

Inter American University of Puerto Rico
Bayamón Campus
School of Engineering
Department of Electrical Engineering

ELEN 3302 – Electric Circuits II

Diagnostic Quiz

Name: _____

Enter all your work and your answers directly in the spaces provided on the printed pages. Use the backs of the printed pages as scratch paper, but full credit will only be given to answers that you neatly transfer to the spaces on the printed pages. Answers must be derived or explained, not just simply written down. The quiz is closed book, and calculators or notes are **not** allowed.

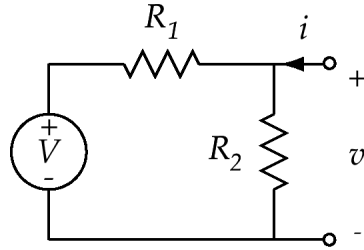
Problem	Points	Grade
1	2	
2	2	
3	2	
4	8	
5	6	
Total	20	

Problem 1: (*2 points*) In the equation below, a , b and c are real constants. Provide an algebraic expression for $x(t)$:

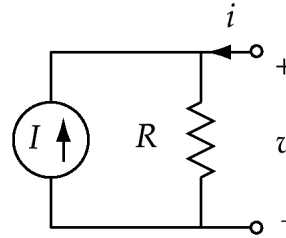
$$a \frac{dx(t)}{dt} + bx(t) = c$$

$x(t) =$

Problem 2: (2 points) The two circuits shown below have the same voltage-current behavior when observed from the terminals shown. What are the values of R and I in terms of R_1 , R_2 and V ?



(a)

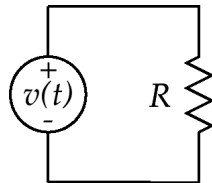


(b)

$R =$

$I =$

Problem 3: (2 points) Determine the numerical value of the average power P dissipated in the resistor R of the circuit shown below when $v(t)$ and R have the values specified in each part.



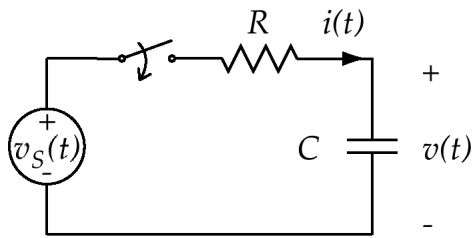
(A) $v(t) = \sqrt{2} \text{ V}$
 $R = 1 \text{ } \Omega$

$P =$

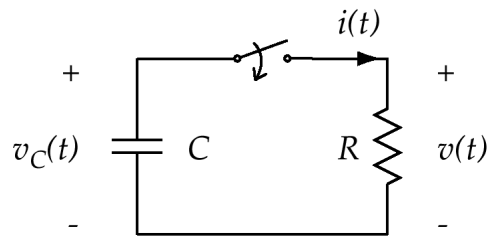
(B) $v(t) = \sqrt{2} \text{ V} \cdot \cos(2\pi \cdot 60 \text{ Hz} \cdot t)$
 $R = 1 \text{ } \Omega$

$P =$

Problem 4: (8 points) At time $t = 0$, the switches below close. In parts (A) and (B), provide an algebraic expression and a *neat* sketch of $v(t)$ and $i(t)$ for $0 \leq t \leq 3RC$.



(a)

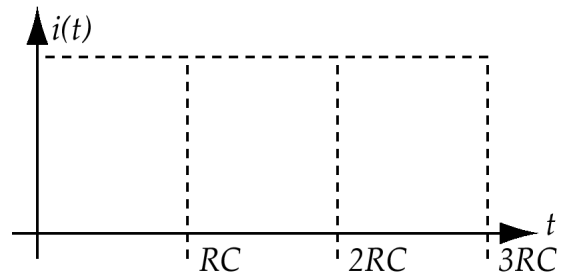
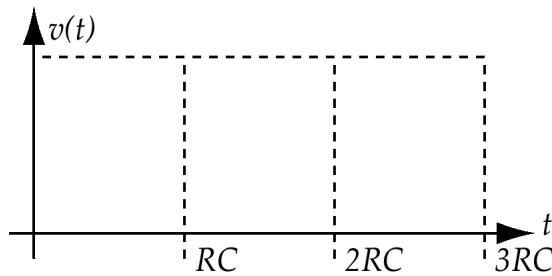


(b)

(A) For circuit (a), $v_S(t) = V$, $V > 0$ and $v(0^-) = 0$

$$v(t) =$$

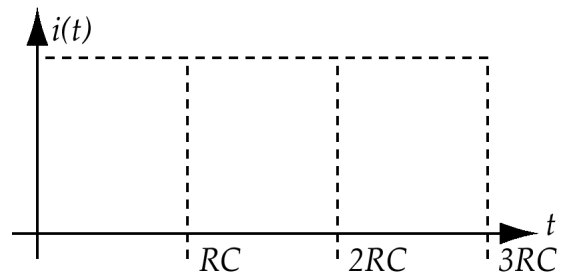
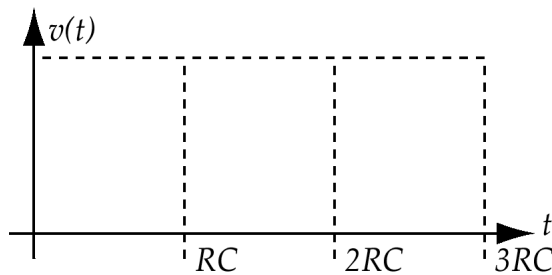
$$i(t) =$$



(B) For circuit (b), $v_C(0^-) = v_0$ and $v_0 > 0$

$$v(t) =$$

$$i(t) =$$



- (C) Assume now that the switch of circuit (a) has been closed for a long time, so that all transients have died, and $v_S(t) = V \sin \omega t$. Provide an algebraic expression for $v(t)$ only. You do **not** need to sketch it.

$$v(t) =$$

Problem 5: (6 points) Recall that $e^{j\theta} = \cos \theta + j \sin \theta$, where $e \approx 2.718$ is Euler's constant, $j = \sqrt{-1}$ and θ is an angle expressed in radians. Evaluate the following expressions:

(A) $e^{j\pi} =$

(B) $3e^{j\frac{\pi}{2}} =$

(C) $\sqrt{2}e^{j\frac{\pi}{4}} + \sqrt{2}e^{-j\frac{\pi}{4}} =$

(D) $\frac{1}{j} =$

- (E) A and b are real, positive numbers, and $b \leq 2\pi$.

$$\frac{4e^{j\frac{2}{3}\pi} \cdot 3e^{j\frac{\pi}{2}}}{2e^{j\frac{\pi}{3}} \cdot 5e^{j\frac{\pi}{4}}} = Ae^{jb}$$

$$A =$$

$$b =$$