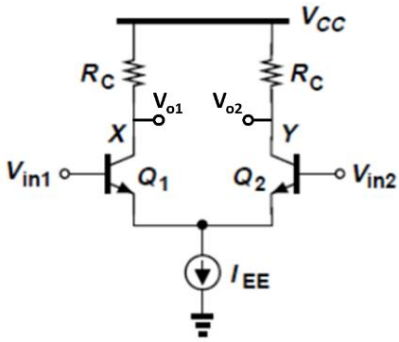
EE225500 **電 子 學 Quiz 6(Lecture10)** **Spring 2021**
2021/06/08

Student ID:_____
Name:_____

(A) 1. Which is **NOT** the right description of a differential pair with an ideal tail current source?
(a) Differential signals are measured with respect to ground
(b) Less pro to common-mode noise
(c) Transistor currents remains the constant as input common-level increases
(d) Transistor currents change in the opposite direction when a differential signal is applied.

For question 2~6, please answer according to the circuit below, and ignore the base current.

(C) 2. Which is **NOT** a right description of this BJT differential pair?
(a) Q_1 , Q_2 are identical
(b) I_{EE} is the tail current source
(c) differential gain= V_{o1}/V_{in1}
(d) output common-mode level=$(V_{o1}+V_{o2})/2$



(C) 3. When $V_{in1}=V_{in2}$, which is **NOT** correct?
(a) $I_{C1} = I_{C2}$
(b) $V_{o1}=V_{o2}$
(c) $V_{o1}=V_{CC}-I_{EE}\times R_C$
(d) $V_{BE1}=V_{BE2}$

(B) 4. When $V_{in1}>>V_{in2}$, which is correct?
(a) $I_{C1}=0$
(b) $I_{C1}=I_{EE}$
(c) $V_{o1}=V_{CC}$
(d) $V_{o2}=0$

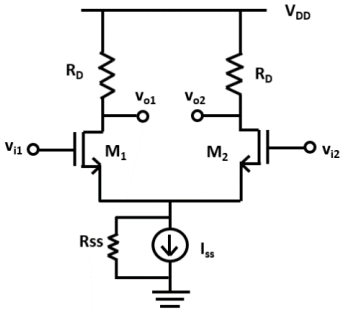
(C) 5. To linearly amplified the differential input signal V_{id}, which answer below is the maximum input signal range? (Hint: Let $I_{C1} = 0.98I_{EE}$)
(a) $-26\text{mV} < V_{id} < 26\text{mV}$
(b) $-60\text{mV} < V_{id} < 60\text{mV}$
(c) $-100\text{mV} < V_{id} < 100\text{mV}$
(d) no limitation

(B) 6. Let $I_{EE} = 1mA, V_{cc} = 5V, R_c = 3k\Omega$,
Find g_m for each of the two transistors at the operating point.
(a) 10 mA/V
(b) 20 mA/V
(c) 26 mA/V
(d) 40 mA/V

For question 7~9, please answer according to the circuit below (M_1, M_2 are identical). Where R_{ss} represent the output resistance of the tail current source.

(D) 7. Let $I_{ss} = 0.8mA, \mu_n C_{ox} = 0.2mA/V^2, \frac{W}{L} = 100,$ $R_D = 5k\Omega, R_{ss} = 25k\Omega$. Please find the differential gain.

(a) 141.25 V/V
(b) 100 V/V
(c) 28.25 V/V
(d) 20 V/V



(A) 8. Which is the most efficient way to achieve high input common mode rejection?

(a) Increase R_{ss}
(b) Increase I_{SS}
(c) Increase V_{DD}
(d) Increase R_D

(D) 9. Which is the possible way to extend the differential input swing range under the fixed tail current Iss?

(a) Decrease R_{ss}
(b) Increase R_D
(c) Decrease V_{DD}
(d) Decrease W/L of both M_1 and M_2

(A) 10. Please find the differential mode voltage gain of the circuit shown below.

(a) $-g_{m1}(\frac{1}{g_{m3}}||r_{o3}||r_{o1})$
(b) $-g_{m1}g_{m3}(r_{o3}||r_{o1})$
(c) $-g_{m1}(r_{o3}||r_{o1})$
(d) $-(g_{m1}r_{o1}) * (g_{m3}r_{o3})$