Course Name: Principles of Electrical Engineering II

Course Number and Section: 14:332:222

Lab #1

TA (Instructor): Siwei Mai

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3.1 Following the discussion in section 7.2 of the textbook, write down the differential equation of the series R-C circuit in the absence of any forcing input. Then, explain or derive equation (1) in your own way.

- **$v_c(t) = v_0 e^{-t/RC}$**
- If vc(0 -) = vc(0 +), then Vc(0) can be substituted with the voltage drop across the resistor Ri in series with Vs. This can be found using the voltage divider formula.

3.2 For R = 10MΩ and C = 15μF, determine the expected time constant τ = RC.

- τ = RC =10*10^6 * 15*10^-6 = **150**

3.3 Equation (2) for V CPP is rather difficult to prove at this time. Take it as a challenge to derive it as you learn increasingly more on the topic of differential equations.

- We use Eulers identity to represent sin and cos functions with e.

3.4 Explain in your own words why an R-C series circuit can act approximately as an integrator as well as a differentiator and under what conditions

- An R-C series circuit can act as an integrator if the voltage across the capacitor low compared to the voltage across the resistor by keeping the input Period(T) < the time constant $\tau = RC$.
- An R-C series circuit can also act as a differentiator if the resistance is larger than capacitive reactance.