1.(a)Use the superposition principle to find the output voltage of the circuit shown in Fig.1.(b) If in the circuit of Fig.1 the 1-kΩ resistor is disconnected from ground and connected to a third signal source v_3, use superposition to determine v_0 in term of v_1, v_2 and v_3.(10%)

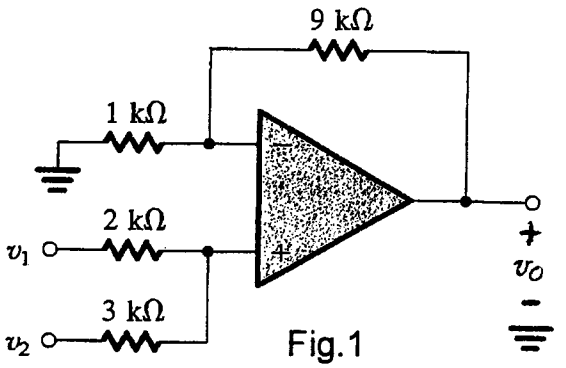

Fig.1

2.A shunt voltage regulator consists of a Zener diode supplied by a constant current of 10 mA. At this operating current the Zener resistance is 5Ω and the Zener voltage is 6.8 V. The circuit and diode I-V characteristics are shown in Fig.2(a) and Fig.2(b), respectively. If the regulator is loaded by a resistor of 2kΩ, the output voltage decreased by_____mV.(10%)

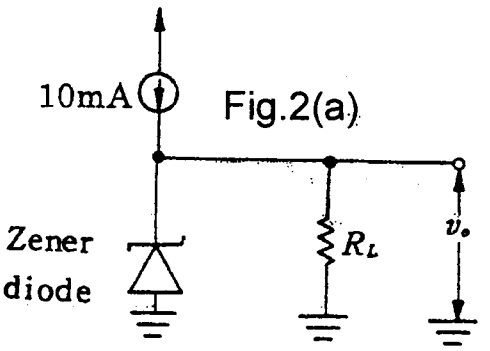

Fig.2(a)

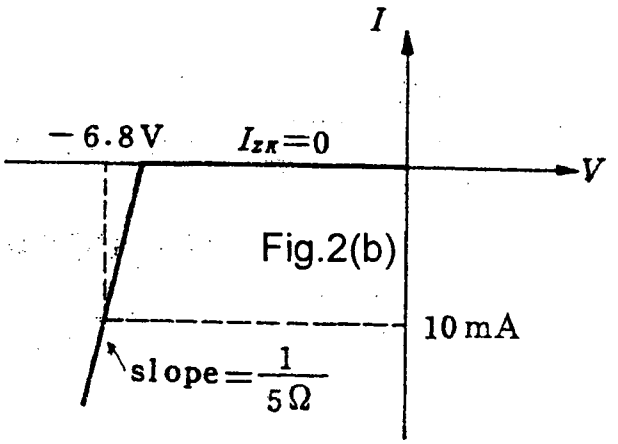

Fig.2(b)

(背面仍有題目,請繼續作答)

3.As shown in Fig.3, assume that the p-n and Zener diodes are ideal, and Vz =5V, Find V_2 and V_3 when the voltage of V_1 is 16 V. (10%)

