Name: _____

EE303 - Midterm Exam #1

Closed Book:
One 8.5"x11" sheet of handwritten notes permitted
Calculator permitted

Important Notes:

- Read each problem completely and thoroughly
- Summarize all your answers in the boxes provided on these exam sheets
- Make sure to mark the units on your answers!
- Do all your work on the exams sheets provided. If you use any additional sheets, please turn them in, so we can consider all work for partial credit
- Do not forget to put your name in the space above

Problem #	Points	Score
1	30	
2	5	
3	5	
4	15	
5	5	
6	20	
TOTAL	**80**	

Name:

Problem 1 [30 pts]

Given the circuit in Fig.1 find an expression for R_{in}, R_{out}, and $A_V=v_{out}/v_{in}$

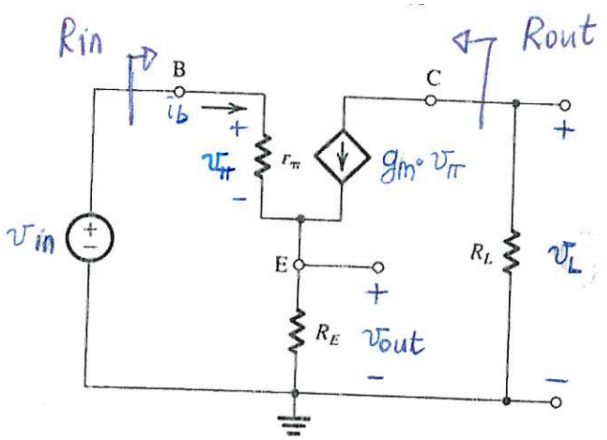

Figure 1

R_{in}	
R_{out}	
A_V	

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Problem 2 [5 pts]

A silicon wafer is doped with donors at a concentration of $N_D=10^{15}$ cm^{-3}. Assuming n_i at room temperature is 10^{10} cm^{-3}
(a) What is the electron concentration n_o (cm^{-3}) at room temperature?
(b) What is the holes concentration p_o (cm^{-3}) at room temperature?

(a) n_o =	
(b) p_o =	

Problem 3 [5 pts]

Using the fact that a silicon diode has $I_S = 10^{-14}$ A at 25°C and that I_S increases by 15% per °C rise in temperature, find the value of I_S at 125°C.

I_S at 125°C =	

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Problem 4 [15 pts]

Consider the circuit shown in Fig. 2. A string of three diodes is used to provide a constant voltage of about 2.1 V. We want to calculate the percentage change in this regulated voltage caused by
(a) a ±10% change in the power-supply voltage without the load
(b) a ±10% change in the power-supply voltage with a load of 1-kΩ connected

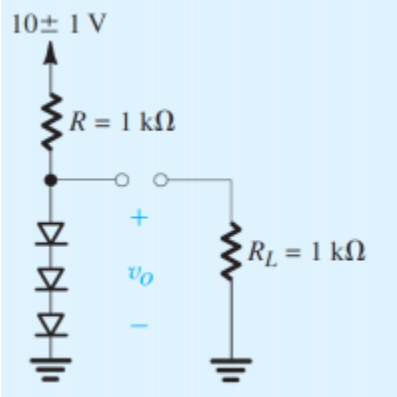

Figure 2

(a) $\Delta V_o/\Delta V_{supply}$ =	
(b) $\Delta V_o/\Delta V_{supply}$ =	

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Problem 5 [5 pts]

For the circuit in Figure 3, utilizing an ideal diode, sketch the steady state output for the input shown. Label the most positive and most negative output levels.

