EXAMINATION NO. 1

NAME_____SCORE_____/100

INSTRUCTIONS: This exam is closed book with one sheet of notes permitted. The exam consists of 4 questions for a total of 100 points. Please show your work leading to your answers so that maximum partial credit may be given where appropriate. Be sure to turn in your exam with the problems in numerical order, firmly attached together.

Problem 1 - (25 points)

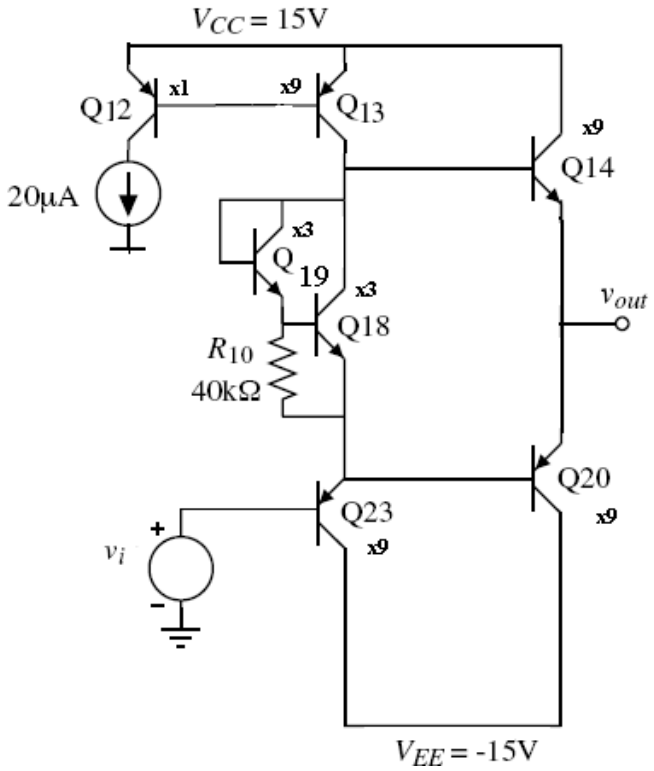
An push-pull output stage is shown. Assume that $\beta_N = \beta_P = 100$, $V_t = 26$mV, and $I_s = 1.11$fA, VBE(on) = 0.6V, VCE(sat) = 0.2V.

a.) Find the dc value of the collector currents when $v_{OUT} = 0$.

b.) If RL=1K, what is the ±peak output voltage of this amplifier? What is the maximum output current that can be delivered to the 1K resistive load?

c.) What is the maximum average power delivered to the load?

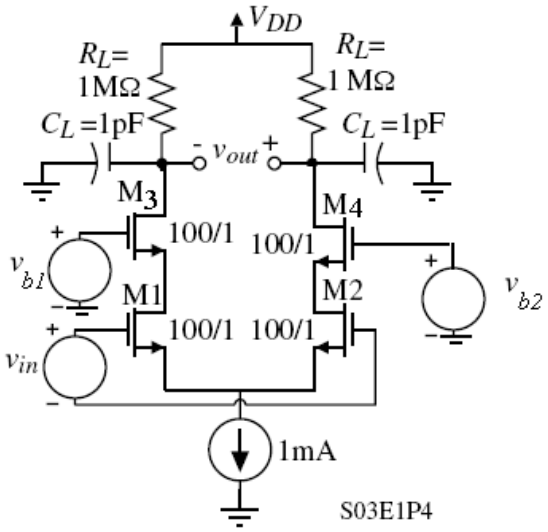
What is the average power drawn from the sources? What is the efficiency of the circuit?



Problem 2 - (25 points)

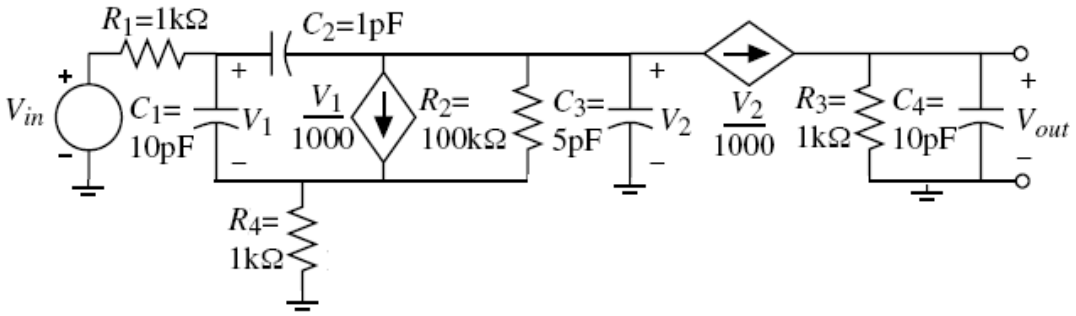
Find the midband gain and the -3dB frequency of the differential amplifier shown.

Assume the parameters of the NMOS transistors are K_N'=100V/μA^2, V_{TN} = 0.7V, and Cgs = 0.2pF and Cgd = 20fF, Lamda =0.04V-1.



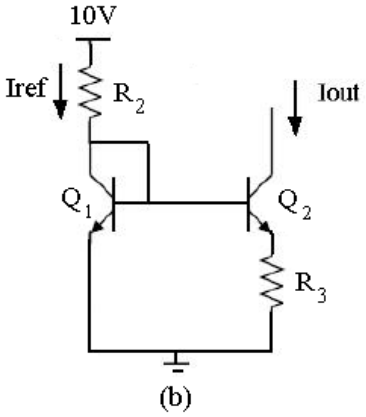
Problem 3 - (25 points)

Find the midband voltage gain, the –3dB frequency and the magnitude of sum of all the poles in Hertz for the circuit shown (Assume zeros are not dominant).

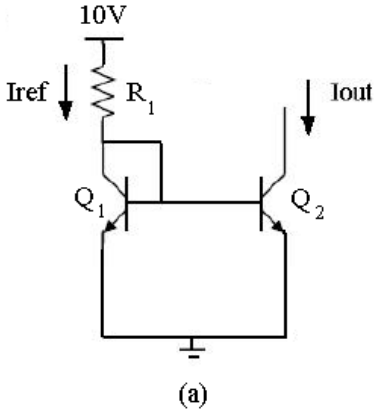


Problem 4 - (25 points)

(a) Find the values of the resistances(R1, R2, and R3) such that Iout=10uA for both circuits. Assume that β_N =100,V_t = 26mV, and VBE= 0.7V for Ic=1mA.
(b) By comparing the values of the resistances, explain the advantage of circuit b.
(c) Compare the output resistances of the two circuits and explain the second advantage of circuit b. Assume VA=10V.(Circuit b is a Widlar current source)



(b)



(a)

Extra Sheet