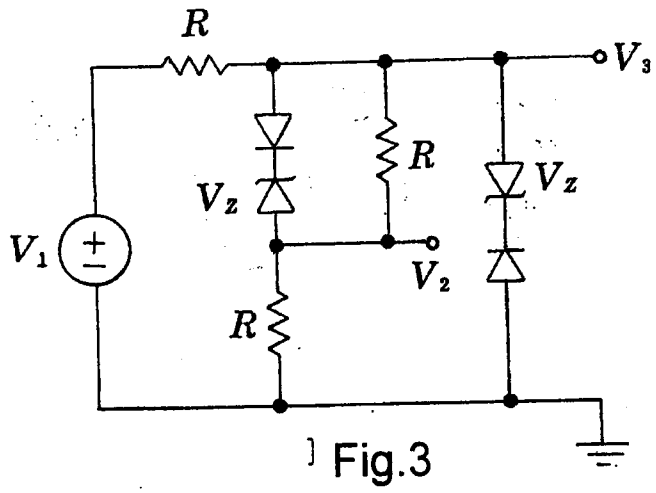

Fig.3

4. For the circuit of Fig.4, let $V_{DD}=V_{SS}=5V$, $V_{tn}=1V$, $V_{tp}=-1V$, all channel lengths=10μm, $k_n'=20\mu A/V^2$, $k_p'=8\mu A/V^2$, and $\lambda=0$. For $I_{REF}=10$ μA, find the widths of all transistors so as to obtain $I_2=50$ μA. It is further required that the voltage at the drain of Q_2 be allowed to go down to within 0.5 V of the negative supply and that the voltage at the drain of Q_5 be allowed to go up to within 0.5V of the positive supply.(15%)

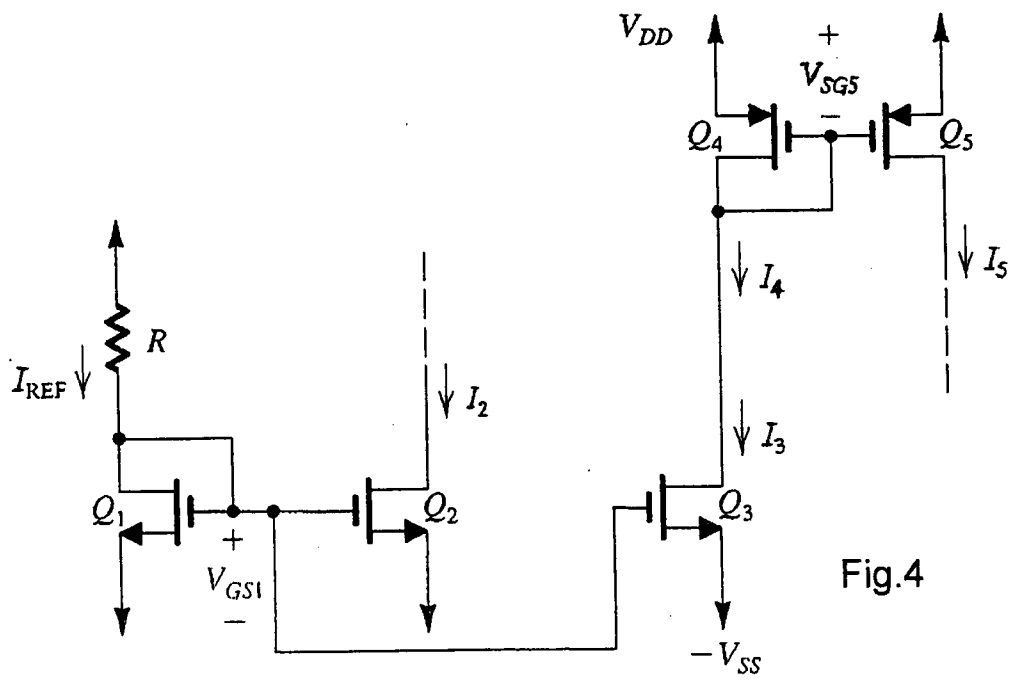

Fig.4

5. How to adjust the threshold voltage(V_t) of a MOSFET?(10%)

6.Consider the circuit in Fig.5 with the input signals changed as follows. For each case that the signals at terminals 5 and 6 interchanged (i.e., $\overline{B}$ applied to 5 and B applied to 6). All the rest are the same. , Please find Y and $\overline{Y}$ (10%)

