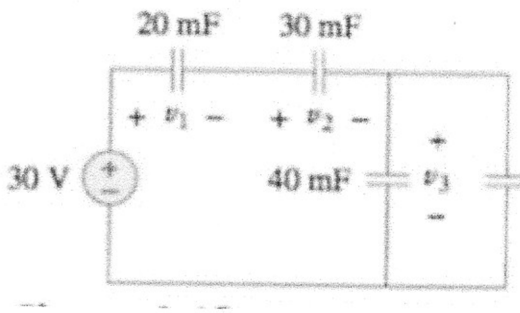
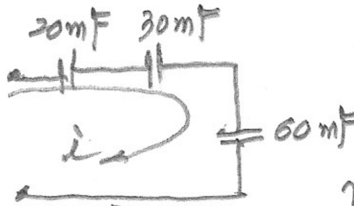
solve

EE101 Quiz 6 February 21, 2017

Name_______________ Student ID_______________________

Find the voltage across the 40 mF capacitor and also the energy stored in it.





$v_K = \frac{1}{C_K}\int i(t)dt = \frac{1}{C_K} Q$

$30V = \left[\frac{1}{20mF} + \frac{1}{30mF} + \frac{1}{60mF}\right] Q$

$Q = \frac{30}{\frac{1}{20mF} + \frac{1}{30mF} + \frac{1}{60mF}}$

$V_3 = \frac{Q}{60mF} = \frac{30}{3+2+1} = 5\ V$

$E_3 = \frac{1}{2} C V_3^2 = \frac{1}{2} \times 40 \times 10^{-3} \times 5^2 = 0.5\ J$

Your answer v_3 = ____5____ V [7 points]

Energy E_3 = ____0.5____ Joule [J] [3 points]

Hint: charges stored in capacitors in series are same since

- q (t) = $\int_{-\infty}^{t} i(\tau)d\tau$
- First calculate C_{eq} seen by the 30V source. (3 points) C_{eq} = ____10____ mF
- Next find the q ____0.3 C____(2 points), then v_3 = ____5____V (2 points)
- Energy (3 points)$E_3(t) = \int_{-\infty}^{t} v_3 . ((40\ mF) \frac{dv_3}{d\tau} d\tau$

$q = CV = 10\ mF\ 30V = 0.3\ C$

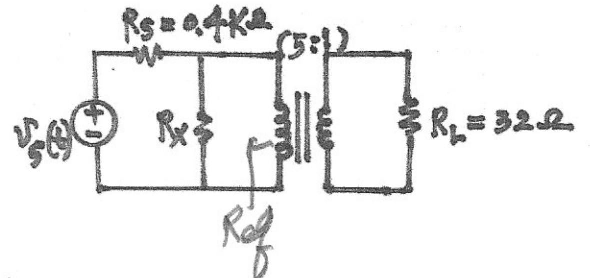
$= 40mF \frac{v_3^2}{2} = 40mF \times \frac{(5)^2}{2} = 0.5C$

Solve

EE101 W2018 Quiz 7, February 26, 2018

Name_______________________ Student ID_______________________

This problem is to make sure a maximum power transfer is achieved by matching the resistance value (or an equivalent resistance) on the power generation side to the load resistance. The problem is made more interesting with use of a transformer with its turn ratio 5:1 between the load and the power generation side.



Q1 (6 points) Find **the value of R_x** for maximum power transfer for to R_L.

$$R_{ef} = 32 \times 5^2 = 32 \times 25 = 800\Omega$$

For max power, $R_S = 0.4K\Omega = R_X \parallel R_{ef} = R_X \parallel 800\Omega$

$\Rightarrow R_X = 800\Omega$

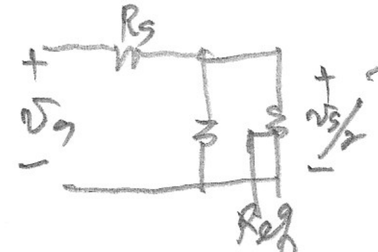
Q2 (4 points) Calculate the **average power** delivered to R_L when the voltage source is

$v_S(t) = 110 \sin \omega t$ [v], where ω = 2π x 60 = 120 π.

Voltage across $R_L = \frac{v_S}{10}$

$$P_{R_L} = \frac{1}{2}\left(\frac{110}{10}\right)^2 / 32\Omega = \frac{\frac{1}{2}(11)^2}{32} = \frac{121}{64} = 1.89\,W$$

voltage peak $= \frac{110}{10} = 11V$



5:1 transformer $\left(\frac{v_S}{2}\right) \times \frac{1}{5} = \frac{v_S}{10}$ on the secondary port, thus on R_L

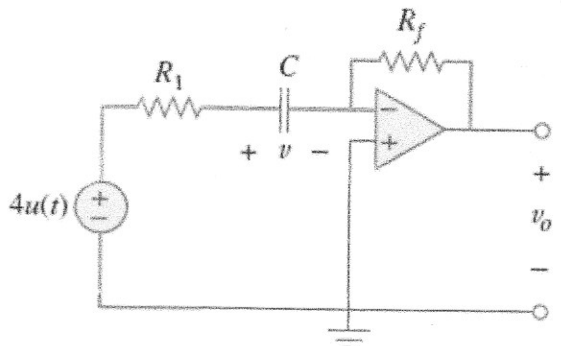
Also $P_{R_L}(\text{average}) = \frac{1}{2}(\text{Voltage Peak})^2 / R_L$

EE101 Quiz 8 March 5, 2018

Solve

Name________________________ Student ID________________________

For the op amp circuit of the given figure, let R_1 = 10 kΩ, R_f = 30 kΩ, C = 90 μF, and $v(0)$ = 1 V.



a) (4 points) Write down an equation to find v(t) for the given input voltage 4 u(t), where u(t) is a step function whose value is 1.0 for t > 0, and 0 for t <0.

$$R_1\left[C\frac{dv(t)}{dt}\right] + v(t) = 4u(t),\ t>0$$

$$(10k\Omega\ 90\mu F)\frac{dv(t)}{dt} + v(t) = 4u(t)$$

$$0.9\frac{dv}{dt} + v = 4u(t) = 4,\ t>0$$

b) (4 points) Solve for v(t) t > 0. Verify your solution by checking v(0) and v(∞).

$$0.9\,dv = (4-v)\,dt$$

$$\frac{-0.9\,d(4-v)}{4-v} = dt$$

$$-0.9\ln(4-v)\Big|_{v(0)}^{v} = t\Big|_0^t$$

$$-0.9\ln\left[\frac{(4-v)}{(4-1)}\right] = t \longrightarrow \frac{4-v}{3} = e^{-\frac{t}{0.9}} \rightarrow 4-v = 3e^{-\frac{t}{0.9}}$$

$$\left[\begin{aligned} -0.9\ln\frac{4-v}{3} &= t \\ \ln\frac{4-v}{3} &= -\frac{t}{0.9} \\ e^{\ln\frac{4-v}{3}} &= e^{-\frac{t}{0.9}} \end{aligned}\right]$$

ans $\boxed{v = 4 - 3e^{-\frac{t}{0.9}}}$

$v(0) = 4 - 3\cdot 1 = 1$ ✓

$v(\infty) = 4$

c) (2 points) What is the output voltage V_o t = ∞.

At t=∞, the current through R_f is zero,

thus $v_o = R_f \cdot 0 = 0$ (ans)