Exam #2 Results

Highest: 100 (5)

Lowest: 33

Median: 85

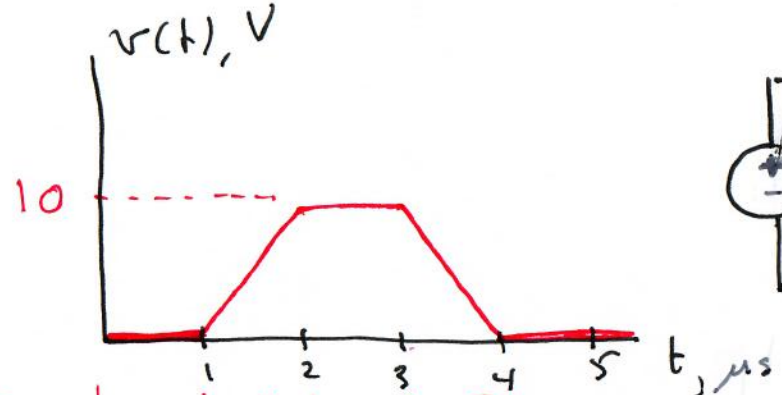
Average: 82.9

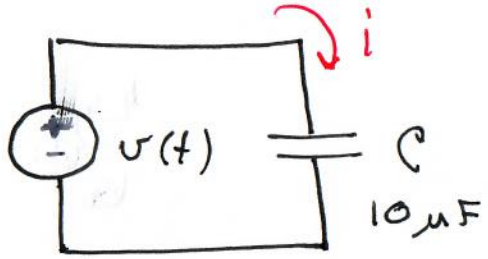
91-100:	8
81-90:	11
71-80:	4
61-70:	3
0-60:	2
	28

Capacitor

$$i = C\frac{dv}{dt}$$

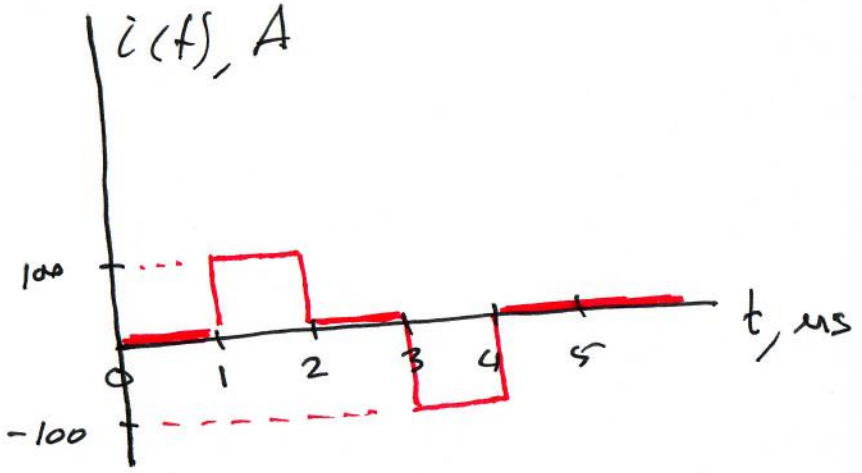
or $$v = \frac{1}{C}\int_{-\infty}^{t} i\,d\tau = \underbrace{\frac{1}{C}\int_{-\infty}^{0} i\,d\tau}_{v(0)\text{ initial value}} + \frac{1}{C}\int_{0}^{t} i\,d\tau$$

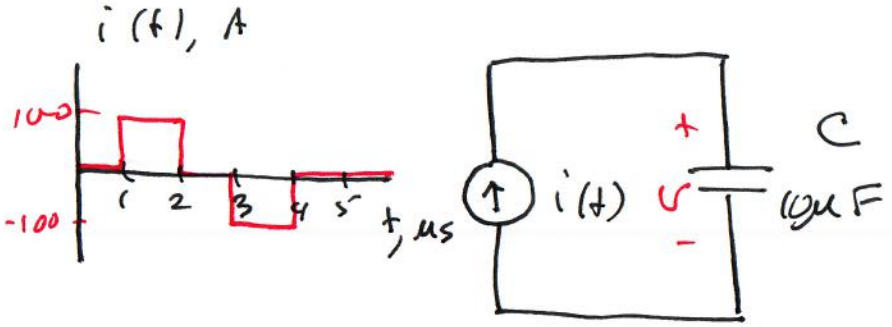




Determine and sketch $i(t)$.

