EE-201
Exam I
February 6, 2001

Name: __________________________________

Student ID: _________________

CIRCLE YOUR DIVISION

Division: 201-1 (Bagwell); 201-2 (Capano); 201-3 (DeCarlo)

INSTRUCTIONS

There are 12 multiple choice worth 5 points each; there is 1
workout problem worth 40 points.

This is a closed book, closed notes exam. No scrap paper is
permitted. No calculators.

All students are expected to abide by the usual ethical standards
of the university, i.e., your answers must reflect only your own
knowledge and reasoning ability. NO CHEATING!
Problem 1
A 10 Ω resistor dissipates 1000 W when a current is passed through the resistor. How much current in amperes passes through the resistor?

(1) 1  (2) 5  (3) 10  (4) 100
(5) 1000  (6) 5000  (7) 10000

Problem 2
The charge through a 20 Ω resistor as a function of time is,

\[ q(t) = 5t + 28 \]

At \( t = 4 \) sec, what is the voltage drop across the resistor in volts?

(1) 1  (2) 10  (3) 100  (4) 110  (5) 240  (6) 480  (7) 1000
Problem 3

What is the transconductance \( g_m \) in mhos when the equivalent resistance of the circuit below is \( R_{eq} = 5 \, \Omega \)?

(1) - 0.8  (2) - 0.2  (3) 0.8  (4) 4  (5) 5  (6) 1.2  (7) -1.2

![Circuit Diagram for Problem 3](image)

Problem 4

Several voltage and current sources are set to zero in the circuit below. What is the voltage drop in volts over the 2\( \Omega \) resistor?

(1) 1  (2) 2  (3) 3  (4) 4  (5) 5  (6) 6  (7) 10

![Circuit Diagram for Problem 4](image)
Problem 5

The equivalent conductance $G_{eq}$ in mhos for the circuit below is?

(1) 0.1  (2) 0.2  (3) 0.4  (4) 1  (5) 5  (6) 2.5  (7) 10

![Circuit Diagram](image)

Problem 6

The value of $V_{AB} = (V_A - V_B)$ in the circuit below is:

(1) 10 V  (2) 20 V  (3) 30 V  (4) 40 V  (5) 50 V  (6) 60 V  (7) 70 V

![Circuit Diagram](image)
Problem 7

The node equation obtained by applying KCL at node 2 is:

\[ V_1 \]
\[ \begin{align*}
(1) \quad i_a + \frac{V_2}{R_a} + \frac{(V_3 + V_1 - V_2)}{R_b} &= 0 \\
(2) \quad -i_b + \frac{V_2}{R_a} + \frac{(V_3 + V_1 - V_2)}{R_b} &= 0 \\
(3) \quad i_a + \frac{V_2}{R_d} + \frac{(V_3 - V_1 - V_2)}{R_b} &= 0 \\
(4) \quad -i_b + \frac{V_2}{R_d} + \frac{(V_3 - V_1 - V_2)}{R_b} &= 0 \\
(5) \quad i_b + \frac{V_2}{R_a} + \frac{(V_3 + V_1 + V_2)}{R_c} &= 0 \\
(6) \quad -i_b + \frac{V_2}{R_a} + \frac{(V_3 + V_1 + V_2)}{R_c} &= 0 \\
(7) \quad i_b + \frac{V_2}{R_d} + \frac{(V_3 - V_1 + V_2)}{R_c} &= 0
\end{align*} \]
Problem 8
The mesh equation obtained by applying KVL around the $i_2$ mesh is:

\[(1) \ l(i_2 - i_1) + 2(i_2 - i_1 + i_1) + 3(i_2 - i_3) = 0\]
\[(2) \ l(i_2 - i_1) + 2(i_2 - i_1) + 3(i_2 - i_3) = 0\]
\[(3) \ l(i_2 - i_1) + 2(i_2 - i_1) + 3(i_2 - i_3) = 0\]
\[(4) \ l(i_2 - i_1) + 2(i_2 - 0) + 3(i_2 - i_4) = 0\]
\[(5) \ l(i_2 - i_1) + 2(i_2 - 0) + 3(i_2 - i_4) = 7\]
\[(6) \ l(i_2 - i_1) - 2(i_2 + i_3) + 3(i_2 - i_4) = 0\]
\[(7) \ l(i_2 - i_1) + 2(i_2 - 0) - 3(i_2 - i_4) = 0\]
Problem 9
The power $P_d$ dissipated in the $4\Omega$ resistor (in Watts) is:

