國立臺灣科技大學

九十一學年度碩士班招生考試試題

系所組別： 電子工程系乙一組、電子工程系乙二組、電子工程系乙三組

科　目： 電子電路學

(總分 100 分)

1. A BJT operates at 27° with β=250 in an active region. (We specify r_{bb}'=0, r_o=40KΩ, C_μ=3pF, and C_π=100pF)
   (1) Plot its high-frequency hybrid-π model, (5%)
   (2) If the BJT is operated at I_C=5mA, find its transconductance g_m=? (A/V) (3%)
   (3) From (2), find its input impedance r_π=? (3%)
   (4) Find the unity-gain bandwidth f_T of the BJT in common-emitter configuration when its short-circuit current gain approaches one.

   (注意: 公式必須先推導出來才給分) (9%)

2. A differential amplifier with an active load is shown in Fig. P2a, whose equivalent circuit is shown in Fig. P2b. Find the followings represented by the parameters of the hybrid-π model
   (1) Output impedance R_o=? (5%)
   (2) Open-circuit voltage gain v_o/v_d=? (5%)
   (3) Transconductsance G_m=? (5%)
   (4) Input-impedance R_i=? (5%)

3. A RC circuit is shown in Fig. P3. If $v_i(t) = Vu(t)$, find
   (1) $v_o(t)$, $t \geq 0$; (10%)
   (2) What is the condition for the $v_o(t)$ being a perfect step-output? (10%)

4. An active filter is shown in Fig. P4.
   (1) Find its transfer function $v_o(t)/v_i(t)$=? (15%)
   (2) What kind of this filter is? (5%)

5. A transformer-coupled Class-A power amplifier is shown in Fig. P5. We assume that the transformer is ideal and its turns-ratio is N:1.
   (1) Plot the AC and DC load line on i_C-v_{CE} output characteristic curve under producing maximum symmetrical swing.

   (注意: i_C-v_{CE} 座標上必須詳細寫出數據才給分) (5%)

   (2) Find the optimal operating point Q(I_{CQ}, V_{CEQ}) for producing maximum symmetrical swing. (5%)
   (3) Find the maximum average output power $P_{L,ac}$=? (W) if the input signal is sinusoidal $v_i(t)=V_{im}\sin\omega t$. (5%)
   (4) Find the maximum power dissipated in the transistor? (5%)

   (注意: (2)-(4)題的結果必須以 V_{cc}, R_L 及 N 表示才給分)

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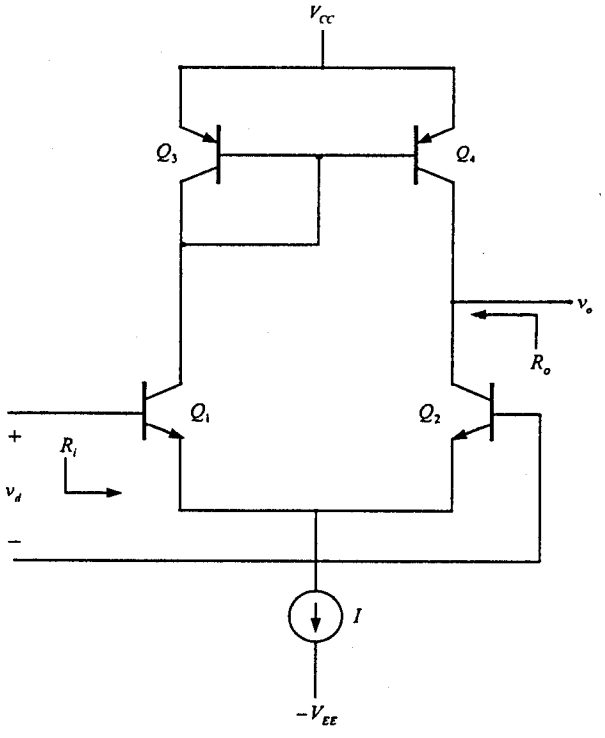
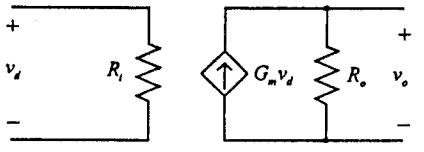


