國立成功大學 104 學年度碩士班招生考試試題

系所組別：生物醫學工程學系乙組

考試科目：電子學

考試日期：0211，節次：1

※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. A basic differential amplifier circuit is shown in Fig. 1. (a) Determine R_E and R_C such that i_E = 80 μA and $v_{O1} = v_{O2}$ = -0.25 V when v_1 = -1.0 V, with V_{BE}(on) = 0.7V and neglecting the base currents. (b) Using the obtained R_E and R_C in part (a), determine v_{O1} and v_{O2} when v_1 = -1.3V and v_1 = 0.7V, respectively. (20%)

2. Design an NMOS pass transistor logic circuit to perform the function $Y = A + B\,(\,C + D\,)$. Assume that both variable and its complement are available as input signals. (10%)

3. An analog signal in the range 0 to 5V is to be converted to a digital signal using an A/D converter for a quantization error less than 1%. Please determine the required number of bits and the input voltage value that represents 1 LSB. (10%)

4. The op-amp in the circuit in Fig. 2 has an open-loop differential voltage gain of $A_d = 10^4$. Assume the op-amp is ideal one. Determine (a) the closed-loop voltage gain $A_o = V_o/V_s$, and (b) the resistances for R_{if} and R_{of} as shown in Fig. 2. (20%)

5. An equivalent high-frequency small-signal circuit of a MOSFET with a load resistance R_L is shown in Fig. 3. Give your derivation in detail for Miller capacitance, and cutoff frequency of this MOSFET. (20%)

6. The transistor parameters of the circuit as shown in Fig. 4 are R_S = 2kΩ, V_{TP} = -1.2V, k'_p = 40 μA/V^2, and $\lambda = 0$. (a) Design the transistor width-to-length ratio such that I_{DQ} = 1.5 mA, and (b) find its small-signal voltage gain. (20%)

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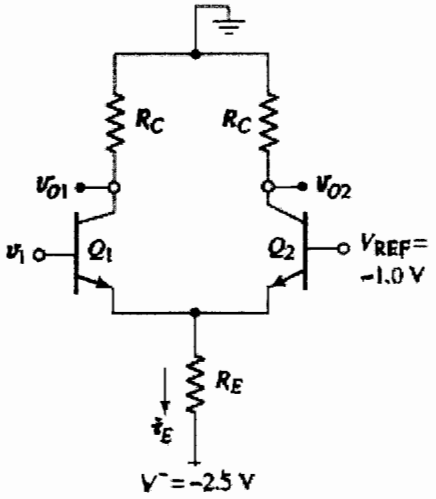

Fig. 1

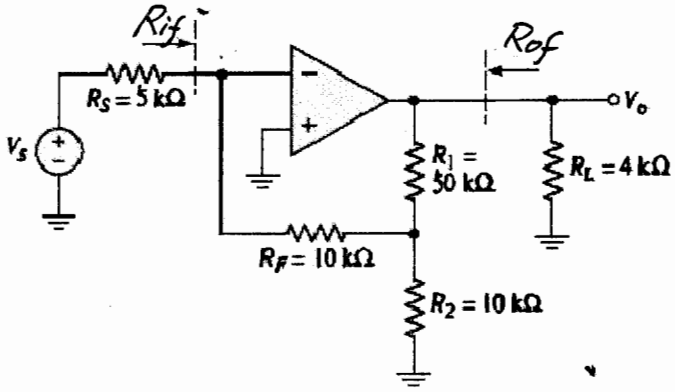

Fig. 2

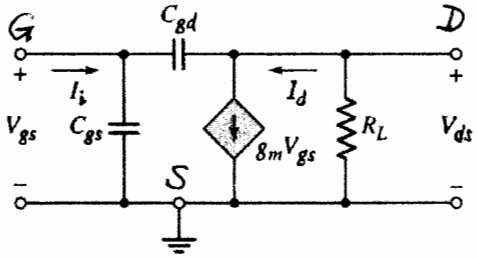

Fig. 3

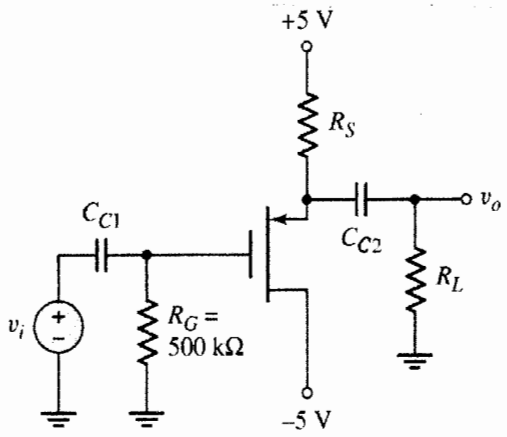

Fig. 4