

# 國立臺北科技大學

九十二學年度自動化科技研究所入學考試

## 電子學試題

填准考證號碼

第一頁 共二頁

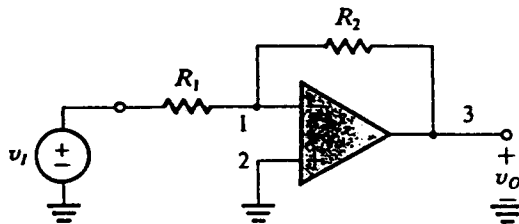
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### 注意事項：

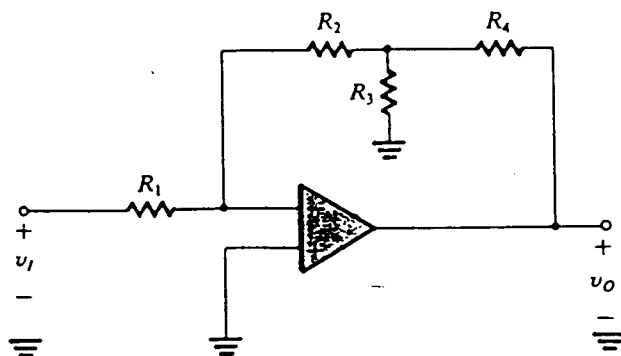
1. 本試題共七題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在答案卷之答案欄內，否則不予計分。

In the following, show all steps that lead to your answer.

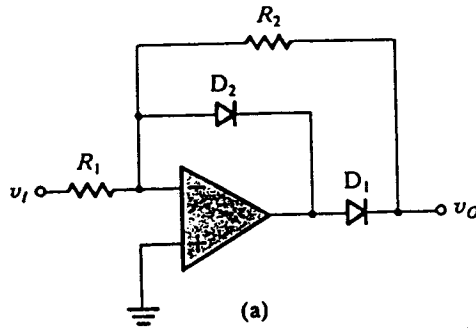
1. For the circuit shown below, derive an expression for the closed-loop gain under the assumption that the op-amp open-loop gain  $A$  is finite. (15%)



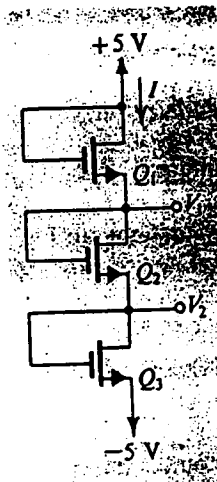
2. For the circuit shown below, assuming the op-amp to be ideal  
(a) Derive an expression for the closed-loop gain  $v_o / v_i$ . (10%)  
(b) For  $R_1 = 1\text{k}\Omega$ ,  $R_2 = R_4 = 10\text{k}\Omega$ , and  $R_3 = 100\Omega$ , determine the value of the closed-loop gain. (5%)



3. Analyze the rectifier circuit as shown below and plot the transfer characteristic of the circuit ( $v_o - v_i$ ). (15%)

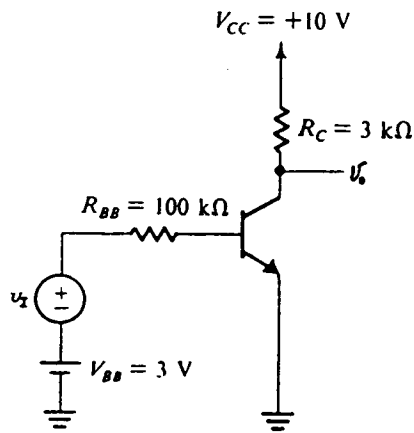


4. For the circuit shown below, let  $V_t = 1V$  and  $\mu_n C_{ox} = 20 \mu A/V^2$ . Utilizing a current  $I = 90 \mu A$ , find the  $W/L$  ratios of the three transistors so that the circuit provides  $V_1 = +1V$  and  $V_2 = -1V$ . (Neglect the small effect of output resistance  $r_o$  of each of the three devices.) (15%)

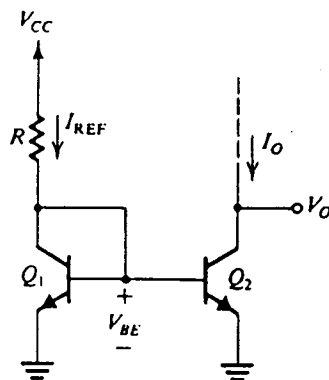


5. For the circuit shown below, assume  $V_{BE} = 0.7 \text{ V}$ ,  $\beta = 100$ .

- (a) Determine the operating point of the circuit. (5%)
- (b) Find the small-signal equivalent circuit using hybrid- $\pi$  model. (5%)
- (c) Find the voltage gain  $v_o / v_i$ . (5%)



6. For the circuit shown below, find the value of  $R$  that results in  $I_o = 1 \text{ mA}$  with  $V_{cc} = 5 \text{ V}$ . Assume that  $V_{BE} = 0.7 \text{ V}$  and neglect the effect of output resistance  $r_o$ . (15%)



7. Find the logic function implemented by the circuit shown below. (10%)