(a)



(b)

Fig. P2

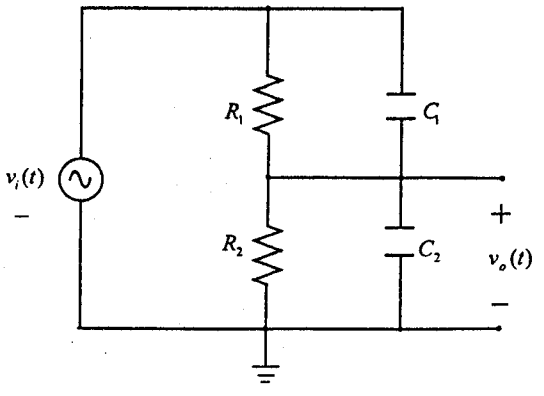


Fig. P3

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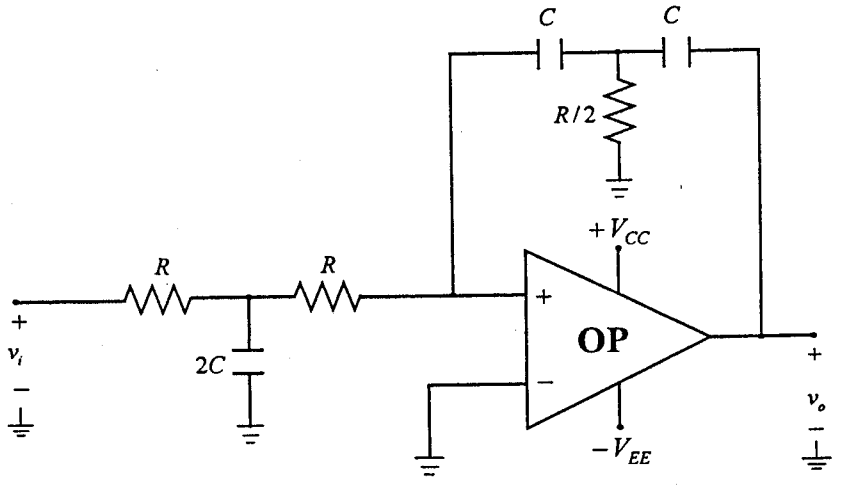
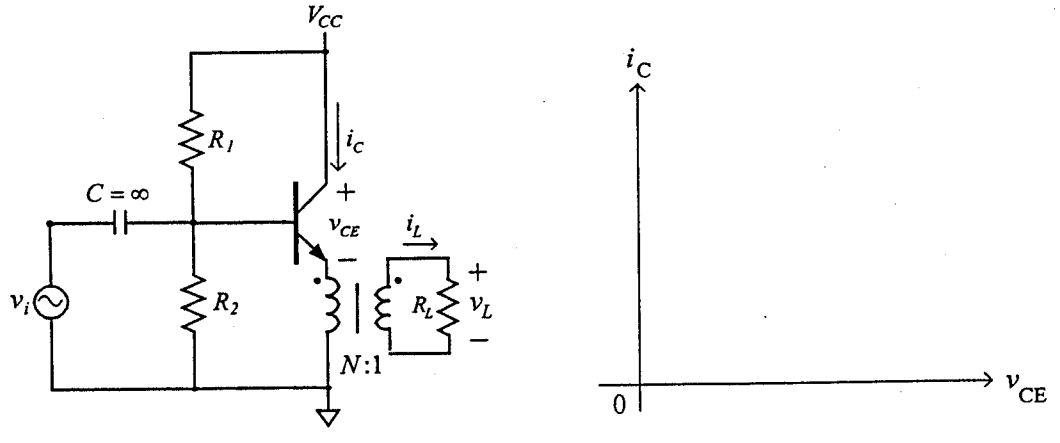


Fig. P4



(a)　　(b)

Fig. P5