

國立成功大學

112學年度碩士班招生考試試題

編 號： 41

系 所： 光電科學與工程學系

科 目： 電子學

日 期： 0207

節 次： 第 1 節

備 註： 不可使用計算機

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

1. The zener diode in the circuit of Fig.1 is specified to have $V_Z=6.8V$ at $I_Z=5\text{ mA}$, $r_z=20\ \Omega$ and $I_{zk}=0.2\text{ mA}$. The power supply voltage $V^+=10V$. Please find the right items.

- (A) $V_o = 6.83\text{ V}$ with no load (B) $I_L=13.6\text{ mA}$ when $R_L=0.5\text{ K}\Omega$ (C) $V_o = 5\text{ V}$ when $R_L=0.5\text{ K}\Omega$ (D) $I_Z = 6.35\text{ mA}$ with no load (6%)

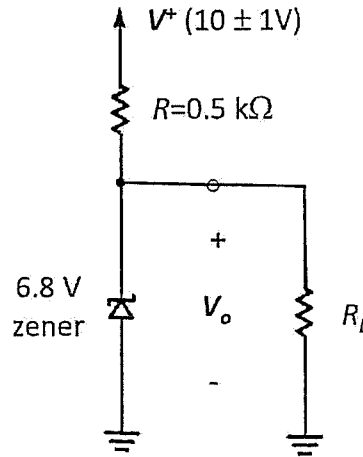


Fig.1

2. The threshold voltage will increase for an n-channel MOS FET when (A)increase the reverse bias of substrate (B) decrease the doping concentration of substrate (C)increase the thickness of gate oxide (D) increase the gate length. (3%)
3. Which of the following statement(s) is(are) true(A)The BJT transconductance increases exponentially with respect to V_{BE} .(B)The MOS FET's transconductance increases linearly with respect to V_{GS} .(C)A PMOS FET has four terminals(D)Compared with MOS FET, BJT device has higher input impedance. (3%)
4. As shown in Fig. 2, if the five forward I-V curves correspond to a GaAs junction diode operated at different temperatures, please identify which of the following item(s) is(are) true.(A) $T_1>T_2$ (B) $T_3>T_4$ (C) $T_2>T_5$ (D) $T_3>T_2$ (E) $T_5>T_4$ (3%)

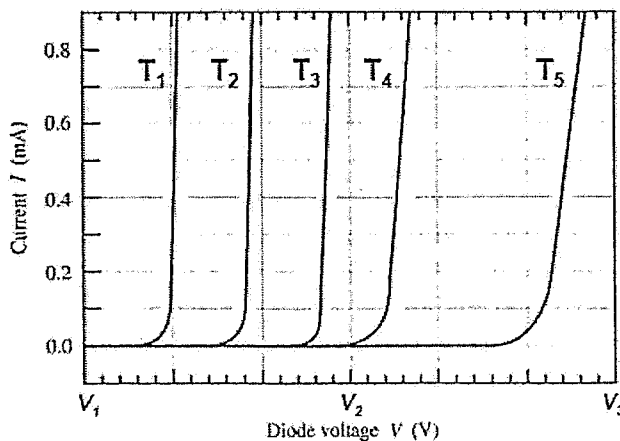


Fig.2

5. As shown in Fig.3, the currents I_{D1} , I_{D2} , I_{D3} , I_{D4} , in each of the diodes D_1 , D_2 , D_3 , D_4 . When diodes are assumed to be ideal, which of the following item(s) is(are) true (A) $I_{D1}=5\text{mA}$, $I_{D2}=2\text{mA}$ (B) $I_{D3}=1\text{mA}$, $I_{D4}=1\text{mA}$ (C) $V_o=1\text{V}$, $I_{D2}=3\text{mA}$ (D) $I_{D3}=1\text{mA}$, $V_o=0\text{V}$ (10%)

