國立聯合大學 100 學年度碩士班考試招生

電機工程研究所 入學考試試題

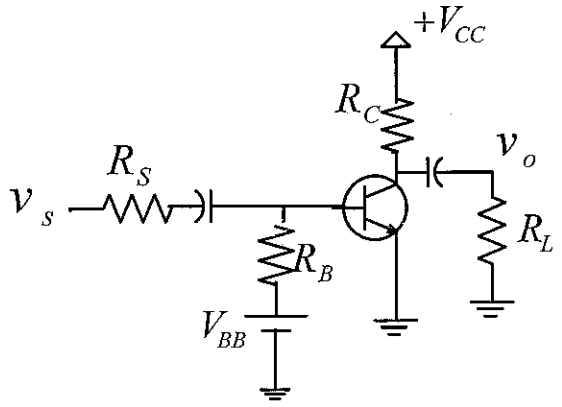
科 目：電 子 學 第 1 頁共 3 頁

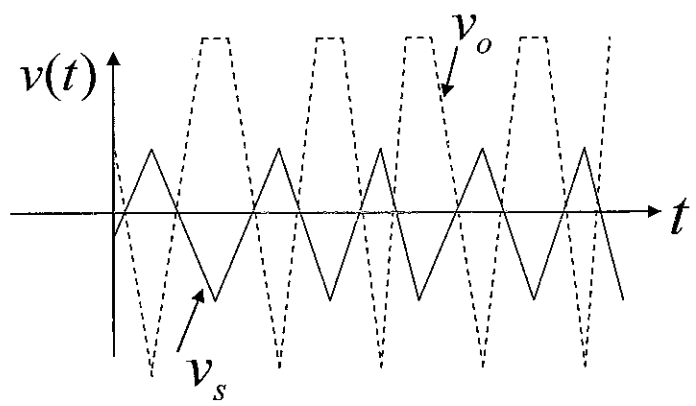
1. (30%) Please indicate whether each of the following statements is always true or sometimes false. Justify your answer by giving a logical argument, otherwise the score will not be counted. (3 points for each)

(a) An electric field pulls electrons and holes current in the same direction.

(b) When the Zener diode worked in the reverse-bias mode the voltage across it is always constant regardless the current flowing through it.

(c) If one gets the following input/output voltage signals from the CE amplifier shown below, the output signal shows that the circuit is working in an unsuitable operating point. One can reduce R_L or V_{CC} to correct this situation.





(d) For the above CE amplifier, if we increase the value of R_B, the operating point will be adjusted, and the distorted output signal could be improved.

(e) An ideal current amplifier is usually considered to have infinite input impedance and zero output impedance.

(f) Since BJT is a nonlinear device, the superposition theorem can not be applied in its analysis. Therefore performing the DC and AC analyses separately of a BJT amplifier is not reasonable.

(g) The coupling capacitor is not necessary in the input and output ports of a differential amplifier.

(h) A negative feedback amplifier can reduce the closed-loop gain but increase the gain sensitivity.

(i) A negative feedback amplifier can reduce the closed-loop gain but increase the bandwidth of the system.

(j) In the analysis of a Shunt-Series feedback amplifier, the feedback network has to be represented with inverse hybrid g-parameters.

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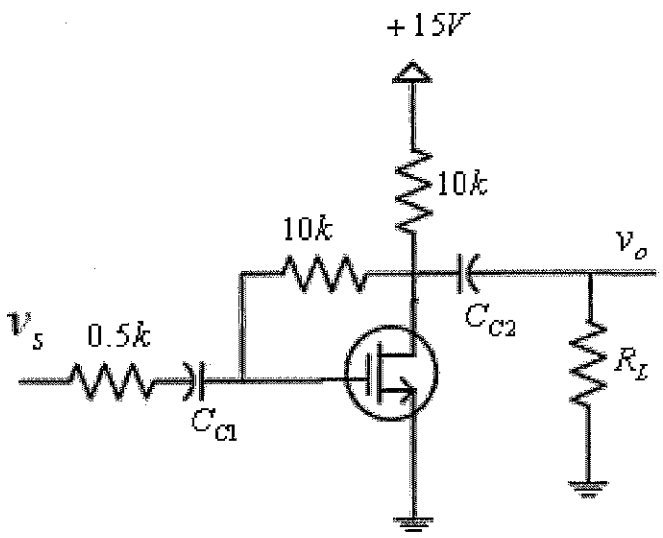
2. (20%) For the following NMOS common-source amplifier, evaluate the following：



