11 级微电子 2+2 模拟电子技术试卷（B）参考答案

选择题 (20)：

1. C
2. B
3. A
4. C
5. D
6. C
7. D
8. C
9. B
10. C

填空题 (15%)：

1. High high low differential common freeback
2. 5(2 point)
3. Operational amplifier negative won't
4. CDAB

问答题：

1 (5%) $I = \dfrac{6.2 - 0.7}{1.8}\ mA$

2. (a) A negative feedback(5%)
   (b) Anegative feedback and the input terminal is in the inverting terminal(5%)

3 (15%) (1)

$\because R_2 = 6.2\mathbf{k} \ll \beta R_{E1} = 150 \times 1.5\mathbf{k} = \mathbf{225k}$

$\therefore V_{B1} \approx \dfrac{R_2}{R_1 + R_2} V_{DD} = \dfrac{6.2}{24 + 6.2} \times 15 \approx 3.08\ \mathbf{V}$

$\therefore V_{E1} \approx V_{B1} - 0.7 \approx 3.08 - 0.7 = 2.38\ \mathbf{V}$

$\therefore I_{E1} = \dfrac{V_{E1}}{R_{E1}} = \dfrac{2.38}{1.5\mathbf{k}} \approx 1.59\ \mathbf{mA}$

Assume Q_1 works in linear region, then

$I_{C1} = \dfrac{\beta}{\beta + 1} I_{E1} \approx 1.58\ \mathbf{mA}$

$\therefore V_{C1} = V_{DD} - I_{C1} R_{C1} \approx 15 - 1.58 \times 5.1 \approx 6.94\ \mathbf{V}$

$\therefore V_{CE1} = V_{C1} - V_{E1} \approx 6.94 - 2.38 = 4.56\ \mathbf{V} > 0.7\ \mathbf{V}$

Q_1 working in linear region is checked.

Since two transistors are bised identically, they have same bias voltages and currents.

$$r_{e1}=r_{e2}=\frac{V_T}{I_C}=\frac{26}{1.58}\approx 16.5\ \Omega$$

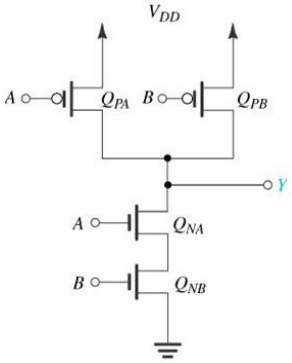
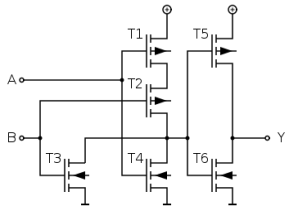
(2) $$A_{v1}\approx-\frac{R_{L1}}{r_{e1}}\approx-\frac{R_{C1}\parallel R_1\parallel R_2\parallel \beta r_{e2}}{r_{e1}}\approx-\frac{1245}{16.5}\approx -75.5$$

$$A_{v2}\approx-\frac{R_{L2}}{r_{e2}}\approx-\frac{R_{C2}}{r_{e1}}\approx-\frac{5.1\mathbf{k}}{16.5}\approx 309.1$$

$$A_v=A_{v1}A_{v2}\approx 75.5\times 309.1\approx 23337$$ **for no-loading case**

(3) $$A_v^{'}=A_{v1}A_{v2}^{'}\approx 75.5\times\frac{5.1\mathbf{k}\parallel 5.1\mathbf{k}}{16.5}\approx 11669$$

4. (10%)

Logic circuit	Truth table	Function
	4% A B Y 0 0 1 0 1 1 1 0 1 1 1 0	1% **NAND** $Y=\overline{A\cdot B}$
 4%	A B Y 0 0 0 0 1 1 1 0 1 1 1 1	1% **OR** $Y=A+B$

5.

(1) $\mathbf{v_o(t)=-RC\frac{dv_1(t)}{dt}}$ (5%)

(2) (15%)**a&b.** $V_{2-}=V_2;\quad V_{1-}=V_1$

$$V_{o2}=V_2+R\frac{V_2-V_1}{R_P}=1.1V_2-0.1V_1$$

$$V_{o1}=V_1-R\frac{V_2-V_1}{R_P}=1.1V_1-0.1V_2$$

c. $V_o=V_{o1}-V_{o2}$

d. $V_o=V_{o1}-V_{o2}=(1.1V_1-0.1V_2)-(1.1V_2-0.1V_1)=10.5-4.5=6$ **V**

6 (5%)

$$I_1 = \frac{V_{REF}}{R_1} = 1\ \mu A$$

$$I_2 = \frac{(W/L)_2}{(W/L)_1} I_1 = 0.5\ \mu A$$