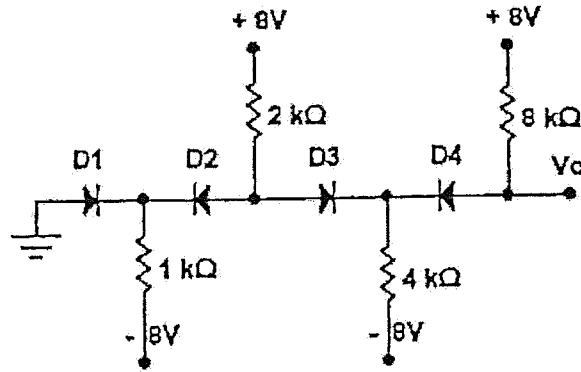


Fig.3

6. If the β is equal to 100 for transistors in Fig.4, which of the following item(s) is(are) true (A) $V_A=4.73\text{V}$, $V_E=1.90\text{V}$ (B) $V_C=11.31\text{V}$, $V_B=4.03\text{V}$ (C) $V_E=2.90\text{V}$, $V_D=12.07\text{V}$ (D) $V_B=3.03\text{V}$, $V_D=12.07\text{V}$ (10%)

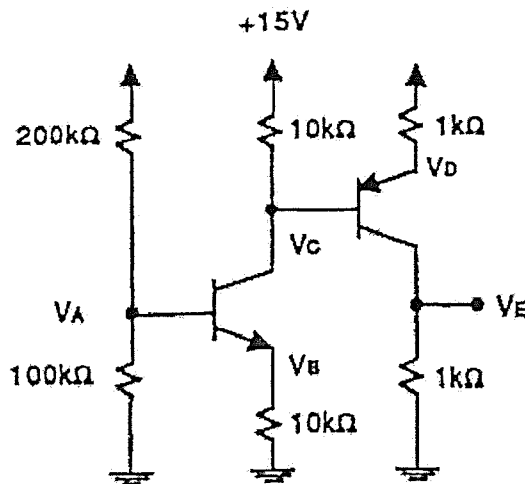


Fig.4

7. As shown in Fig.5, $g_m=1\text{mA/V}$ and $r_o=100\text{k}\Omega$. Note that while the lower end of r_o is not actually grounded, the signal there is small. Assume it to be zero. (A) Find $V_o/V_i=?$ (B) If $R_s=0$, $V_o/V_i=?$ (C) If $R_s=3.76\text{k}\Omega$, $V_o/V_i=?$ (15%)

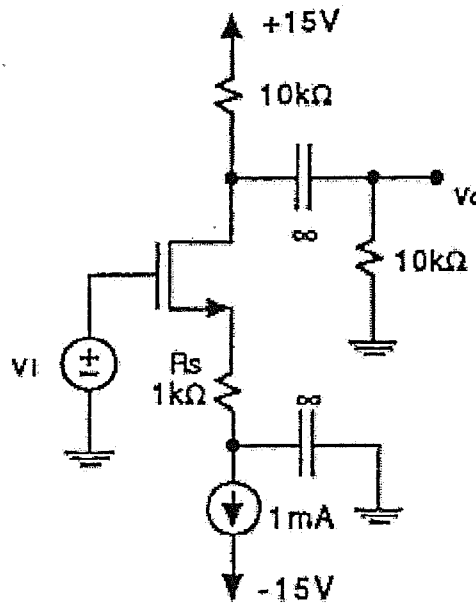


Fig.5

8. All BJT transistors in circuit shown in Fig. 6 are identical and have current gain $(\beta) \gg 1$. Please find i_o in terms of i_A and i_B . (10%)

