ENGR 3301-001
Examination 2
November 2, 2010

Please Print.

Last Name: First Name:

Instructions

WRITE CLEARLY and NEATLY. Messy and illegible writing will result in ZERO credit.

1. Examination Duration: 1 hour 15 minutes. If you come early (up to 15 minutes), you can have that extra time.

2. You can use a calculator, and the Help Sheet that has been verified by the instructor.

3. There are 2 parts, A and B. Part A: 40 points – (3 problems, 13.33 points each) and Part B: 60 points (3 problems, 20 points each). A bonus problem for 20 points is at the end. **DO NOT RELY ON PARTIAL CREDITS, which will be given only for proper steps/logic, and solely at the discretion of the instructor. SHOW ALL YOUR STEPS. Highlight your answers.**

4. Answer in the space/sheets provided. Additional sheets are provided at the end for scratch work and/or for space needs. Do not un-staple; if you do, staple back with page numbers in order.

5. Any copying or cheating will result in appropriate action as per university regulations.

Score Tabulation (For Grading Purposes by the Instructor)

A1 -
A2 -
A3 -
B1 -
B2 -
B3 -
Bonus -
A.1

The current and voltage at the terminals of the inductor in the circuit shown below are given by:

\[ i(t) = (4 + 4e^{-40t}) \text{ A, } t \geq 0; \]
\[ v(t) = -80e^{-40t} \text{ V, } t \geq 0. \]

Determine the numerical values of \( V_s, R, I_0 \) and \( L \).
A2
Assume that the op amp in the circuit below is ideal. Determine the range of values \( v_g \) so that the op amp operates in a linear (non-saturating) mode.
Find the equivalent inductance across the terminals "a" and "b".
**B1 (20 points)**

The switch in the circuit shown below has been open for a long time before closing at $t = 0$. For $t \geq 0$, (a) Determine characteristic equation for (5 points), and (b) Determine the current, $i_L(t)$.. (15 points)
B2 (20 points)
The switch in the circuit has been in position 1 for a long time, and moves instantaneously to position 2 at $t = 0$. Determine $v_0(t)$ for $t \geq 0^+$. 
B3. (20 points)
In the circuit shown, the op amps are ideal, and have supply voltages of +20 V and -20 V for each op amp. Determine the output voltage, $V_0$. 
C. Bonus (20 points)

In the circuit shown below, the initial voltage across the capacitor is 24 V, and the initial current through the inductor is zero. The component values are given by $R = 8 \, \text{k}\Omega$, $C = 0.1 \, \mu\text{F}$ and $L = 40 \, \text{H}$. Determine the resulting voltage response, $v(t)$ for $t \geq 0$. 

\[ 
\begin{array}{c}
\text{C} \\
\text{V}_0 \\
\text{L} \\
\text{R} \\
\text{i}_C \\
\text{i}_{L_0} \\
\text{i}_R \\
\text{v}
\end{array}
\]