EE 140, Spring 1994
Final Exam
Professor ?

BJT Parameters

$I_S = 1 \times 10^{-14}$ A

$C_\pi = 1$ pf

$C_\mu = .1$ pf

$C_{CS,nPn} = 1$ pf

$C_{CS,PnP} = 0$ pf

$V_{A,nPn} = V_{A,PnP} = 50\ V_0$

$\beta_{nPn} = \beta_{PnP} = 100$

$V_{CE(SAT)} = .2$

MOS

$V_{T,n} = 1\ V_0$

$V_{T,P} = -1\ V_0$

$k'_n = k'_P = 50\ \mu A/V^2$

$\lambda_n = \lambda_P = .05$

$\gamma_n = \gamma_P = .3$

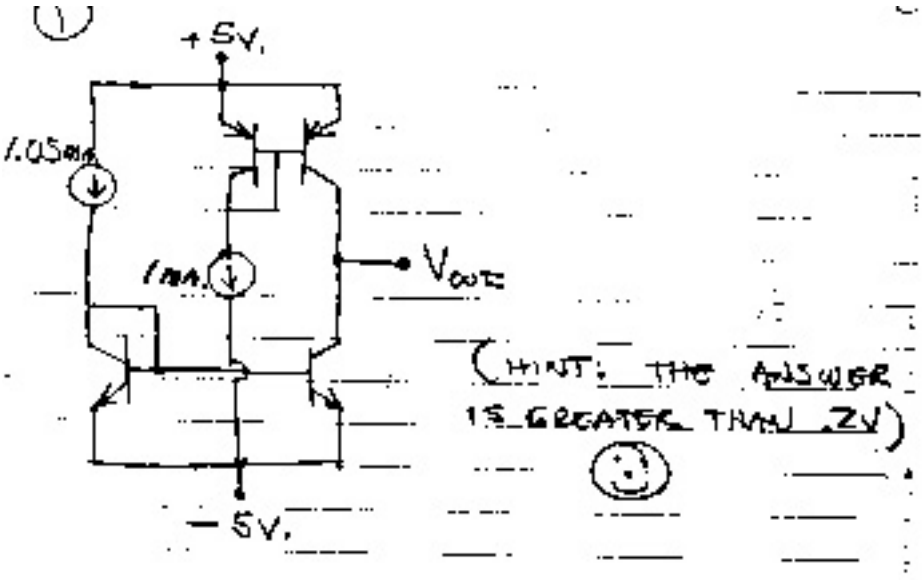
$C_\pi = 1$ pf

$C_\mu = .1$ pf

$C_{SB} = 1$ pf

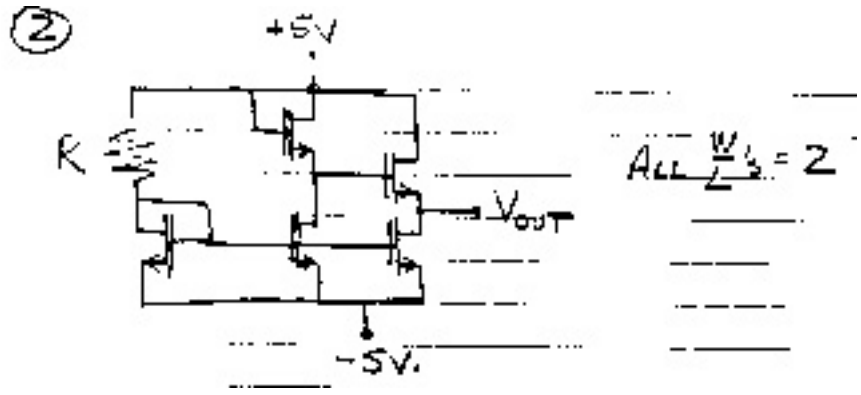
$C_{DB} = 1$ pf

$2\phi_f = .6\ V_0$



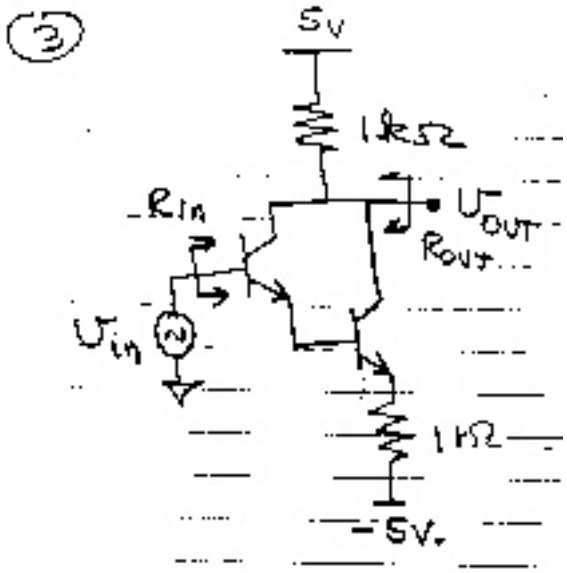
(1) What is the DC voltage at V_{OUT}?

V_{OUT} = _____ V_0



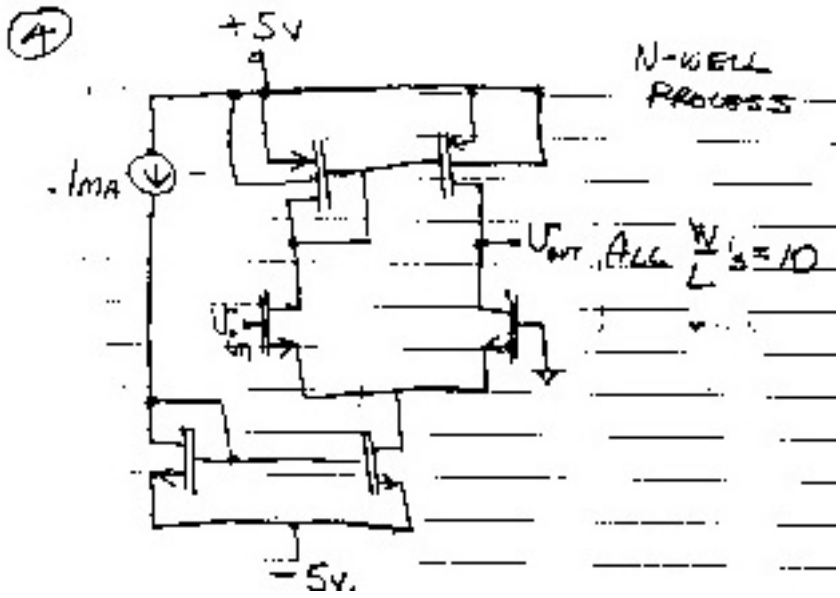
(2) What is the value of R so that V_{OUT} = 1 V_0?

