NAME SOLUTION

ECE 831

EXAM III

NOV. 19, '08

PROBLEM	POINTS	SCORE
1	25	
2	25	
3	25	
4	25	
	100	

NAME _____

1) GIVEN $= Hs + \frac{K_0}{s} + \sum \frac{(2k_i)s}{s^2+\omega_i^2}$

$$Z_{LC}(s) = \frac{48s^4+20s^2+1}{3s(8s^2+1)} = \frac{48s^4+20s^2+1}{24s(s^2+1/8)}$$

FIND A 1ST FOSTER LC ONE PORT. SKETCH YOUR CIRCUIT. LABEL ELEMENT VALUES

$$H = \left.\frac{Z_{LC}}{s}\right|_{s\to\infty} = \frac{48s^4}{24s^4} = \frac{48}{24} = 2$$

$$K_0 = \left. sZ_{LC}\right|_{s\to 0} = \frac{1}{24(\frac{1}{8})} = \frac{1}{3}$$

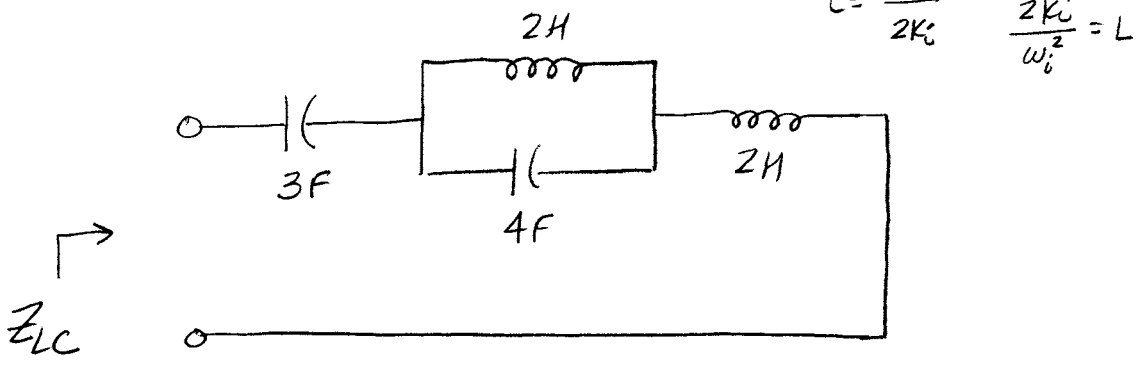
$$2K_i = \left.\frac{s^2+1/8}{s}\ \frac{48s^4+20s^2+1}{24s(s^2+1/8)}\right|_{s^2=-\frac{1}{8}}$$

$$= \frac{48(\frac{1}{64})+20(-\frac{1}{8})+1}{24(-1/8)} = \frac{48-20(8)+64}{24(-8)}$$

$$= \frac{-48}{-24(8)} = \frac{2}{8} = \frac{1}{4}$$

$$Z_i = \frac{\frac{1}{4}s}{s^2+1/8} = \frac{1}{\frac{4}{s}s^2+\frac{4}{s}\frac{1}{8}} = \frac{1}{4s+\frac{1}{2s}}$$

$C = \frac{1}{2K_i}$ $\quad \frac{2K_i}{\omega_i^2} = L$



-3PT/ERROR

NAME

2) GIVEN

$$Z_{RC}(s) = \frac{2s+7}{2s^2+15s+1}$$

FIND A 1ST CAUER RC ONE PORT. SKETCH YOUR CIRCUIT. LABEL ELEMENT VALUES

$$2s^2+15s+1 \overline{)\,2s+7}\quad 0 \Rightarrow R_1 = 0\,\Omega$$

$$2s+7 \overline{)\,2s^2+15s+1}\quad \frac{s}{} \Rightarrow C_2 = 1F$$

$$\underline{2s^2+7s}$$

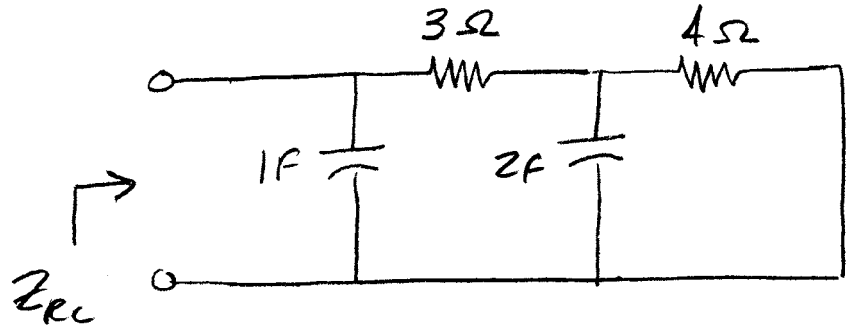
$$8s+1 \overline{)\,2s+7}\quad 3 \Rightarrow R_3 = 3\,\Omega$$

