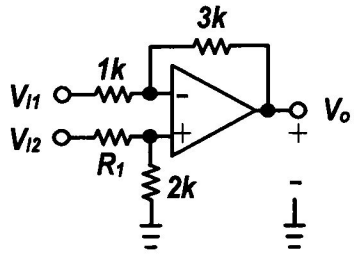
國立交通大學 101 學年度碩士班考試入學試題

科目：電子學(8011)　　考試日期:101 年 2 月 18 日 第 2 節

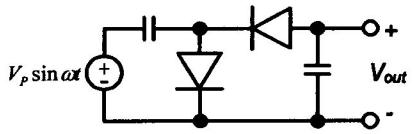
系所班別：電機學院碩士在職專班　　組別：電子與光電組甲類　　第 1 頁,共 3 頁

【可使用計算機】＊作答前請先核對試題、答案卷(試卷)與准考證之所組別與考科是否相符！！

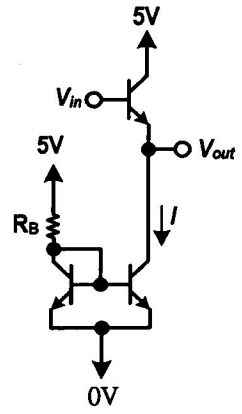
1. [10%] For the amplifier shown below, if $R_1 = 1k\Omega$ and the OpAmp is ideal. What is the CMRR of this circuit? (5%), To make this amplifier to have a zero common-mode gain. What is the value for R_1? (5%)



2. [5%] For the diode circuits shown below. If these diodes are not ideal, and has a forward conducting voltage drop $V_F = 0.7V$. Assume $V_P = 5V$. What is the peak instantaneous voltage of V_{out}?



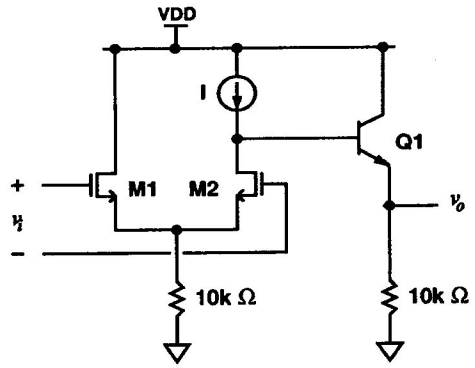
3. [15%] For the BJT circuit shown below, all BJT are identical with $\beta = 25$, $V_{BE(on)} = 0.7V$, $V_{CE(on)} = 0.2V$. (5%) What is the value of R_B to make $I = 1mA$? (5%) What is the maximum input peak-to-peak voltage swing for V_{in} without generating any output distortion? (5%) If V_A of the BJT is $10V$ and a 50Ω load is connected to V_{out}, what is the voltage gain V_{out}/V_{in}.



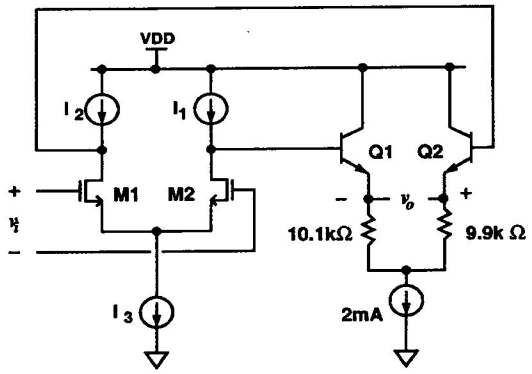
4 [20%] Consider the circuit shown below. Assume that M1 and M2 are operated in the saturation region, and Q1 is operated in the forward active region. If the transconductance of M1 and M2 are 1mA/V, the transconductance of Q1 = 10 mA/V, and β=20. The output impedance of current source I = 100kΩ. Neglect channel length modulation effect and Early effect.

(a) (10%) Find the differential mode gain $\frac{v_o}{v_i}$.

(b) (10 %) Find the common mode gain $\frac{v_o}{v_{icm}}$, where v_{icm} is the input common mode voltage.