R = _____ Ω

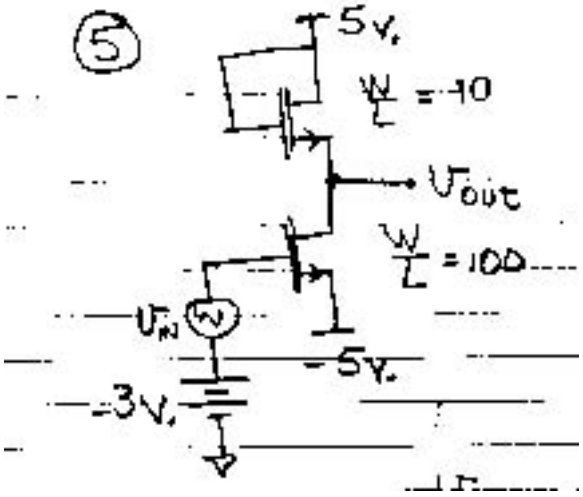


(3a) What is V_{OUT}/V_{IN}? _____

(3b) What is R_{OUT}? _____

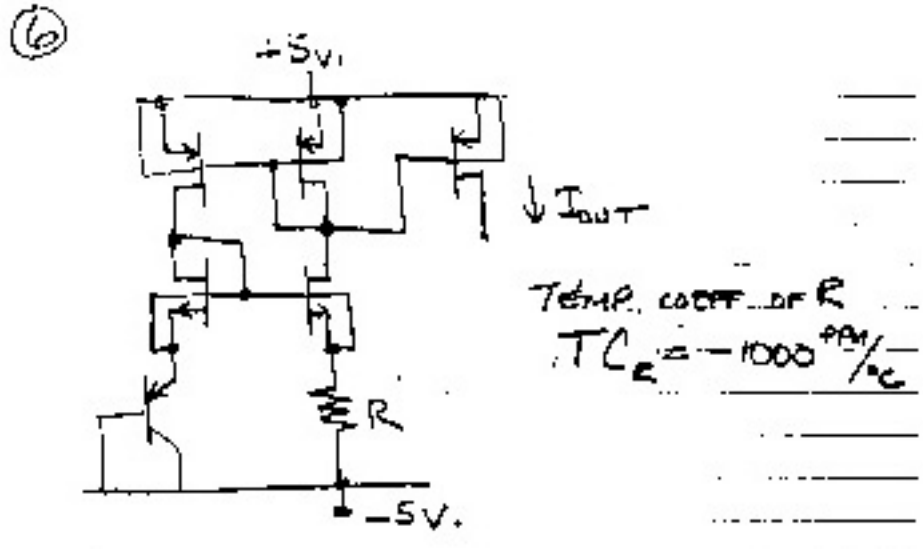


(4) What is V_{OUT}/V_{IN}? _____

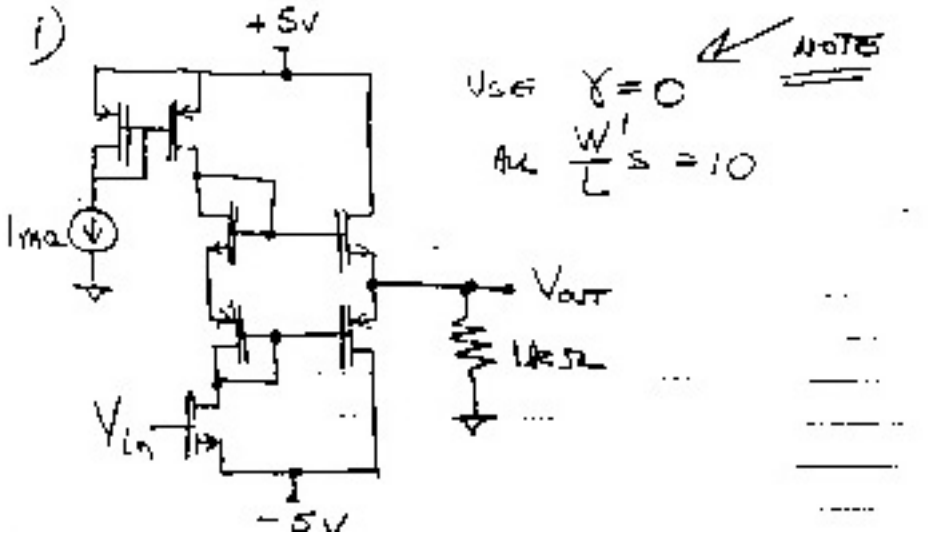


(5a) What is V_{OUT}/V_{IN}? _____