$\frac{dv}{dt}$	0	10^7	0	-10^7	0	
$i = C\frac{dv}{dt}$	0	100	0	-100	0	





Find and sketch $v(t)$,

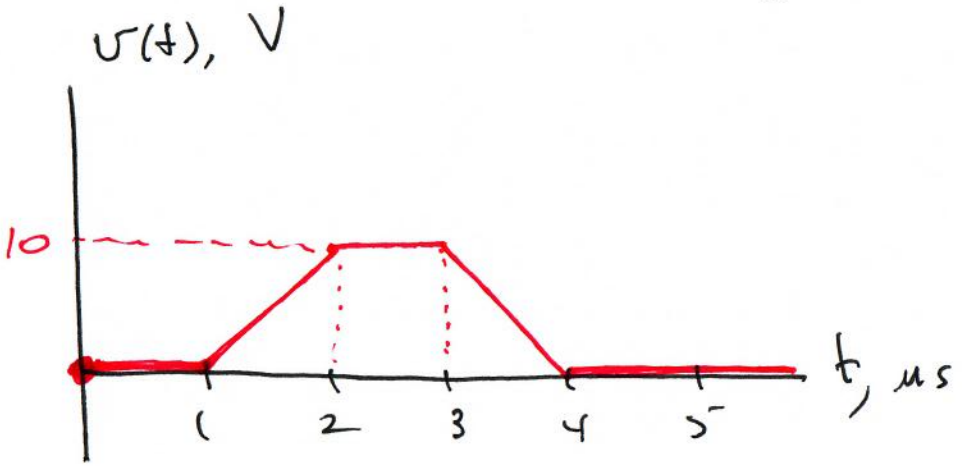
The capacitor is initially uncharged.

$$Q = C V, \quad Q = 0 \Rightarrow V = 0$$

$$v(t) = \frac{1}{C}\int_{-\infty}^{0} i\,d\tau + \frac{1}{C}\int_{0}^{t} i\,d\tau$$

