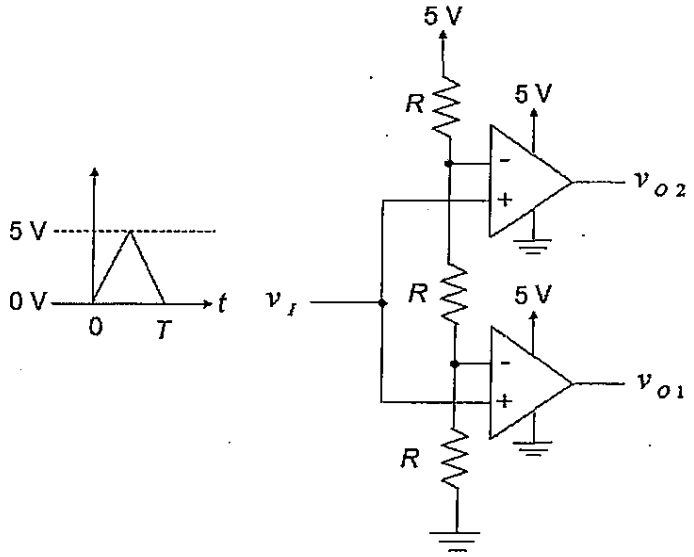
國立成功大學 107 學年度碩士班招生考試試題

系　　所：工程科學系

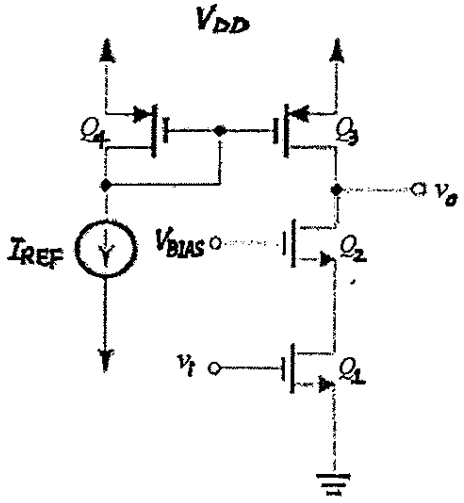
考試科目：電子電路

考試日期：0206，節次：1

3. The operational amplifiers are ideal. $R = 100\ \text{k}\Omega$. (a) Determine v_{O1} and v_{O2} when $v_I = 2.5$ V. (b) Plot the output waveform of v_{O1} and v_{O2} if v_I is a triangular waveform as shown in the figure. (20 pt.)



4. For the following amplifier, $I_{\text{REF}} = 1$ mA and $V_{\text{DD}} = 10$ V. For all transistors, $k_n' = k_p' = 500\ \mu\text{A/V}^2$, $|V_{tn}| = |V_{tp}| = 1$ V, $(W/L)_4 = 1\ \mu\text{m}/\mu\text{m}$, $(W/L)_1 = (W/L)_2 = (W/L)_3 = 4\ \mu\text{m}/\mu\text{m}$, and, for both NMOS and PMOS, $|V_A| = 100$ V. (a) Analyze the voltage gain $A_v \equiv v_o/v_i$. (b) Try to increase the magnitude of voltage gain by changing the active output load of the current mirror using the cascade transistor. What's the voltage gain you obtain? (20 pt.)



國立成功大學 107 學年度碩士班招生考試試題

系　　所：工程科學系

考試科目：電子電路

考試日期：0206，節次：1

5. Find R_o, R_{in3}, and $G_m \equiv \left. i_o \middle/ v_i \right|_{v_o=0}$. Assume $r_{o1}=r_{o2}=r_{o3}=r_{o4}=r_{o5}=100\ \text{k}\Omega$ and $g_{m1}=g_{m2}=g_{m3}=g_{m4}=g_{m5}=10\ \text{mA/V}$. (20 pt.)