(5b) What is the lowest frequency pole ω_{pi} _____ rad/sec



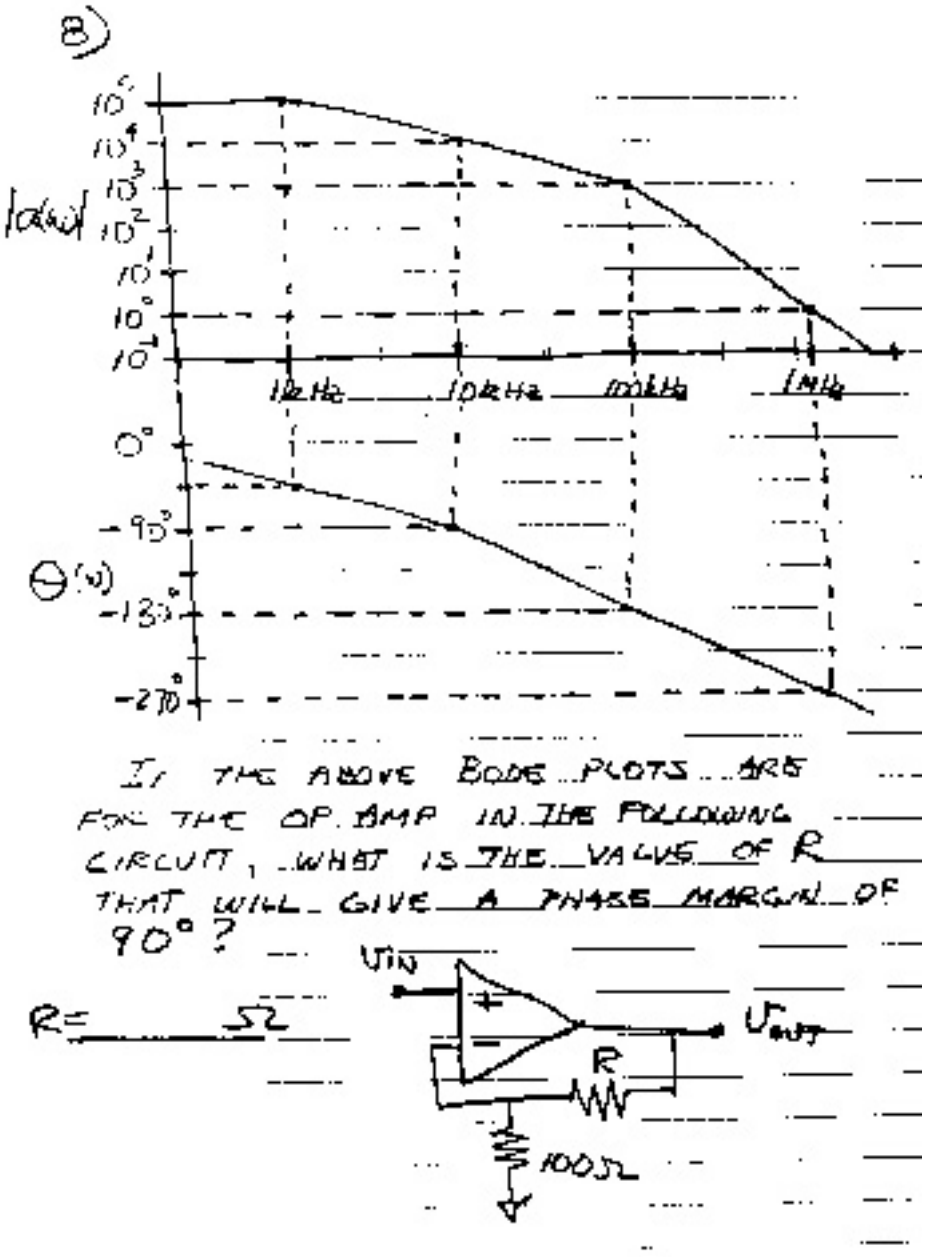
(6a) What is the value of R for an output current of .1 mA? _____ Ω



(7a) If V_{IN} is set so that $V_{OUT} = 0\ V_0$, what is the power dissipation of this circuit?