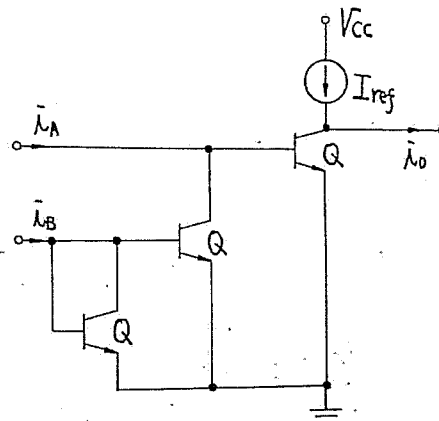


Fig. 6

9. A two-stage differential amplifier is shown in Fig. 7. All transistors in circuit are identical and have infinity Early voltage, $V_{BE(on)}$ of 0.7 V , and current gain (β) of 50 . V_{DC} in circuit is 5 V . (30%)
- (a) Determine values of R_1, R_2, R_3 , and R_4 that could meet $R_{id} = 1\text{ k}\Omega$ (R_{id} is the differential-mode input resistance, defined as the ratio of differential input voltage ($v_{id} = v_{i1} - v_{i2}$) to the input current i_b), $R_{od} = 150\text{ }\Omega$ (R_{od} is the differential-mode output resistance, defined as the ratio of differential input voltage ($v_{od} = v_{o1} - v_{o2}$) to the input current i_o), $I_1 R_1 = 3 V_{BE(on)}$, and $I_2 R_2 = 2 V_{BE(on)}$.
- (b) Find the differential-mode voltage gain $A_d = \frac{v_{o1} - v_{o2}}{v_{i1} - v_{i2}}$.

(c) Find the differential-mode voltage gain $A_c = \frac{v_{o1} + v_{o2}}{v_{i1} + v_{i2}}$.

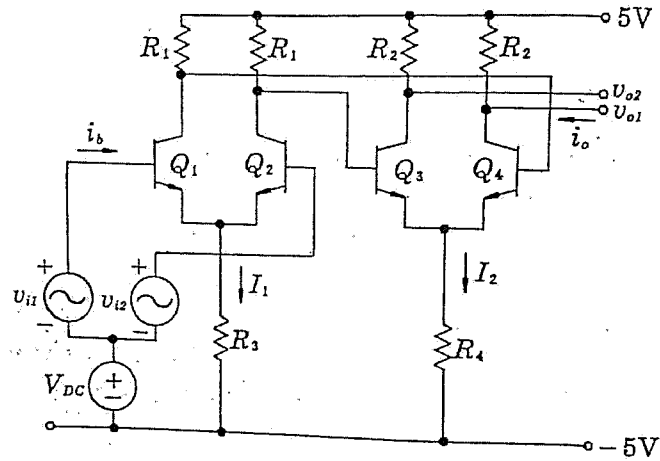


Fig. 7

10. Figure 8 shows a multiple stage amplifier. Q_1 in circuit has $\beta = 100$ and $r_{\pi} = 1 \text{ k}\Omega$. Q_2 in circuit has $\beta = 100$ and $r_{\pi} = 0.5 \text{ k}\Omega$. (10%)

- (a) Determine the capacitors C_1 , C_2 , and C_3 in Fig. 8 which the lower 3dB frequency of circuit is 100 Hz.
- (b) Find the overall voltage gain of the circuit in Fig. 8.

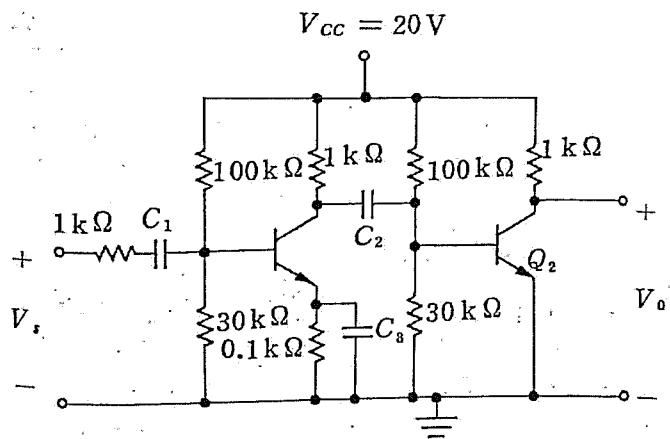


Fig. 8