

科目：電子學 適用：電機系三

編號：841

考生注意：

1. 依次序作答，只要標明題號，不必抄題。
2. 答案必須寫在答案卷上，否則不予計分。
3. 限用藍、黑色筆作答；試題須隨卷繳回。

本 試 題

共 2 頁

第 1 頁

1. For the circuit shown in Fig. 1(a), assume V_{in} has input waveform as shown in Fig. 1(b).
 (a) If both diodes are ideal model, plot the output waveform of V_{out} . [5%]
 (b) If both diodes have a constant voltage model with a turn-on voltage of 1V, plot the output waveform of V_{out} . [5%]

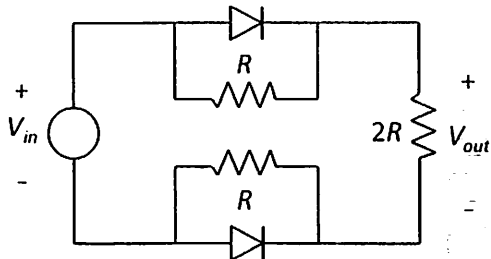


Fig. 1(a)

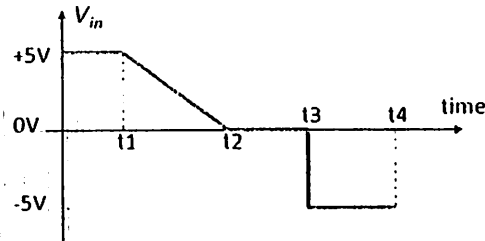


Fig. 1(b)

2. For the equivalent circuit in Fig. 2, (a) derive the voltage gain ($A_v = v_{out}/v_{in}$), [5%] and (b) plot the Norton equivalent circuit seen at v_{out} . [5%]

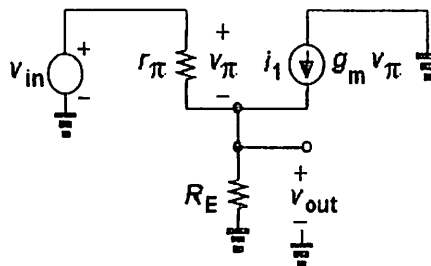


Fig. 2

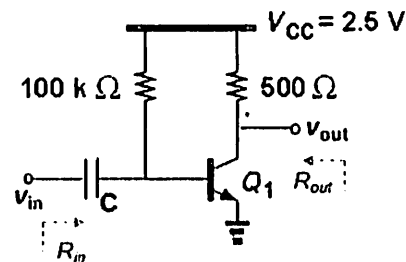


Fig. 3

3. For the circuit shown in Fig. 3, assume C is large enough, $V_T = 26$ mV, $\beta = 100$, $V_A = 18$ V, and $V_{BE} = 0.7$ V. (a) Determine its operating point (I_C , V_{CE}), [5%] (b) plot its small-signal model, [5%] and (c) find its voltage gain ($A_v = v_{out}/v_{in}$), R_{in} , and R_{out} . [10%]
4. For the two circuits shown in Fig. 4, assume $V_A = \infty$ and capacitors are large enough, derive their voltage gain ($A_v = v_{out}/v_{in}$), respectively. [10%]

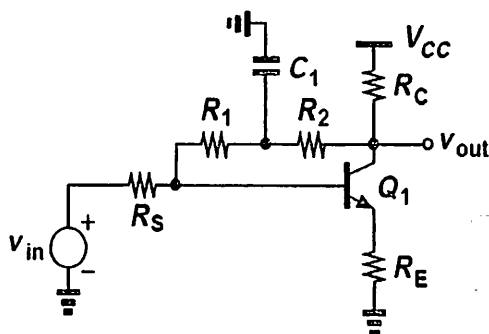


Fig. 4(a)

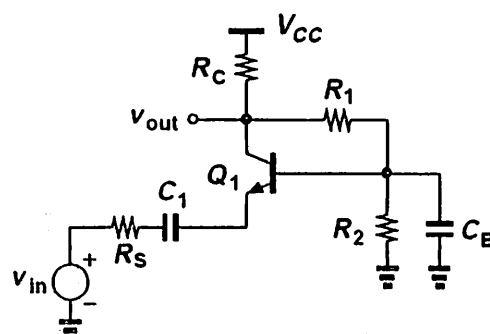


Fig. 4(b)

