ELECTRICAL ENGINEERING DEPARTMENT
EEL204 ANALOG ELECTRONIC CIRCUITS
MAJOR TEST

**Date: May 4, 2009** **Max. Marks 40** **Time: 3:30PM to 5:30PM**

**Note: This is an open Book and open Notes (only Handwritten and NOT Photocopied) examination. Discussions with the neighbour(s) will not be tolerated.**

**Q1.** Fig. Q1 shows a RC coupled amplifier designed as a cascade of Emitter Follower and a Common Emitter Stage. Given that $\beta = 100$, $f_T = 400MHz$, $I_{E2Q} = I_{E1Q} = 1mA$, $V_{CC} = 10V$, $V_{CE1Q} = 5.7V$, $V_{CE2Q} = 2.4V$, $R_L = 4K\Omega$, $C_L = 2Pf$, $C_\mu = 0.2pF$ and $R_S = 1K\Omega$.

i. Find the values of $V_{E1}$, $R_{E1}$, $R_1$, $R_2$, $R_{E2}$, and $R_C$. (5)

ii. Neglectin $r_{bb}'$ and $r_o$, draw the hybrid $\pi$ equivalent circuit of the amplifier. (4)

iii. Find the overall gain and (2)

iv. Find the bandwidth of the amplifier assuming $C_{C1}$, $C_{C2}$ & $C_E \rightarrow \infty$. (2)

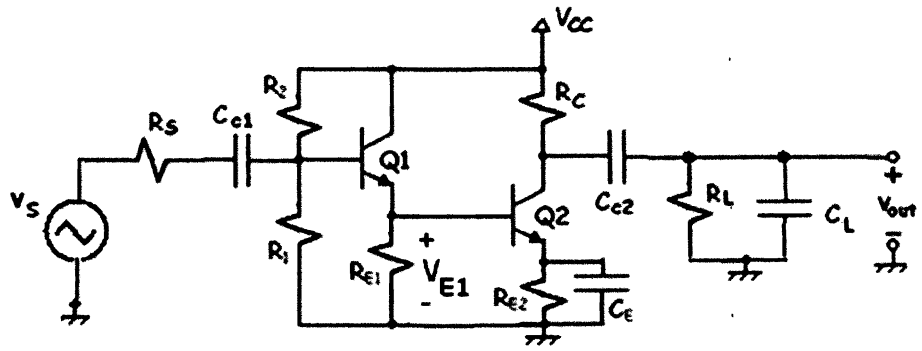


Fig. Q1

**Q2.** The circuit in Fig Q2 is a cascode differential amplifier with simple current mirror load. Given that $V_{DD} = -V_{SS} = 5V$. $K_N' = 100\mu A/V^2$, $K_P' = 50\ \mu A/V^2$, $\lambda_N = \lambda_P = 0.05V^{-1}$, $V_{TN} = |V_{TP}| = 0.7V$, $(W/L)_1 = (W/L)_2 = 50$, $C_L = 5pF$, $I_{BIAS} = 400\mu A$. Find

i. Slew rate of the amplifier. (2)

ii. $g_m$ of $M_1$ and $M_2$ (3)

iii. Gain of the amplifier. (3)

iv. 3dB bandwidth of the amplifier. (3)

v. If $V_{min}$ of the current source at the bottom is 1.0V, find the minimum DC voltage that can be applied to the gates of $M_1$ and $M_2$, $V_{GS1}(min)$, such that the amplifier works properly. (3)

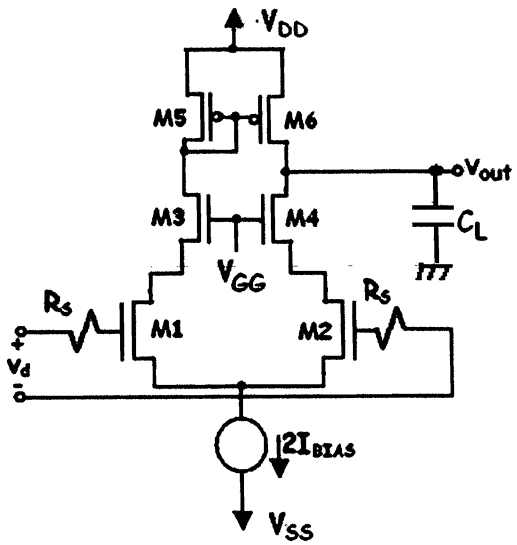


Fig. Q2

**Q3.** a) For the three circuits in Fig. Q3, identify the nature of feedback, if it is a feedback amplifier. (3)

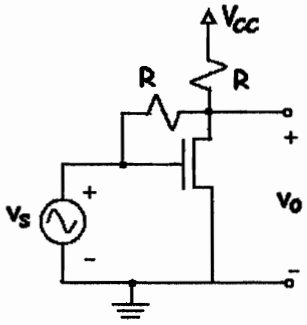


Fig. Q3(a)

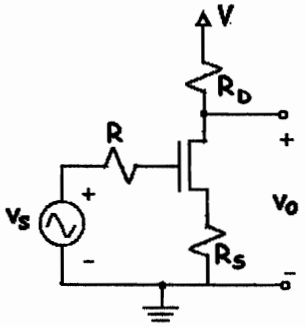


Fig. Q3(b)

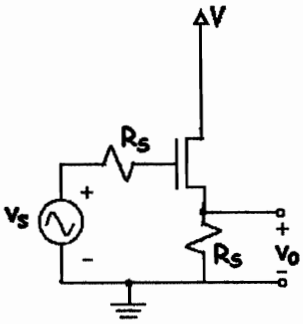


Fig. Q3(c)

b) A feedback amplifier needs to be designed with a voltage gain of 50±0.5. The basic amplifier has a gain that can vary up to ±10%. The original amplifier has an input impedance of 10KΩ. Determine the

i. appropriate feedback configuration you would use, (2)
ii. value of the open loop gain (gain without feedback), (3)
iii. feedback ratio, β (3)
iv. input impedance of the amplifier with feedback. (2)

*GOOD LUCK*