# Analog Circuits (EE3002/EE5310) : Problem Set 6

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For the following problems, use the data below: $\mu_n C_{ox} = 300\,\mu A/V^2$, $\mu_p C_{ox} = 75\,\mu A/V^2$, $V_{Tn} = V_{Tp} = 0.6\,\text{V}$; $\lambda_p = \lambda_n = 0.1/\text{V}$.

## Problem 1

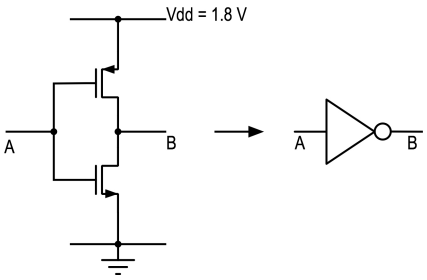


Figure 1: Circuit for problem 1.

Design the inverter (determine the W/L of each device) in Fig. 1 to have a self-bias voltage of 0.9 V and a quiescent current of 54 $\mu$A when self-biased. Ignore $\lambda$ for operating point calculations. What is the dc gain of this inverter? (Use this inverter for the rest of the problems).

## Problem 2

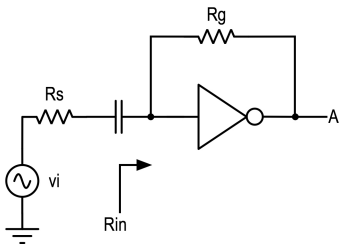


Figure 2: Circuit for problem 2.

The capacitor in infinite. Rs = 5 K, and Rg = 1 M. Determine the incremental input resistance Rin, and the gain to the output at node A. What is the largest sinusoidal input amplitude that you can use for a sinusoidal output?

## Problem 3

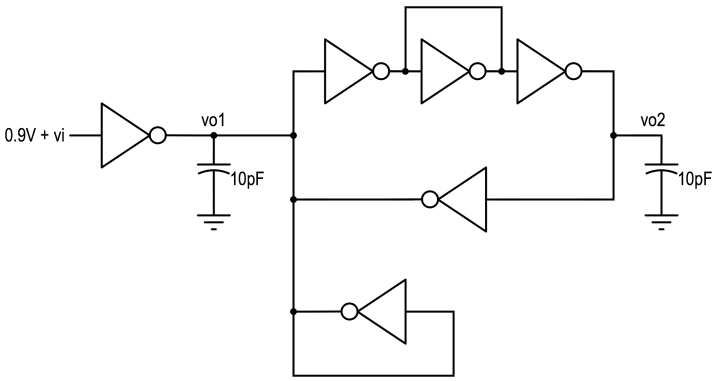


Figure 3: Circuit for problem 3.

Determine the small-signal transfer functions from vi to vo1 and vo2.

## Problem 4

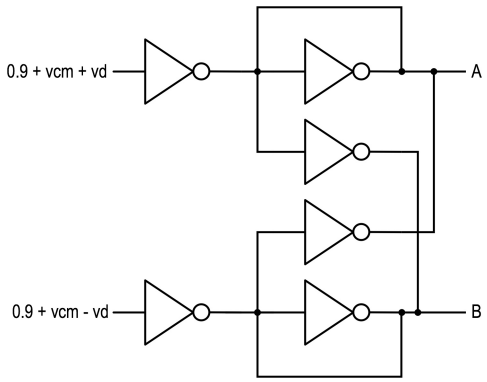


Figure 4: Circuit for problem 4.

vcm and vd are small signals. Determine the quiescent voltages at nodes A and B. Then find the small-signal voltages at nodes A and B.