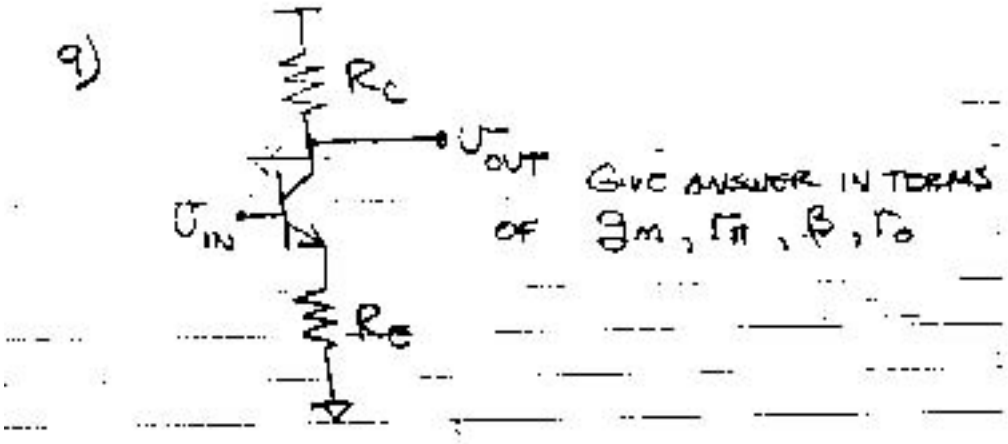
pwr = _____ mW

(7b) If $V_{OUT} = 3V_0$, what is the power dissipation for everything except the resistor? _____ mW



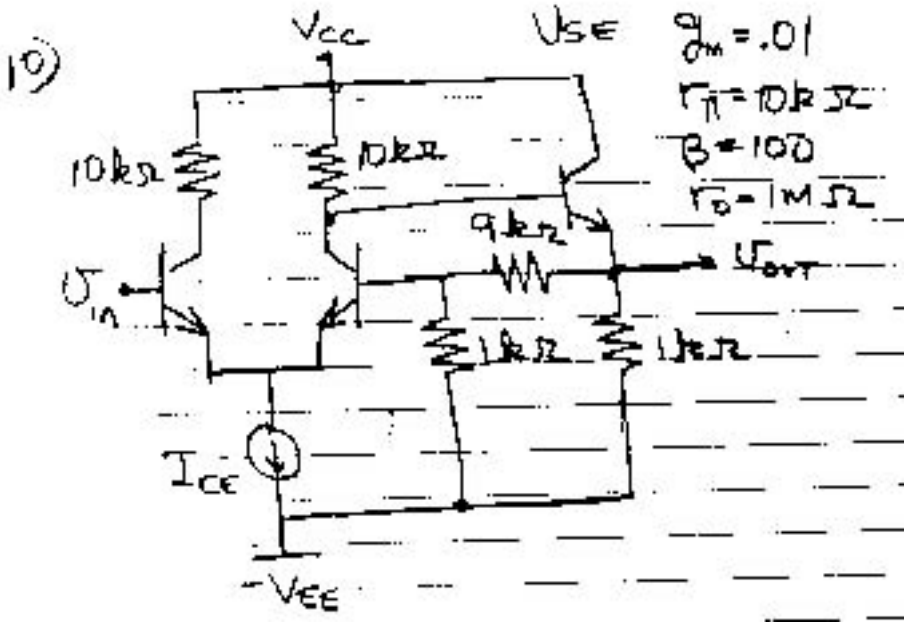
(8) If the above Bode plots are for the op amp in the following circuit, what is the value of R that will give a phase margin of 90°?

