14. For a common-emitter amplifier circuit shown in Fig. 6 what's the maximum gain we can obtain? Please use $V_{CE,SAT}=0$ for this question
(A) V_{cc}/V_T (B) $V_{cc}*q/kT$ (C) $V_{cc}/(I_c*R)$, I_c is the collector current of Q_1(D) none of the above

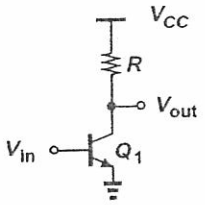

Fig. 6

15. For a common-drain circuit, its low-frequency gain can be
(A) larger than unity (B) smaller than unity (C) 10 (D) all of the above are possible

(40 pts)以下為計算題，共兩大題

1. (20pts)Given the transfer function of a filter, $T(S) = {}^{3}/_{(2S^3 + 4S^2 + 4S + 2)}$, answer the following questions:

(a) (6 pts) List all the pole(s) and zero(s) in the unit of ***rad/s***.
(b) (6 pts) Draw the pole-zero pattern of the filter. Is this a high-pass filter or a low-pass filter (or neither)?
(c) (4 pts) Calculate the magnitude function of the filter, $|T(j\omega)|$.
(d) (4 pts) Calculate the ω_{3dB}.

2. (20 pts) The circuit in Fig. 7 contains a two-stage BJT CE amplifier with its bias circuit. Note that $\beta=100$ for all BJTs, in which Q_0 to Q_2 have the same I_s. Q_3 has scale current $I_{s3}(=3I_s)$ and Q_4 has scale current $I_{s4}(=5I_s)$. To simplify calculation, you can neglect base-width modulation and can assume C_1 to C_3 is quite large. Note that all BJTs are in forward-active region. Please use $V_T=25$ mV and V_i is an AC voltage source only.

(a) (5 pts) Please calculate R_0 so that $I_{c3}+I_{c4}=8$ mA.
(b) (7 pts) Draw the small-signal model for this two-stage amplifier.
(c) (8 pts) Now, $R_{B1}=R_{C1}=R_{B2}=R_{C2}=2K\Omega$ Calculate V_{out}/V_i.

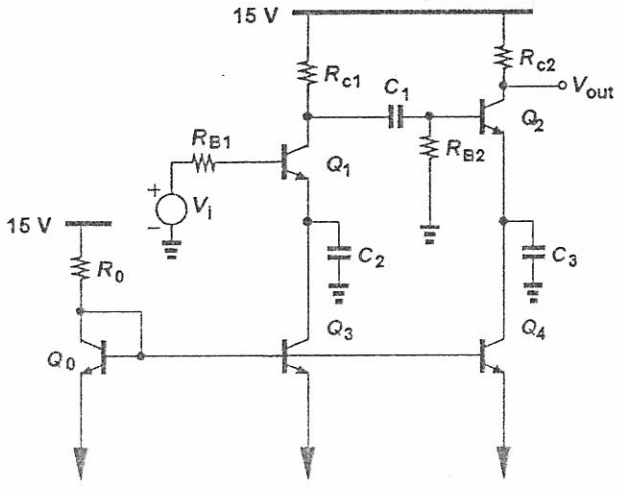

Fig. 7

試題隨卷繳回