國立臺北科技大學107學年度碩士班招生考試

系所組別：1503 自動化科技研究所

第二節　電子學　試題　（選考）

注意事項：

1. 本試題共六題，共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

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1. (25%) Suppose that each diode in the circuit as shown below has the same cut-off voltage of $V_r = 0.65V$.

   (a) If input voltage $V_I = 8V$ and $R_1 = 2K\Omega$, please calculate the current of I_{D1} and I_{D2}. (15%)

   (b) If input voltage $V_I = 5V$, please calculate the value of R_1 required such that I_{D1} is one-half the value of I_{D2}. (10%)
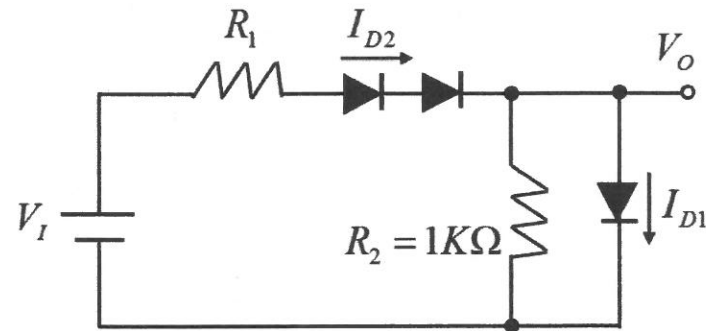
2. (10%) In design of bipolar junction transistors (BJTs), what is the most wanted condition of doping majority-carrier concentrations for appropriate BJT characteristics?

   (A) $N_B = N_E > N_C$;　(B) $N_B > N_E > N_C$;　(C) $N_C > N_B = N_E$;

   (D) $N_E > N_B > N_C$;　(E) $N_C = N_B > N_E$;　(F) $N_C > N_B > N_E$;

3. (30%) Suppose that the NMOS transistors in the circuit as shown below have $V_t = 1V$, $\mu_n C_{ox} = 120\mu A / V^2$, $\lambda = 0$, and $L_1 = L_2 = 1\mu m$. Find that the required values of gate width for each of Q_1 and Q_2 to obtain the voltage and current values indicated?
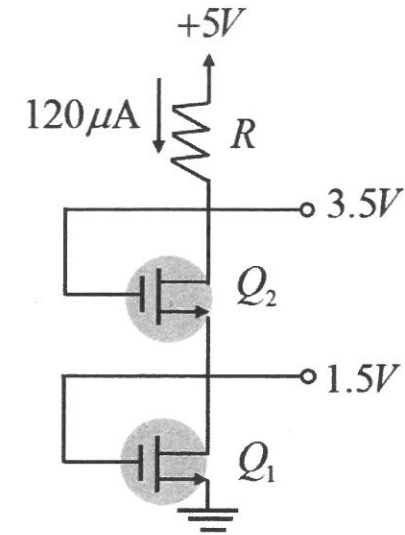
4. (15%) Suppose that an ideal voltage amplifier with a gain of $0.9 V / V$ and a resistance $R = 100K\Omega$ connected in the feedback path, that is, between the output and input terminals. Please use the Miller's theorem to find the input resistance of this circuit.

5. (5%) For an ideal voltage amplifier, which of the following statements is not correct?

   (A) It has an infinitely high input resistance ;　(B) It has an infinitely high open-circuit voltage gain ;　(C) It has an infinitely high output resistance

6. (15%) An amplifier has that open voltage gain of $+40dB$, input resistance of $10K\Omega$ and output resistance of 100Ω, and is used to drive $1K\Omega$ load. Find the power gain in dB