R = _____ Ω



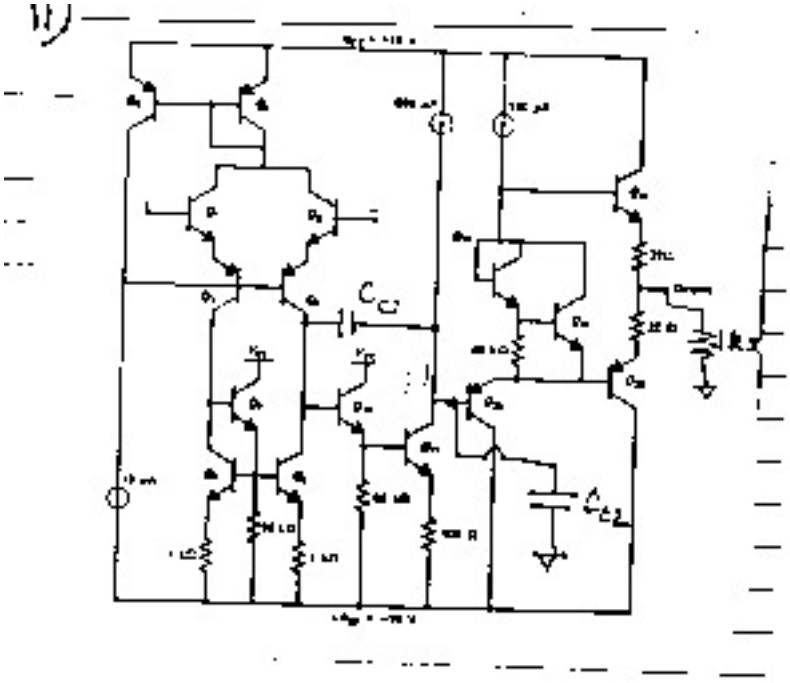
(9a) What kind of local feedback is being used in this circuit? _____

(9b) What is the loop gain, T, of this circuit? _____



(10a) What is the loop gaing of this circuit? T = _____

(10b) What is V_{OUT}/V_{IN}? _____



Assume the input is set so the output is at $-5V_0$

(11a) If C_{C1} = 20 pf and C_{C2} = 0 pf, what is the slew rate of this circuit? _____ V/μsec

(11b) At what frequency is the dominant pole if C_{C1} = 20 pf and C_{C2} = 0 pf? _____ rad/sec

(11c) For C_{C1} = 10 pf, what is the value of C_{C2} for 45° of phase margin if the poles and zeros of this circuit not associated with C_{C2} are at:

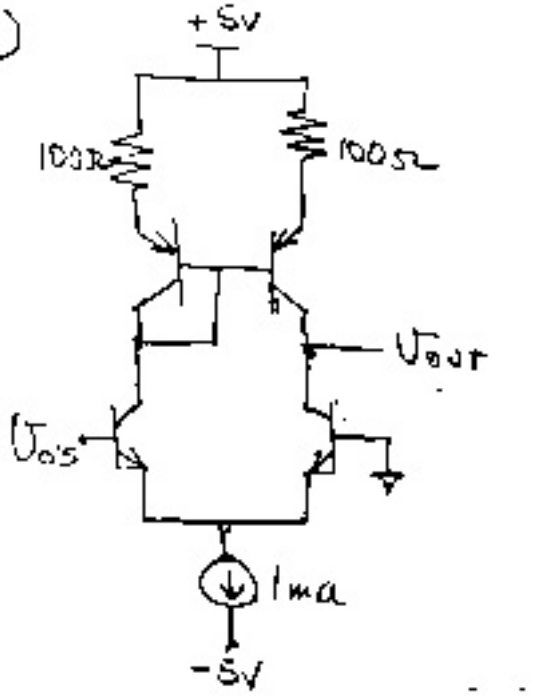
f_{p1} = 1 MHz
f_{p2} = 1 MHz
f_{p3} = 10 MHz
f_{p4} = 100 MHz
f_{z1} = 1.0 MHz
f_{z2} = 50 MHz

Assume that these poles do not move as the pole associated with C_{C2} is moved. Also assume the open loop gain, $A_0 = 10^5$.

(i.e. do not calculate the gain)

_____

12)



What is the input offset voltage, V_{OS}, that sets $V_{OUT} = 0V_0$

V_{OS} = _____ V
