EECS 40 — MIDTERM #1
2 October 2000

Name: ____________________________
Last, First
Signature: ____________________________

Student ID: _______

Guidelines:
1. Closed book and notes except 1 page of formulas.
2. You may use a calculator.
3. Do not unstaple the exam.
4. Show all your work and reasoning on the exam in order to receive full or partial credit.
5. This exam contains 8 problems and corresponding worksheets plus the cover page.

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f = 10^{-15}
p = 10^{-12}
n = 10^{-9}
\mu = 10^{-6}
m = 10^{-3}
K = 10^3
M = 10^6
Problem 1 (15 points)

What is the value of the unknown node voltage in each of the following circuits? Assume diodes are perfect rectifiers.

(a)

(b)

(c) Is R = T for all possible inputs?

(WARNING: You must fill out truth tables in this problem to receive credit.)
Problem 2 (15 points)

(a) Find $V_y$.

(b) Find $V_x$.

(e) Find power delivered by the voltage source.
Problem 3 (12 points)

For the circuit below:

(a) Identify known and unknown node voltages, and
(b) Write sufficient nodal equations to solve for the unknown node voltages (do not solve).

(a.1) known node voltages:

(a.2) unknown node voltages:

Nodal Equations:

\[ \begin{align*}
V_{bb} & \quad R_3 \quad I_{dd} \\
R_1 & \quad I_{dd} \\
R_2 & \quad I_{cc} \\
\end{align*} \]
Prob. 3 Worksheet
Problem 4 (10 points)

For the circuit below, using nodal analysis write sufficient equations to find $V_x$ and $V_y$. Do not solve.

Equations:

- $V_{BB} - V_x + I_{CC} R_1 = 0$
- $V_x - V_y + I_{CC} R_2 = 0$
- $V_y + V_{AA} - V_x = 0$
Prob. 4 Worksheet
Problem 5 (15 points)

For the circuit above, the capacitor is initially uncharged. The switch closes at $t = 0$.

(a) Find $V_C$ for $t = 0^+$ and $t \to \infty$.

$$V_C(t = 0^+) = \underline{\text{_______}}$$

$$V_C(t \to \infty) = \underline{\text{_______}}$$

(b) Sketch (very neatly and accurately!) $V_C$ vs. $t$ on the graph below. You must label the axes.

(c) Write an equation for $V_C(t)$.

$$V_C(t) = \underline{\text{_______}}$$
Prob. 5 Worksheet
Problem 6 (10 points)

In the lab on RC circuits, you measure the pulse response of the circuit below.

You know $R$ is $2\,\text{K}\Omega$. What is the value of $C$?

\[ C = \underline{\phantom{000}} \]
Problem 7 (11 points)

You measure the I-V graph of a circuit in a “black box” in the lab.

What is a possible circuit that is in the box? Draw here ↓ .
Problem 8 (12 points)

In this experiment you “peek,” i.e., you open the box before testing it. You see the following circuit:

![Circuit Diagram]

What will be the I-V graph you will measure for this circuit? (You must label axes for credit.)

![I-V Graph]