ECE2100
Exam 2

This is an open book, and notes exam. You may use a calculator.

NAME:________________________________________________

I certify that the work below is my own.

Signature:__________________________________________
Problem 1

Use: $V_i = 1V$

$k_n'(W/L) = 2A/V^2$

$\lambda = 0$ for all transistors

The 0.25A current source is not ideal and may have a voltage drop across it.

All caps are large.

Solve the circuit for the DC values of:
(a) $V_{D2}$
(b) $V_{s1}$
(c) $I_s$
Problem 2:

\( v_{\text{sig}} = 0.01\sin(\omega t) \). Does this circuit operate as an AC amplifier? If so, what is the gain, \( \frac{V_o}{V_{\text{sig}}} \), of the following circuit in terms of VDD?
Problem 3

Use: \( v_t = 1V \)
\( k_u(W/L) = 1 \text{mA/V}^2 \)
\( v_{\text{sig}} \) is an AC source

Transistor 1 has DC values: \( V_{GS} = 5V, \ ID = 8mA \)
Transistor 2 has DC values: \( V_{GS} = 5V, \ ID = 8mA \)
Transistor 3 has DC values: \( V_{GS} = 3V, \ ID = 2mA \)

For the following hybrid-\( \pi \) equivalent circuit, find the following values:

(a) \( R_i \) (input resistance – ignore the 50ohm and \( V_{\text{sig}} \))
(b) \( R_{\text{out}} \) (output resistance)
(c) gain, \( \frac{V_O}{V_{\text{sig}}} \)
**Problem 4**

For the circuit shown below, draw the AC small-signal equivalent circuit (use hybrid-π or model T). Make sure that everything is labeled in terms of the transistor number. \( \lambda \neq 0 \) for all transistors. \( v_{\text{sig}} \) is an AC source.