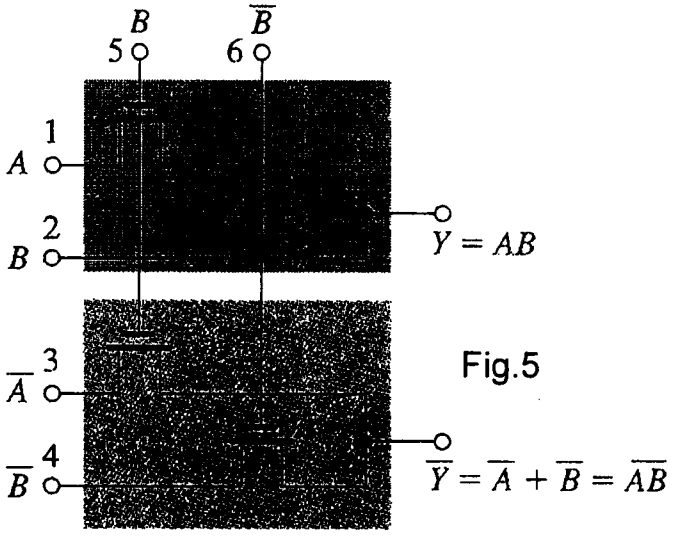

Fig.5

7.The circuit shown in Fig.6 consists of a differential stage followed by an emitter follower, with series-shunt feedback supplied by the resistance R_1 and R_2. Assuming that the dc component of Vs is zero, and that β of the BJTs is very high. Please find the values of $A_f=V_0/Vs$, R_{in} and R_{out}. Assume that the transistors have β=100.(15%)

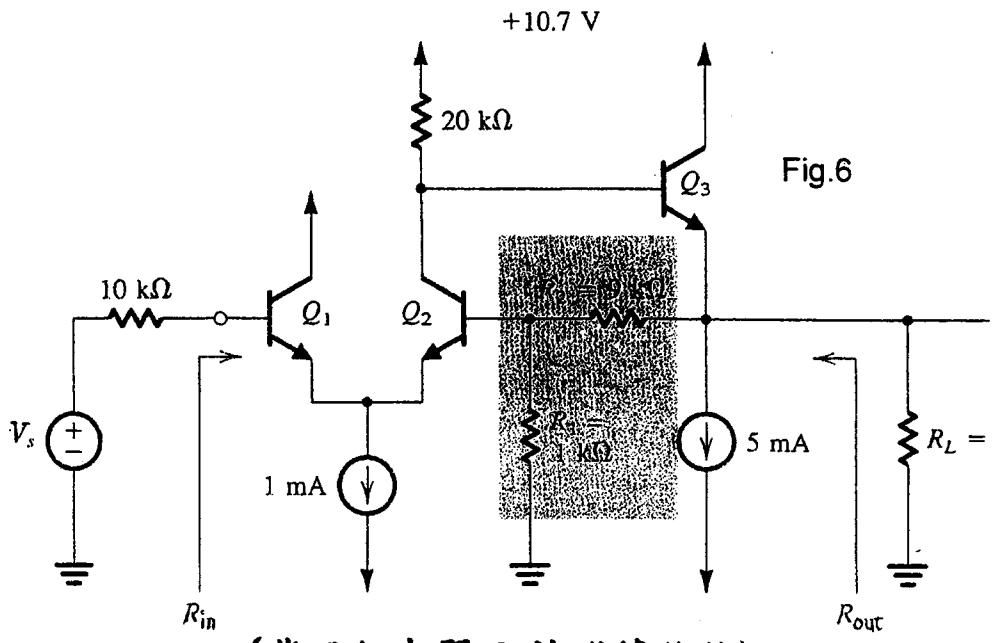

Fig.6

(背面仍有題目,請繼續作答)