$$\underline{2s+3}$$

$$4 \overline{)\,8s+1}\quad 2s \Rightarrow C_4 = 2F$$

$$\underline{8s}$$

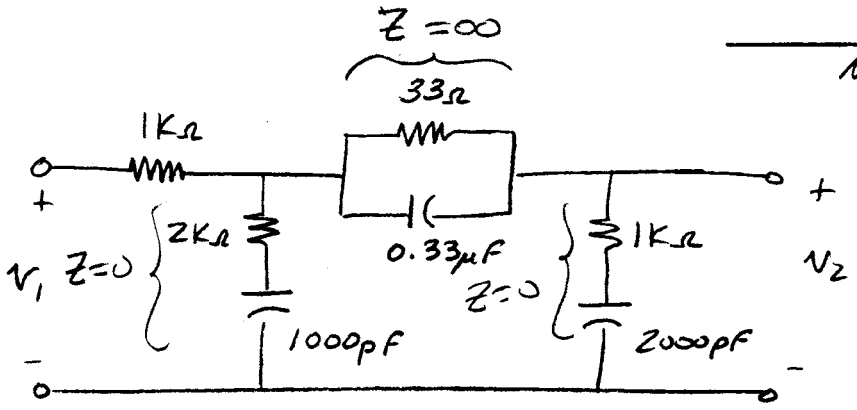
$$1 \overline{)\,4}\quad 4 \Rightarrow R_5 = 4\,\Omega$$



−4 PT/ ERROR

NAME _____

3)



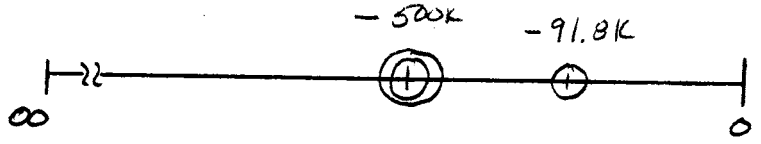
WHERE $p = 10^{-12}$, $\mu = 10^{-6}$

(6) A) FIND THE TRANSMISSION ZEROS OF $\frac{V_2}{V_1}$. MARK THE LOCATION ON THE GRAPH BELOW

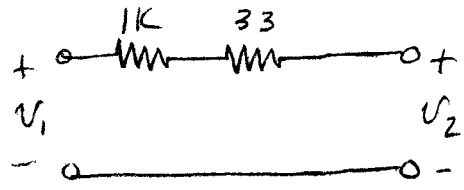
$$\frac{1}{s\ 1000p} = -2K \Rightarrow s = -\frac{1}{(1n)(2K)} = -500K \text{ RAD/SEC}$$

$$\frac{1}{s\ .33\mu} = -33 \Rightarrow s = -\frac{1}{(.33\mu)33} = -91.8K \text{ RAD/SEC}$$

$$\frac{1}{s\ 2000p} = -1K \Rightarrow s = -\frac{1}{(2n)(1K)} = -500K \text{ RAD/SEC}$$

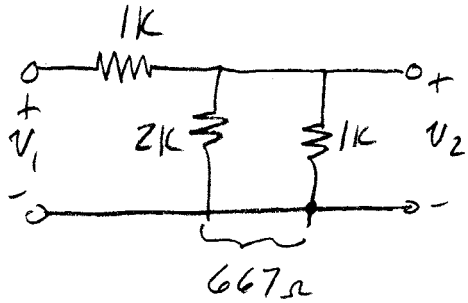


B) WHAT IS $\frac{V_2}{V_1}$ AT $s=0$? OPEN C's



$\left.\frac{V_2}{V_1}\right|_{s=0} =$ 1 (10)

C) WHAT IS $\frac{V_2}{V_1}$ AT $s=\infty$ SHORT C's



$\left.\frac{V_2}{V_1}\right|_{s=\infty} =$ 0.4 (9)