(a) The g_m. (Assuming $\frac{\mu_n C_{ox} W}{2L} = 1^{mA}/_{V^2}, V_{tp} = 1V$.) (5 points)

(b) The voltage gain $A_v = {}^{v_o}/_{v_s}$.(Assuming $R_L = 5k\Omega$.) (5 points)

(c) The corner frequencies ω_{C1} and ω_{C2}. (Assuming $C_{C1} = 2\mu F, C_{C2} = 2\mu F$.) (6 points)

(d) The lower corner frequency ω_L. (2 points)

(e) If $v_s(t) = 0.001\sin(\omega_L t)$ sketch the $v_o(t)$ signal.(2 points)

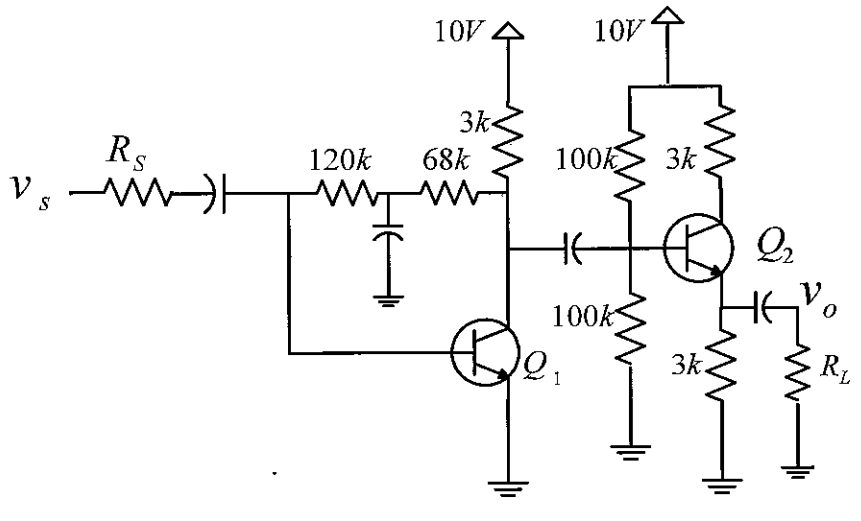
3. (25%) For the following two stages amplifier, evaluate the following：

(a) The g_m, r_π, r_e for Q_1 and Q_2. (6 points)

(b) The A_{vo1}, A_{is1}, R_{i1}, R_{o1} for the 1st stage amplifier. (8 points)

(c) The $A_{vo2}, A_{is2}, R_{i2}, R_{o2}$ for the 2nd stage amplifier. (8 points)

(d) The overall voltage gain A_v. (Assuming $R_s = 1k\Omega, R_L = 10k\Omega$) (3 points)



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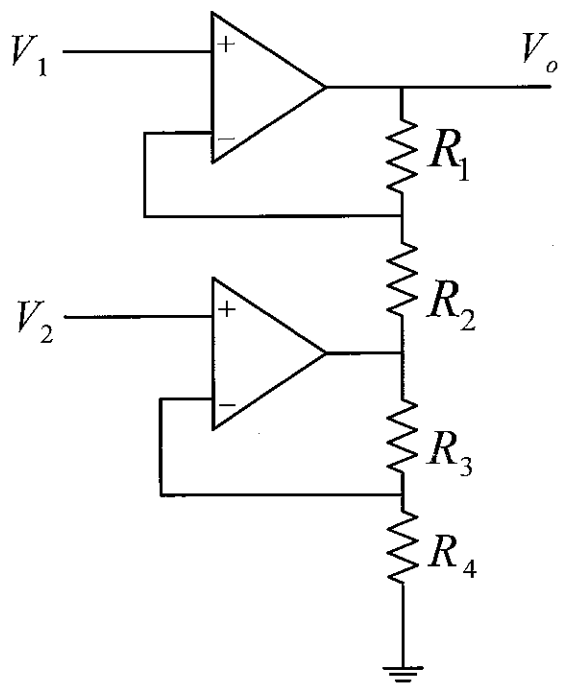
科 目：電 子 學 第 3 頁共 3 頁

4. (10%) Consider the following ideal operational amplifier circuit.

(a)Find the output function $V_o = f(V_1, V_2)$.(5 points)

(b)What is the strategy that can change the circuit into a differential amplifier. (5 points)



5. (15%) Consider the following ideal operational amplifier circuit with $C_1 = 1mF, C_2 = 1mF$.

(a) Find the transfer function $H(s) = \frac{V_o(s)}{V_i(s)}$. (10 points)

(b) Sketch the Bode diagram of this system. (5 points)