ECE 214 – Electrical Circuits Lab
Lecture 11

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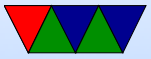
Announcements

- Final writeup due last day of classes
  (Friday May 1st 5pm)
- Final on Tuesday May 5th, 8am
- Lab notebooks will be collected immediately after the final.

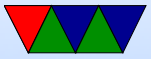


Midterm #2 Review

1. Microcap

(a) Initial conditions; put `IC=10ma` in the value field after the value.
As far as I can tell, no menu option to set this.

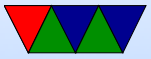
(b) Why initial conditions? In a perfect situation you can end up perfectly balanced or meta-stability. In real world random thermal noise is enough to kick things going eventually.
Not mosfet specific.



(c) Why use switches? Purely because non-free version of Microcap doesn't haven them.
Otherwise it would be much better to simply drop a MOSFET in place.
Note: MOSFETs *aren't* ideal switches, you'll learn more about that later.

2. Voltage Doubler

(a) On plot, current is Y-axis, Voltage is X-axis
(b) $V_{out} = V_{DC} + 2V_a$, so 12V if ideal
If you run it through microcap, actually 11.4V (only



one diode drop)

If you add in the scope probes and such, even lower, at 100Hz is from 9.4 to 10.6V. (roughly 10V avg)

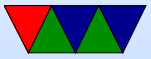
(c) Show ramp up? Just ripple?

3. RLC Circuits

(a) i. $R_S = \frac{2\pi f L}{Q} = 1.3\Omega$

ii. DC resistance has no frequency component, so the measurement ignores the complex component of the inductor.

(b) $\omega_0 = \frac{1}{\sqrt{LC}} = 100\text{krad/sec.}$



NOT kHZ (it is 15.9kHz)

If you got 31.6krad/sec you multiplied by $1\mu F$ instead of $.1\mu F$

(c) $\alpha = \frac{R}{2L} = 25,000$, $\omega_0 = 100,000$, so underdamped

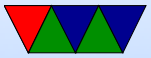
(d) Image is underdamped. Critical and over-damped are exponentials without ringing.

4. Boost Converter

(a) $E = \frac{1}{2}CV^2$, $\frac{1}{2}(10\mu F)(10)^2 - \frac{1}{2}(10\mu F)(9.8)^2 = 19.8\mu J$

(b) $D = 1 - \frac{V_{in}}{V_{out}} = 1 - \frac{10}{25} = .6 = 60\%$

(c) $V(t) = V_0 e^{\frac{-t}{RC}} = 402\mu s$



(d)i. $P = I^2R = 8W$

ii. 32, probably a few more to be safe

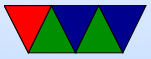
5. Astable Multivibrator

(a)i. $(2-3) = -6e^{\frac{-t}{20k\times.05\mu F}}$, t=1.79ms, $f = \frac{1}{2\times t} = 279Hz$
I pretty much took anything between 200 and 300Hz. If you did it a fancy way and think I graded wrong, let me know, but be sure to have a good explanation.

ii. 50% (both caps the same)

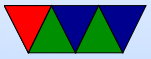
(b) A=square wave, peak at 9V, B=Complex exponential

6. Extra Credit 8.142V



Notes on the Final

- Cumulative
- Likely to be very similar to the midterms, especially the questions people struggled with the first time.
- Additionally will have some Lab#10 stuff, such as BoM and pricing.



Course reviews

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