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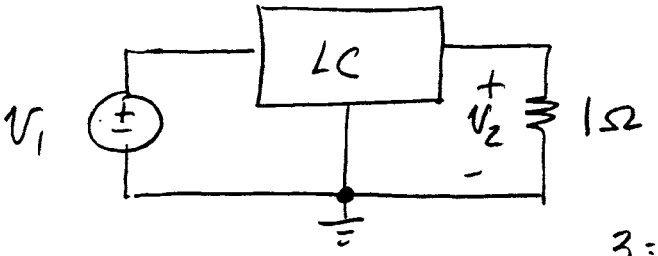
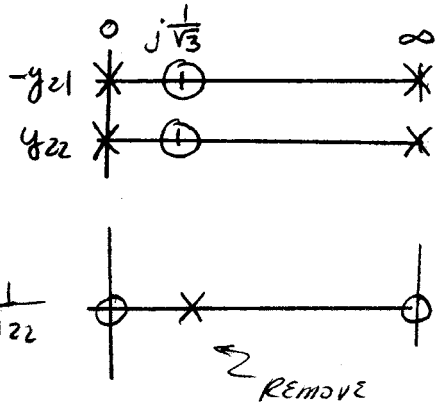
4) GIVEN

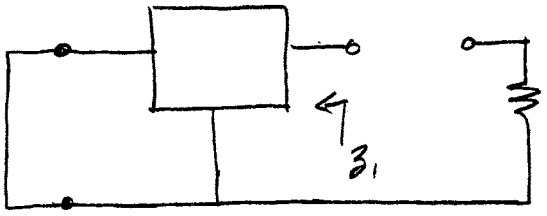
$$G_{12} = \frac{V_2}{V_1} = K\,\frac{3s^2+1}{3s^2+3s+1} = \frac{K\,\frac{3s^2+1}{3s}}{\frac{3s^2+1}{3s}+1} = \frac{-y_{21}}{y_{22}+Y_2}$$

A) SYNTHESIZE THE LC CIRCUIT USING OUR 2-PORT TECHNIQUE SKETCH YOUR FINAL CIRCUIT WITH ELEMENT VALUES.





REMOVE TO MAKE THE TRANS. ZERO AT $s = j\frac{1}{\sqrt{3}}$



$$Z_1 = \frac{1}{y_{22}} = \frac{3s}{3s^2+1} = \frac{1}{\frac{3s^2}{3s}+\frac{1}{3s}}$$

$$= \frac{1}{1s+\frac{1}{3s}}$$

$C = 1F$ $\quad L = 3H$

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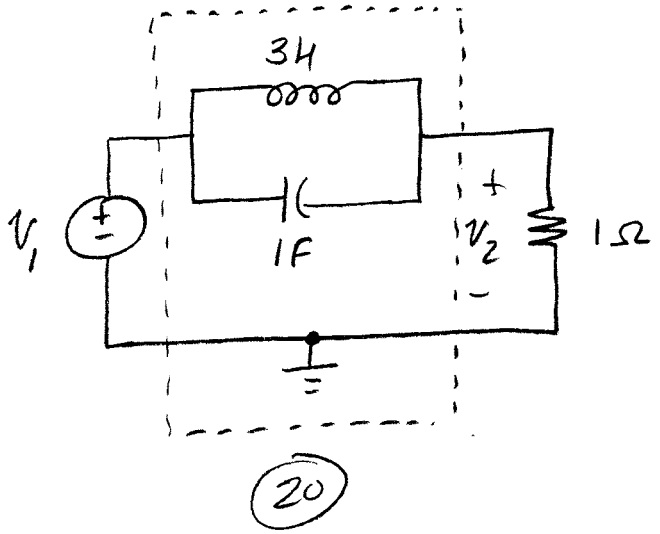
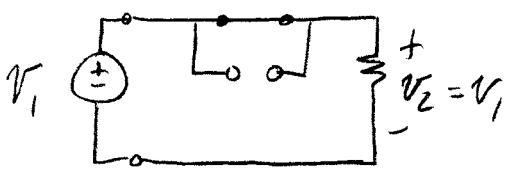
4) Additional work space



B) Determine the value of K

$$\frac{V_2}{V_1} = K \left. \frac{3s^2+1}{3s^2+3s+1} \right|_{s=0} = K \frac{1}{1}$$

Circuit at $s=0$



$K =$ 1 (5)