EECS 140 Fall 2000

Midterm 1

Prof. Brodersen

Use the following parameters unless otherwise stated.

Assume all W/L's are 10.

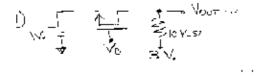
Vtn = Vtp = 0.5V

 $Kn' = Kp' = 100 \text{ microA/V}^2$

LAMBDAn = LAMBDAp = 0.01

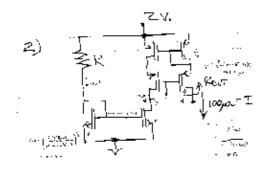
GAMMAn = GAMMAp = 0

Problem #1



What is the Voltage at Vb so that Vout is 2 Volts?

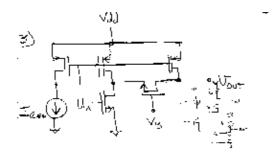
Problem #2



- a.) What is R so that Iout = 100 micro A?
- b.) What is the output resistance, Rout?

Problem #3

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Assume the following small signal parameters for all transistors:

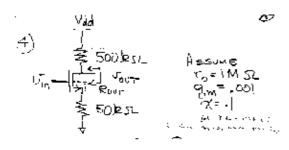
Gm = 0.00125

X = 0.1

R0 = 1 MOHM

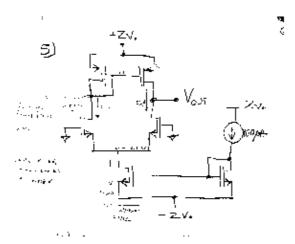
What is the gain, Vout/Vin?

Problem #4



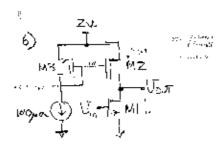
- a.) What is Rout?
- b.) What is the gain?

Problem #5



What is the DC voltage at Vout?

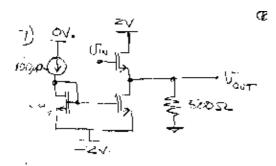
Problem #6



What is the maximum and minimum voltage at Vout that keeps all devices in saturation?

- a.) Vout,max = ?
- b.) Vout,min = ?

Problem #7



a.) What is the maximum and minimum voltage at Vout?

Vout,max = ? Vout,min = ?

b.) What is the efficiency in percent including all transistors and the current source if the output swing is a sinewave with 0.05 Volt peak to peak amplitude?

ANSWERS:

- 1.) Vb = 1.945 V
- 2.) a.) 10.53 KOHM b.) 225.6 KOHM
- 3.) Gain = -1000
- 4.) a.) 495.2 KOHM
 - b.) -9.7
- 5.) 1.184 Volts
- 6.) a.) 1.553 Volts
 - b.) 0.447 Volts

7.) a.) max = 0.306 Volts, min = -0.05 Volts b.) 0.1042%

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Problem #7 4