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254 國立成功大學九十六學年度碩士班招生考試試題   共 2 頁,第 / 頁
編號: 254   系所:電機工程學系丁組,甲,乙,戊, 微電3所 科目:電子學
                              電通所丙,丁.
本試題是否可以使用計算機: ☑可使用 , □不可使用 (請命題老師勾選)

1. Consider the circuit in Fig. 1. The transistor parameters are $V_{TN} = 1$ V and $k_n' = 36$ $\mu A/V^2$. Determine the width-to-length ratio required in transistor M_2 such that $I_D = 0.5$ mA, $V_1 = 2$ V, and $V_2 = 5$ V. (10%)

2. For the TTL circuit in Fig. 2, assume parameters of $\beta_F = 50$, $\beta_R = 0.1$, V_{BE}(on) = 0.7 V, V_{BE}(sat) = 0.8 V, and V_{CE}(sat) = 0.1 V. Determine the power dissipated in the circuit (no load condition) for (a) $V_{in} = 0.1$V and (b) $V_{in} = 5$ V. (20%)

Fig. 1   **Fig. 2**
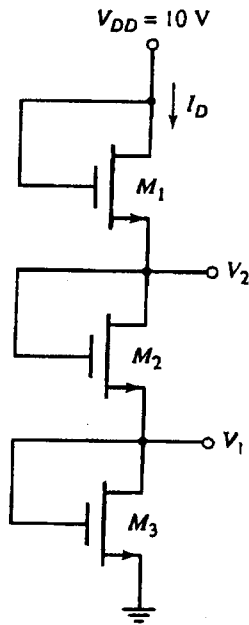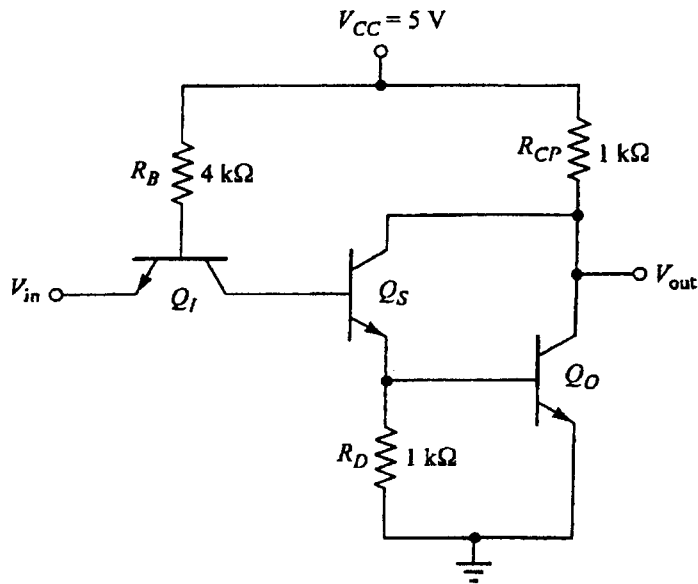
3. (a) Why the current of a forward-biased p-n junction is an exponential function of the bias voltage? (5%)

   (b) Calculate the overall voltage gain of a common-source amplifier for which $g_m = 2.5\ mA/V$, $r_o = 100\ k\Omega$, and $R_G = 1000R_D = 10\ M\Omega$. Assume the amplifier is fed from a signal source with a Thevenin resistance of $0.5\ M\Omega$, and the amplifier output is coupled to a load resistance of $25\ k\Omega$. (5%)

   (c) For the circuit shown in Fig. 3, draw the possible load line of the Schottky transistor and explain the advantage(s) of using such a Schottky transistor in this circuit. (10%)

4. (a) Assume $V_{CC} = 15V$、$V_{BE} = 0.7\ V$、$R_1 = 2R_2 = 100\ k\Omega$, $\beta_{dc}(\equiv I_C / I_B) = 75$, and $R_C = 3R_E = 6\ k\Omega$ for the circuit shown in Fig. 4, calculated V_{CE} and I_C. (10%)

   (b) Assume the circuit shown in Fig. 5 has matched BJTs, derive the small-signal input resistance R_i, output resistance R_o, and current gain $A_i(=i_o / i_i)$. (7%)

（背面仍有題目,請繼續作答）

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電通許天.丁.

國立成功大學九十六學年度碩士班招生考試試題 共 2 頁，第2頁

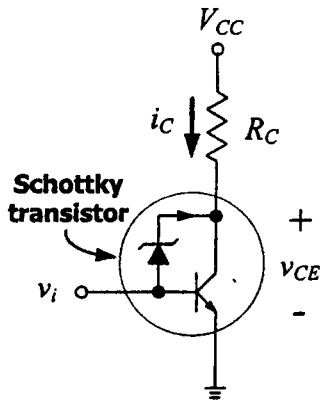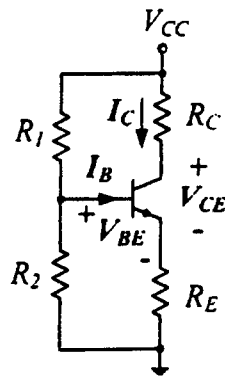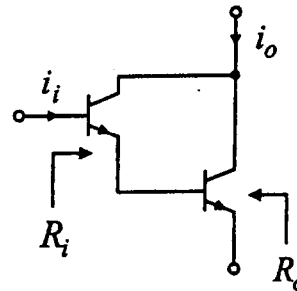本試題是否可以使用計算機： ☑可使用 ， □不可使用 （請命題老師勾選）

Fig. 3   **Fig. 4**   **Fig.5**

5. We need an amplifier with a rise time of 300 ns. The amplifier we have has rise time of 3 μs and gain of 40. Find the resulting feedback factor β, if we correct the rise time problem with negative feedback. (5%)

6. We have a nonfeedback amplifier with voltage gain of 920, $R_o = 3k\Omega$ and $R_i = 11k\Omega$. (a)Determine the class of feedback amplifier so that $R_{of} \leq 10\Omega$ and $R_{if} \geq 800k\Omega$. (4%) (b)Find the feedback factor β and closed-loop gain A_f of the feedback amplifier. (4%)

7. Consider the circuit shown in Fig. 6, Let
   $R_1 = 2k\Omega$, $R_2 = 667\Omega$, $R_3 = 200k\Omega$, $C = 0.1\mu F$. Assume that op amp is ideal.

(a) Find $\dfrac{V_o}{V_i}$ as a function of passive components R_1, R_2, R_3 and C. (8%)

(b) Find the zeros and poles of this transfer function. (4%)

(c) Plot the magnitude response of this transfer function. (8%) (Note: you have to show some numerical values at the important points on this plot to get the grade points).
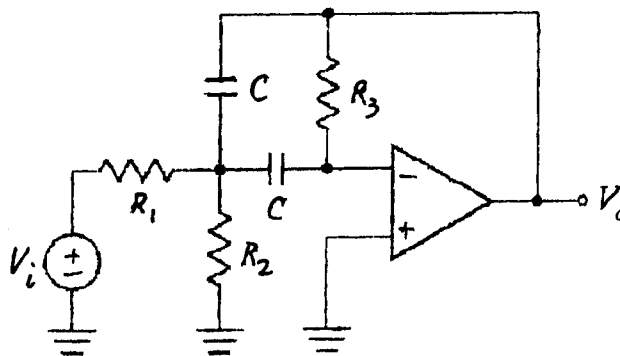

Fig. 6