(1) 5  (2) $\frac{8}{3}$  (3) 9  (4) 10  (5) 20  (6) 12  (7) 36

Problem 10
If the current $I_X = 5$ A, then the current $I_S$ is:

(1) 1 A  (2) 5 A  (3) 10 A  (4) 15 A  (5) 20 A  (6) 25 A  (7) 30 A
Problem 11
Choose $R_1$ and $R_3$ (in $\Omega$) such that the voltage $V_0 = -10V_1 - 25V_2$.

1. $R_1 = 10$ and $R_3 = 25$
2. $R_1 = 100$ and $R_3 = 25$
3. $R_1 = 250$ and $R_3 = 10$
4. $R_1 = 25$ and $R_3 = 100$
5. $R_1 = 25$ and $R_3 = 250$
6. $R_1 = 250$ and $R_3 = 25$
7. $R_1 = 25$ and $R_3 = 10$

Problem 12
The linear relationship among $V_{out}$, $V_{s1}$, and $I_{s2}$ is:

1. $V_{out} = 0.8R_1 V_{s1} + 0.8R_1 I_{s2}$
2. $V_{out} = 0.8 V_{s1} + 0.8R_1 I_{s2}$
3. $V_{out} = 0.8R_1 V_{s1} - 0.8R_1 I_{s2}$
4. $V_{out} = 0.8 V_{s1} - 4R_1 I_{s2}$
5. $V_{out} = 0.8 V_{s1} - 0.8 I_{s2}$
6. $V_{out} = 0.8 V_{s1} + 4R_1 I_{s2}$
7. $V_{out} = 0.8 V_{s1} - 0.8R_1 I_{s2}$
Workout Problem (40 points; allow 20 minutes)

Full credit depends on showing all work and formulas. You are expected to label your solution to each part as (a) through (g). Please put a box around your final answer to each part. Use nodal analysis on the circuit below as follows:

(a) (4 pts) Identify the supernode by drawing a Gaussian curve on your circuit diagram.

(b) (10 pts) Apply KCL to the supernode and express the result in terms of $V_A$, $V_B$, and $V_C$. Group like terms, i.e., $(?) V_A + (?) V_B + (?) V_C = (?)$.

(c) (7 pts) Write a second equation constraining the voltages of the supernode. Express the result in terms of the node voltages.

(d) (8 pts) Write a third node equation at $V_C$. Simplify and group like terms.

(e) (4 pts) Put equations in matrix form for the power delivered by voltages, $V_A$, $V_B$, and/or $V_C$, and $I_{s2}$.

(f) (3 pts) Put equations in matrix form for the power delivered by voltages, $V_A$, $V_B$, and/or $V_C$, and $I_{s2}$. 

(g) (4 pts) Find an expression in terms of conductances, $G_i$, node voltages, $V_A$, $V_B$, and/or $V_C$, and $I_{s2}$ for the power delivered by voltages.
Name:
Name:
Solutions to MC

1. (3) (10 A)
2. (3) (100 V)
3. (6) (0.8 mho)
4. (4) (4 V)
5. (1) (0.1 mho)
6. (2) (20 V)
7. (7)
8. (4) \((i_2 - i_1) + 2(i_2 - 0) + 3(i_2 - i_3) = 0\)
9. (3) (9 W)
10. (6) (25 A)
11. (5) (R1 = 25 Ω; R3 = 250 Ω)
12. (7) \(V_{out} = 0.8 V_{s1} - 0.8R_1 I_{s2}\)

Solution to Workout