8. As shown in Fig.7, please identify the corresponding semiconductor devices.(10%)

(A)_____(B)_____ (C)_____ (D)_____ (E)_____

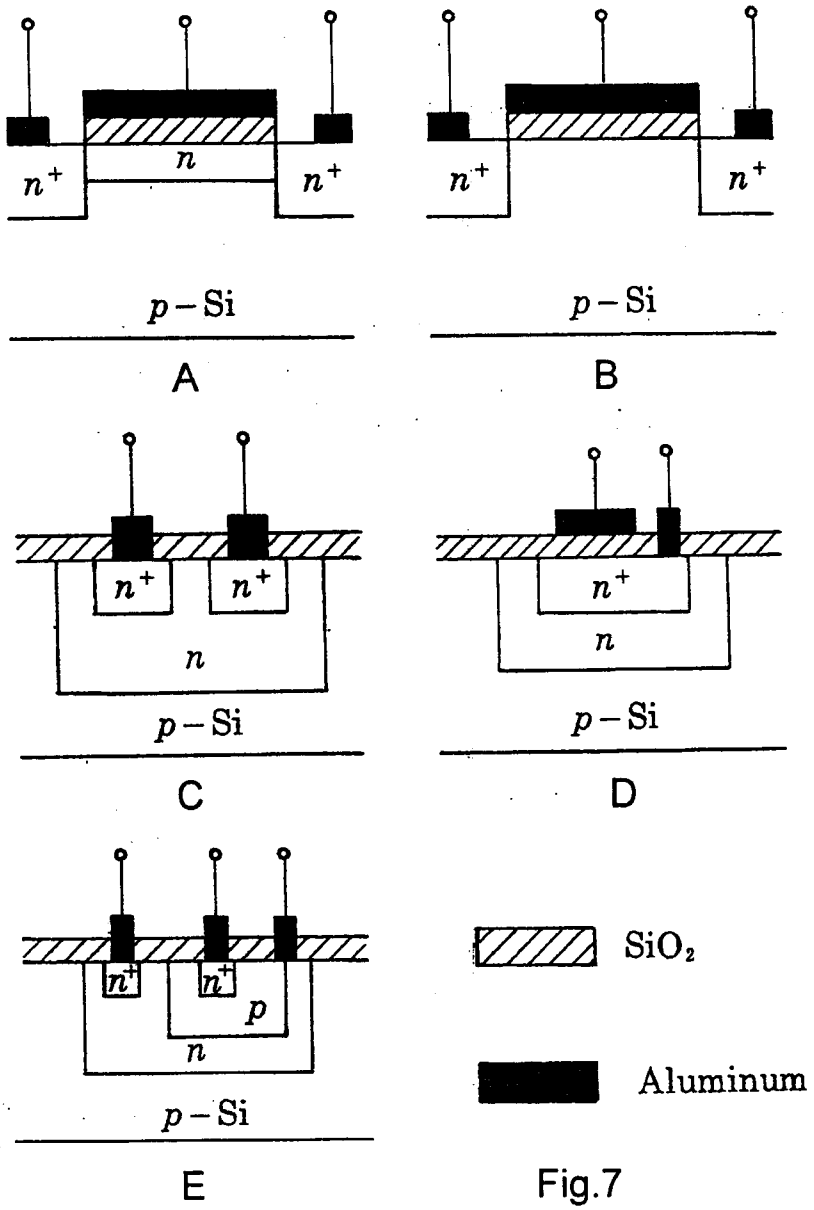

Fig.7

9. Around room temperature, the carrier mobility in a Si semiconductor will increase if

(A)Both temperature and the impurity doping concentration are reduced.

(B)The temperature is increased and the impurity doping concentration is decreased.

(C) Both the impurity doping concentration and the applied external electric field are increased

(D) Both the impurity doping concentration and the applied external electric field are reduced.
(E) Both temperature and the applied external electric field are increased.
Please choose the correct answer(s).(2%)

10. Si sample P is doped with boron of $5\times10^{16}cm^{-3}$. Si sample Q is doped with phosphorus of $5\times10^{16}cm^{-3}$. Si sample R is doped with boron of $5\times10^{16}cm^{-3}$ and with phosphorus of $5\times10^{16}cm^{-3}$. With respect to the conductivity of each sample at room temperature, which of the following is correct? (2%)
(A)P>Q>R (B) R>P=Q (C) P<Q<R (D) Q>P>R (E) P=Q>R

11. Which of the following devices is (are) enhancement type?. (2%)
(A)NMOS with V_t= +1V
(B)NMOS with V_t= -1V
(C)PMOS with V_t= +1V
(D)PMOS with V_t= -1V
(E)N-channel JFET
(F)P-channel JFET

12.Compared to MOSFET, BJT has
(A)higher input impedemce
(B)higher transconductance
(C)higher current driving capability
(D)current dominated by drift current
(E)capability of excellent analog switch
Please choose the correct answer(s).(2%)

13.Which of the following statements is(are) true? (2%)
(A)As the biasing current increases, the BJT transconductance increases linearly with respect to biasing current.
(B)As the biasing current increases, the MOSFET transconductance increases linearly with respect to biasing current.
(C)The BJT transconductance increases exponentially with respect to V_{BE}.
(D) The MOSFET transconductance increases linearly with respect to V_{GS}.