$$= \frac{1}{C}\int_{0}^{t} i\,dt$$

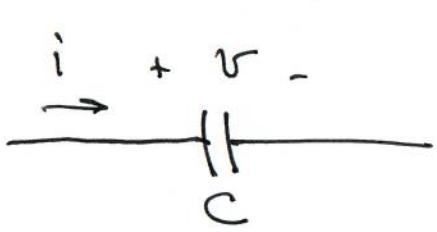
$$= 10^5 \int_{0}^{t} i\,dt$$



Capacitor

$$i(t) = C\frac{dv}{dt}$$

$$v(t) = v(0) + \frac{1}{C}\int_0^t i\,dt$$



$$Q = CV$$

$$\frac{dQ}{dt} = i$$

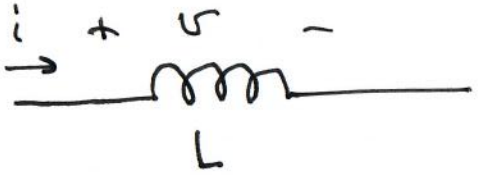
$$i = C\frac{dv}{dt}$$

$$w_c = \frac{1}{2}Cv^2$$

Inductor

$$v(t) = L\frac{di}{dt}$$

$$i(t) = i(0) + \frac{1}{L}\int_0^t v\,dt$$



v and i must satisfy the PSC

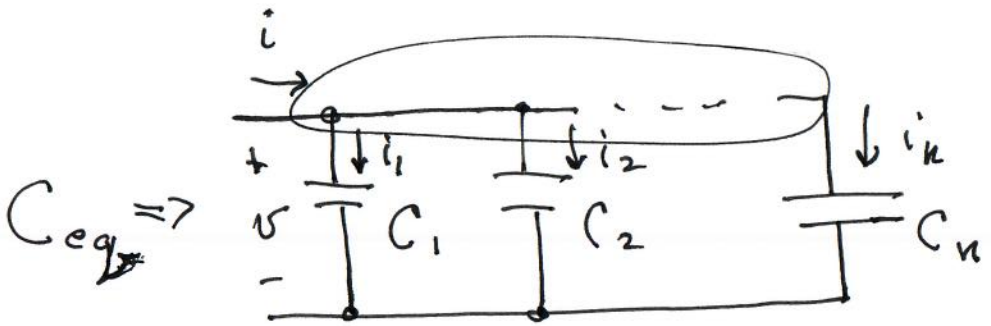
$$\lambda = Li$$

$$\frac{d\lambda}{dt} = v(t) \Rightarrow v(t) = L\frac{di}{dt}$$

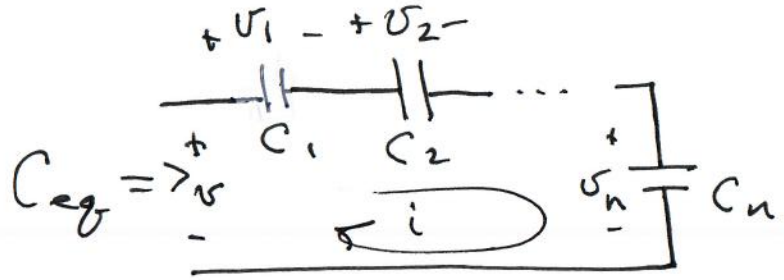
$$w_L = \frac{1}{2}Li^2$$

Spring

$$w_s = \frac{1}{2}kx^2$$



C_{eq} =>



C_{eq} =>

$$i_1 = C_1 \frac{dv}{dt}, \quad i_2 = C_2 \frac{dv}{dt}$$

$$\cdots \quad i_n = C_n \frac{dv}{dt}$$

$$i = i_1 + i_2 + \cdots + i_n$$

$$= C_1 \frac{dv}{dt} + C_2 \frac{dv}{dt} + \cdots + C_n \frac{dv}{dt}$$

$$i = \underbrace{(C_1 + C_2 + \cdots + C_n)}_{C_{eq}} \frac{dv}{dt}$$

$$C_{eq} = C_1 + C_2 + \cdots + C_n$$

Assume all capacitors are initially uncharged

$$v_1 = \frac{1}{C_1} \int_0^t i \, d\tau$$

$$v_2 = \frac{1}{C_2} \int_0^t i \, d\tau$$

$$\vdots$$

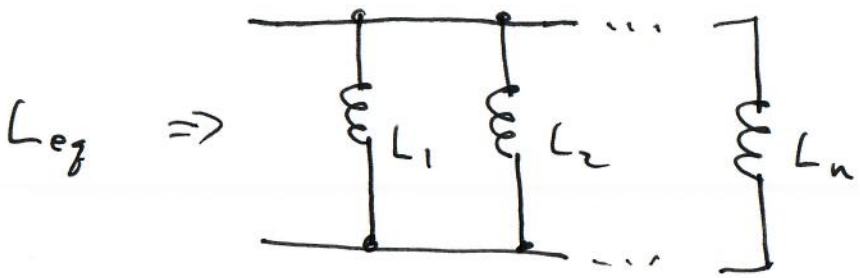
$$v_n = \frac{1}{C_n} \int_0^t i \, d\tau$$

$$v = v_1 + v_2 + \cdots + v_n$$

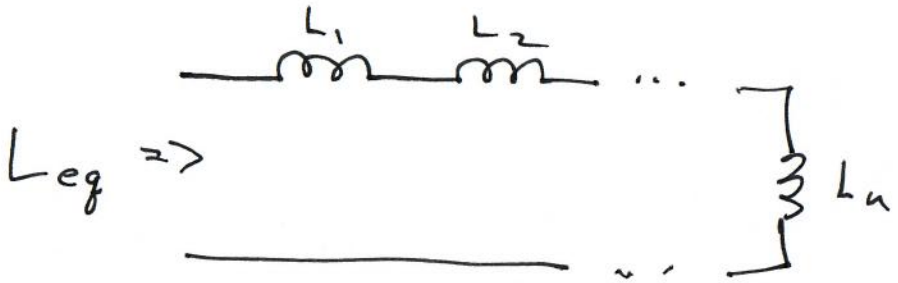
$$= \frac{1}{C_1} \int_0^t i \, d\tau + \frac{1}{C_2} \int_0^t i \, d\tau$$

$$+ \cdots + \frac{1}{C_n} \int_0^t i \, d\tau$$

$$v = \underbrace{\left(\frac{1}{C_1} + \frac{1}{C_2} + \cdots + \frac{1}{C_n} \right)}_{1/C_{eq}} \int_0^t i$$



$$\frac{1}{L_{eq}} = \frac{1}{L_1} + \dots + \frac{1}{L_n}$$



$$L_{eq} = L_1 + L_2 + \dots + L_n$$

Series

resistance $R_{eq} = R_1 + \cdots + R_n$

inductance $L_{eq} = L_1 + \cdots + L_n$

capacitance $1/C_{eq} = \frac{1}{C_1} + \cdots + \frac{1}{C_n}$

conductance $1/G_{eq} = \frac{1}{G_1} + \cdots + \frac{1}{G_n}$

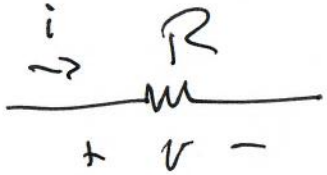
Parallel

$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_n}$

$\frac{1}{L_{eq}} = \frac{1}{L_1} + \frac{1}{L_2} + \cdots + \frac{1}{L_n}$

$C_{eq} = C_1 + C_2 + \cdots + C_n$

$G_{eq} = G_1 + G_2 + \cdots + G_n$



$v = Ri$

$i = \frac{1}{R} v$

G

$G \triangleq \frac{1}{R}$

units of conductance are Ω^{-1} or S siemens

Resistance units are ohms, Ω

Inductance units are henrys, H

Capacitance " " farads, F

Conductance " " siemens, S

10^6	M	meg
10^3	k	
10^{-3}	m	
10^{-6}	μ	
10^{-9}	n	

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