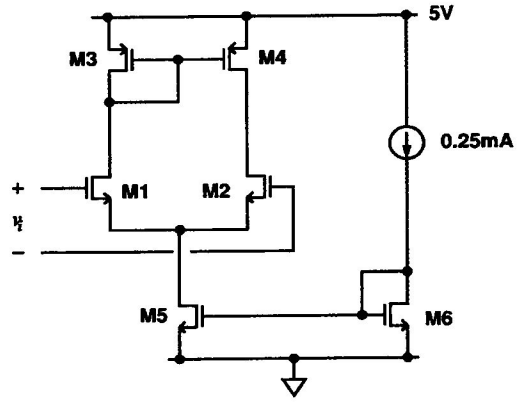
5.[10 %] Consider the fully differential amplifier shown below. Assume that M1 and M2 are operated in the saturation region, and Q1 and Q2 are operated in the forward active region. If the transconductance of M1 and M2 are 1mA/V, the transconductance of Q3 and Q4 are 10 mA/V, and β=20. Neglect channel length modulation effect, Early effect, and current source output impedance. Find the input offset voltage of the differential amplifier.



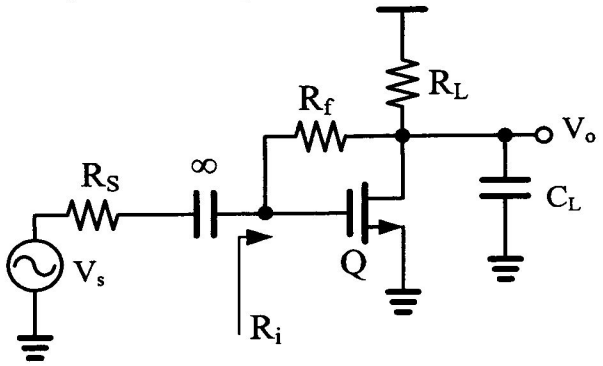
6. [10%] Consider the circuit shown below. Assume that all the MOSFETs are operated in the saturation region, $V_{Tn} = |V_{Tp}| = 0.5V$, If the transconductance of M1, M2, M3, and M4 = 1mA/V. The transconductance of M5 and M6 = 2mA/V. Let $\mu_n C_{ox}\left(\frac{W}{L}\right)_5 = \mu_n C_{ox}\left(\frac{W}{L}\right)_6 = 4mA/V^2$.

$\mu_n C_{ox}\left(\frac{W}{L}\right)_1 = \mu_n C_{ox}\left(\frac{W}{L}\right)_2 = \mu_p C_{ox}\left(\frac{W}{L}\right)_3 = \mu_p C_{ox}\left(\frac{W}{L}\right)_4 = 2mA/V^2$.

Find the input common mode range of the amplifier

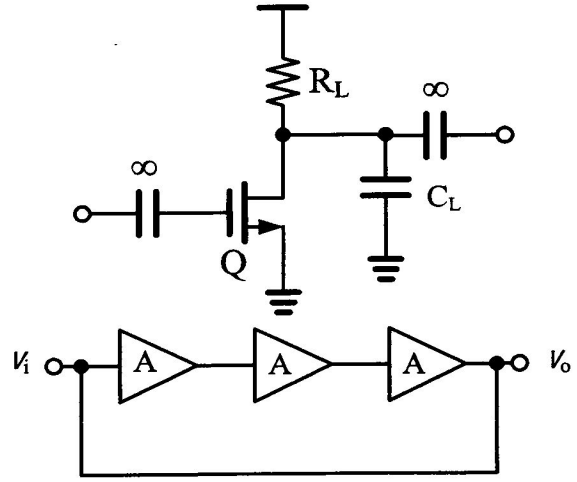


7.[10%] A feedback amplifier is as shown below. Let R_S = 5 KΩ, R_f = R_L = 10 KΩ, and transistor g_m = 10 mA/V. The amplifier is loaded to a capacitor of 10 pF. Ignore all the other parasitic capacitance.



(a) (5%) Find the input resistance R_i.
(b) (5%) What is the 3dB bandwidth of V_o/V_s?

8. [20%] A common-source amplifier is as shown below, with R_L = 10 KΩ and C_L = 10 pF. Transistor g_m is to be determined. A feedback amplifier consists of three stages of the amplifier.



(a) (10%) What is the g_m value such that the feedback circuit oscillates? What is the oscillation frequency?
(b) (10%) If g_m = 0.1 mA/V, what is the phase margin according to the Bode plot?