EE101 Final Examination, 4-7 p.m. March 20, 2018

Name____________________ Student ID_____________________

2 pages of formulas and tables only are allowed. But, you must show all your work even when you apply formulas to get full credits. Otherwise, you will lose points.

Problem 1 [10] ___________
Problem 2 [ 5] ___________
Problem 3 [10] ___________
Problem 4 [10] ___________
Problem 5 [10] ___________
Problem 6 [10] ___________
Problem 7 [10] ___________
Problem 8 [ 5] ___________
Problem 9 [ 5] ___________
Problem 10 [10] ___________
Problem 11 [ 5] ___________
Problem 12 [10] ___________

___________________________________

TOTAL [100] ___________
[1] (10 points) Find the current $i_o$ and voltage $v_o$ for a current source of 13 A.
[2] (5 points) Find the equivalent resistance between terminal a and terminal b.
[3] (10 points) Calculate the voltage $V$ in the circuit below.
[4] (10 points) Find the mesh current $i_1$. 
(for continuation of problem 4 solution)
[5] (10 points) (a). (8 points) Find an expression for $V_o$ in terms of $V_1$, $V_2$, and $V_3$.

(b). (2 points) What is the value of $V_o$ when $(V_1, V_2, V_3) = (75, 80, 90)$?
[6] (10 points) Find the maximum power that can be transferred to resistor R in the circuit below and find its maximum power dissipation.
(continuation of problem 6 solution)
[7] (10 points) **Find the voltage across the collector and emitter terminals** \( (V_{CE}) \) of the bipolar junction transistor (BJT) below with \( \beta=100 \) and \( V_{BE}=0.7 \) V for the circuit below.
[8] (5 points) Find an expression for $L_{eq}$ in terms of $R_1$, $R_2$ and $L$. 

\[ I(t) = \frac{1}{L_{eq}} \int_{t_0}^{t} v_i(t') \, dt' \]
[9] (5 points) Find $C_{eq}$ of the following capacitor network.
(10) (5 points) Find the inductor current $i(t)$ and $\frac{di(t)}{dt}$ for $t = 0-$ and for $t = 0+$. 
[11] (5 points) Determine the transformer ratio \( n \) for maximum power transfer to the 8 \( \Omega \) load when the Thevenin’s equivalent voltage and the equivalent resistance for the amplifier circuit are 10V and 128 \( \Omega \). Assume that the transformer is an ideal transformer which is lossless, unity coupled and its self-inductances of the primary and secondary ports are infinitely large.

(Hint: \( V_2 = n V_1 \) and \( I_2 = I_1 / n \))
[12] (10 points) Find the voltage across 1F capacitor $v(t)$ for $t > 0$.

(Hint: determine for $t > 0$ whether the circuit is overdamped, critically damped or underdamped so that you can start solving for $v(t)$ with a particular equation form.)
(Prob. 12 solution continued)