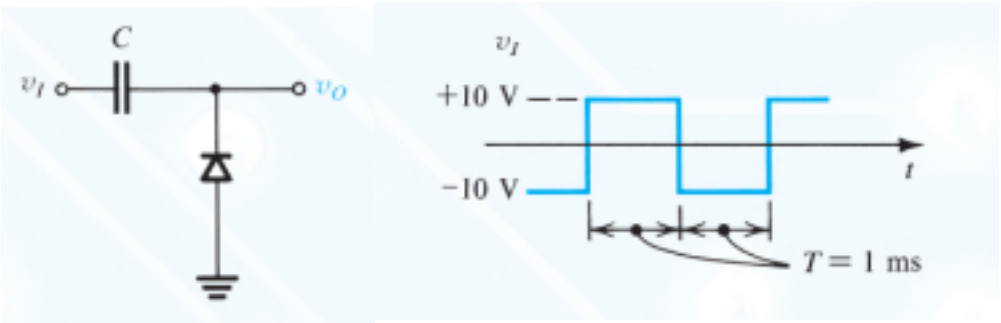
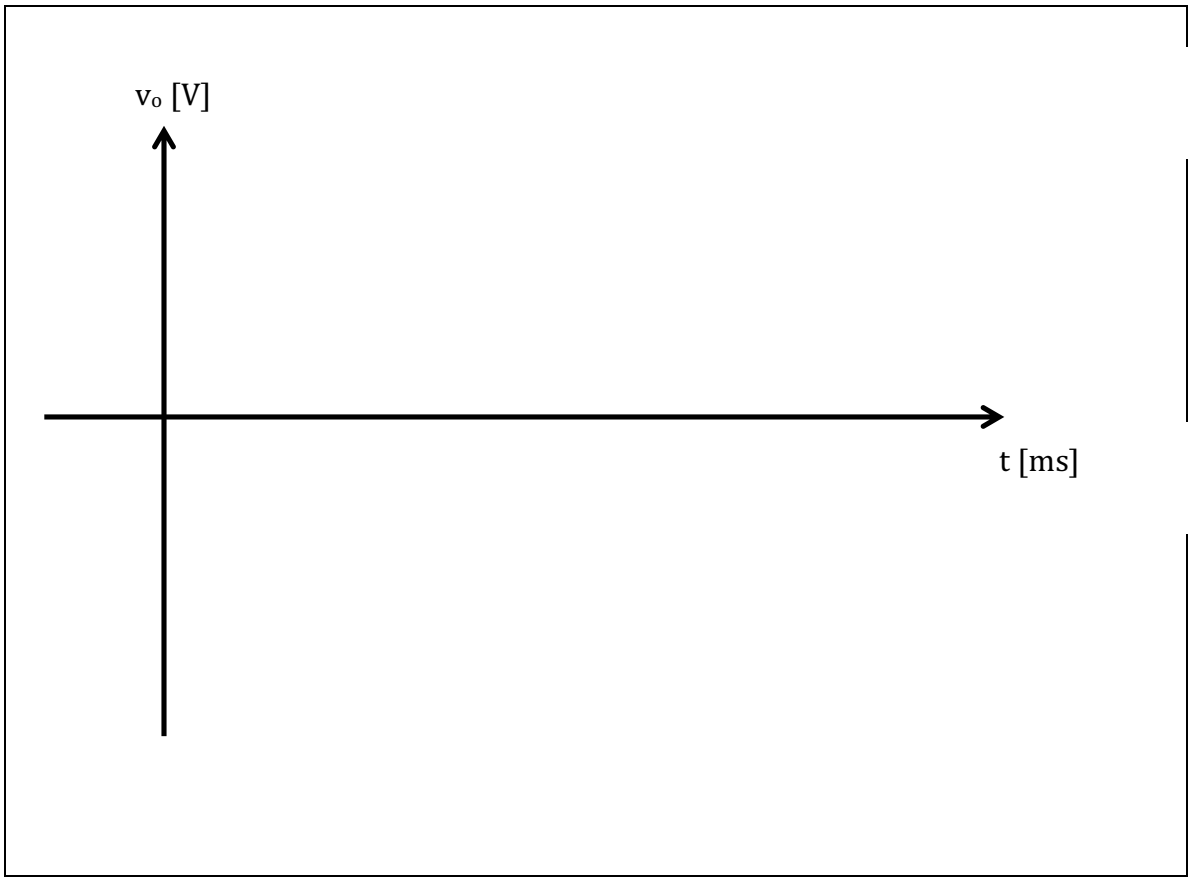


Figure 3.



Name:

Problem 6 [20 pts]

In the following circuit assuming $\mu_n C_{ox} = 100\ \mu A/V^2$ and $V_{TH}=0.4$ V and $\lambda \approx 0\ V^{-1}$, determine the maximum allowable value of W/L if M_1 must remain in saturation.

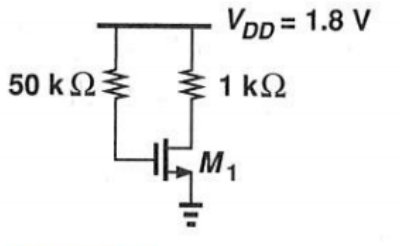


Figure 4.

Assume the current flowing into the gate of the transistor is negligible ($I_G=0$).

V_{GS} =	
W/L ≤	