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5. For the three circuits shown in Fig. 5, using the small-signal model of MOSFETs below, derive their voltage gain ($A_v = v_{out}/v_{in}$) and output resistance (R_{out}) seen at v_{out} . [30% (10% for each)]

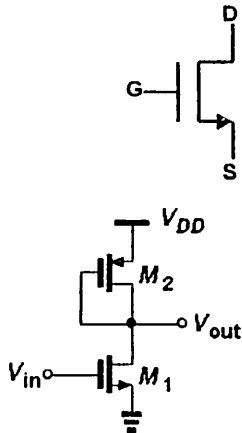


Fig. 5(a)

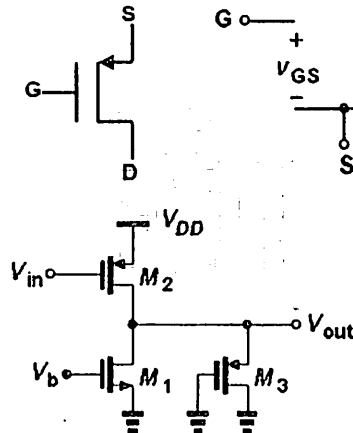


Fig. 5 (b)

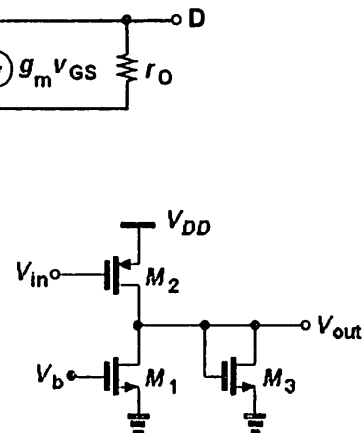


Fig. 5 (c)

6. Determine I_1 and I_2 of the two circuits shown in Fig. 6. Assume all the BJTs have the same characteristics and neglect the base current. [10%]

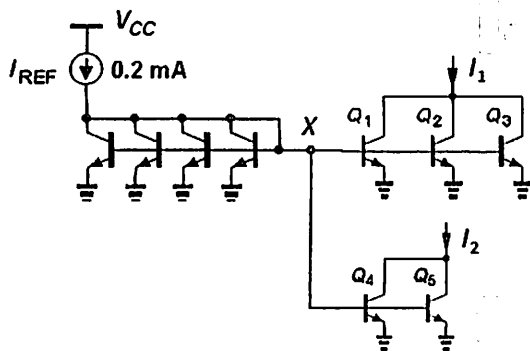


Fig. 6(a)

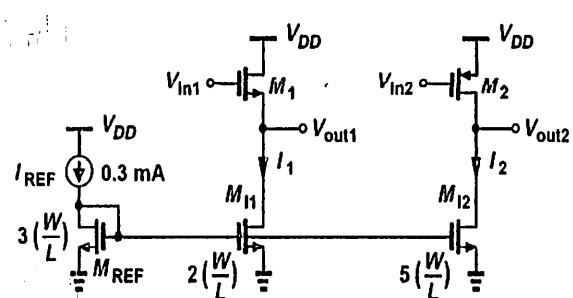


Fig. 6(b)

7. For the circuit shown in Fig. 7, the operational amplifier has an open-loop gain of A_1 .
 (a) If $A_1 = \infty$, derive V_{out}/V_{in} . [2%]
 (b) If $A_1 \neq \infty$, derive V_{out}/V_{in} again. [3%]
 (c) Prove that the error for the V_{out}/V_{in} in the previous two cases is approximately equal to $\frac{1}{A_1} (1 + \frac{R_1}{R_2})$. [5%]

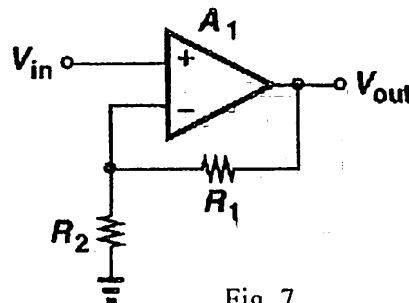


Fig. 7