

23W-EC ENGR-10-LEC-1 Hw #7 (Optional)

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TOTAL POINTS

90.5 / 100

QUESTION 1

1 Problem 1 15 / 15

✓ - 0 pts Correct

- 5 pts Incorrect Loop 1 analysis
- 5 pts Incorrect Loop 2 analysis
- 2.5 pts Correct loop analysis but got wrong current delivered by the independent source.
- 2.5 pts Correct loop analysis but got wrong V_o value

QUESTION 2

2 Problem 2 12.5 / 15

- 0 pts Correct
- 5 pts Wrong KCL at Node 1
- 5 pts Wrong KCL at Node 2
- 2.5 pts Correct node analysis but got wrong V_c
- ✓ - 2.5 pts Correct node analysis but got wrong I_n

QUESTION 3

Problem 3 15 pts

3.1 (a) 5 / 5

✓ - 0 pts Correct

- 2 pts Incorrect solving the phasor domain

3.2 (b) 5 / 5

✓ - 0 pts Correct

- 2 pts Method is right but got the incorrect value of Z .

3.3 (c) 4 / 5

- 0 pts Correct

- 1 pts V_x

✓ - 1 pts I_{dep}

- 1 pts I_L

QUESTION 4

Problem 4 20 pts

4.1 (a) 8 / 8

✓ - 0 pts Correct

- 2 pts partially correct when calculating the impedance but got the wrong answer.

4.2 (b) 7 / 7

✓ - 0 pts Correct

- 2 pts whole work is correct but got the wrong answer due to 4(a) or calculation error.

4.3 (c) 4 / 5

- 0 pts Correct

- 1 pts V_X

- 1 pts I_{dep}

- 1 pts I_L

✓ - 1 pts V_S

- 1 pts V_L

QUESTION 5

Problem 5 25 pts

5.1 (a) 5 / 5

✓ - 0 pts Correct

- 2 pts wrong direction of current or voltage source

5.2 (b) 7.5 / 10

- 0 pts Correct

- 2.5 pts I_B

- 2.5 pts I_R

✓ - 2.5 pts V_L

- 2.5 pts V_A

5.3 (c) 5 / 5

✓ - 0 pts Correct

- 1 pts V_S

- 1 pts I_R

- 1 pts V_L

- 1 pts V_A

5.4 (d) 2.5 / 5

- 0 pts Correct

- 2.5 pts Incorrect analysis on Lead or Lag

✓ - 2.5 pts wrong degree

QUESTION 6

6 Problem 6 10 / 10

✓ - 0 pts Correct

- 4 pts Wrong current source value when doing Norton

- 4 pts Wrong impedance after transforming

- 2 pts misunderstood thevenin and norton

1 Problem 1 15 / 15

✓ - 0 pts *Correct*

- 5 pts Incorrect Loop 1 analysis
- 5 pts Incorrect Loop 2 analysis
- 2.5 pts Correct loop analysis but got wrong current delivered by the independent source.
- 2.5 pts Correct loop analysis but got wrong V_o value

2 Problem 2 12.5 / 15

- **0 pts** Correct
- **5 pts** Wrong KCL at Node 1
- **5 pts** Wrong KCL at Node 2
- **2.5 pts** Correct node analysis but got wrong V_c
- ✓ - **2.5 pts** *Correct node analysis but got wrong I_n*

3.1 (a) 5 / 5

✓ - 0 pts Correct

- 2 pts Incorrect solving the phaser domain

3.2 (b) 5 / 5

✓ - 0 pts *Correct*

- 2 pts Method is right but got the incorrect value of Z.

3.3 (c) 4 / 5

- 0 pts Correct

- 1 pts V_x

✓ - 1 pts I_{dep}

- 1 pts I_L

4.1 (a) 8 / 8

✓ - 0 pts Correct

- 2 pts partially correct when calculating the impedance but got the wrong answer.

4.2 (b) 7 / 7

✓ - 0 pts Correct

- 2 pts whole work is correct but got the wrong answer due to 4(a) or calculation error.

4.3 (c) 4 / 5

- 0 pts Correct

- 1 pts V_X

- 1 pts I_{dep}

- 1 pts I_L

✓ - 1 pts V_S

- 1 pts V_L

5.1 (a) 5 / 5

✓ - 0 pts *Correct*

- 2 pts wrong direction of current or voltage source

5.2 (b) 7.5 / 10

- 0 pts Correct

- 2.5 pts \$\$I_B\$\$

- 2.5 pts \$\$I_R\$\$

✓ - 2.5 pts \$\$V_L\$\$

- 2.5 pts \$\$V_A\$\$

5.3 (c) 5 / 5

✓ - 0 pts Correct

- 1 pts \$\$V_S\$\$

- 1 pts \$\$I_R\$\$

- 1 pts \$\$V_L\$\$

- 1 pts \$\$V_A\$\$

5.4 (d) 2.5 / 5

- 0 pts Correct

- 2.5 pts Incorrect analysis on Lead or Lag

✓ - 2.5 pts *wrong degree*

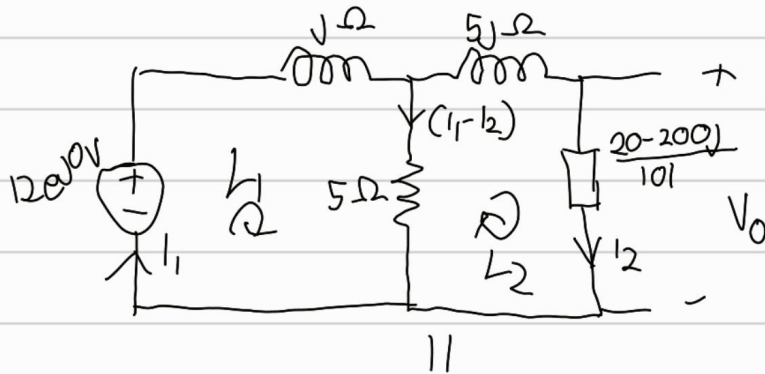
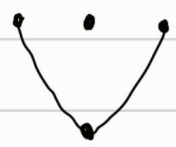
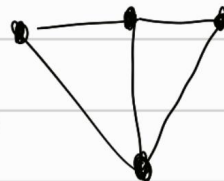
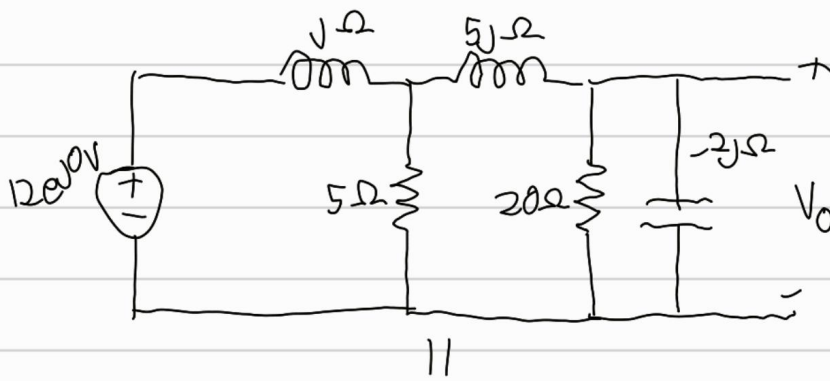
6 Problem 6 10 / 10

✓ - 0 pts *Correct*

- 4 pts Wrong current source value when doing Norton
- 4 pts Wrong impedance after transforming
- 2 pts misunderstood thevenin and norton

ECE 10 HW # 7

①



$$V_0 = \frac{20 - 200j}{101} I_2 =$$

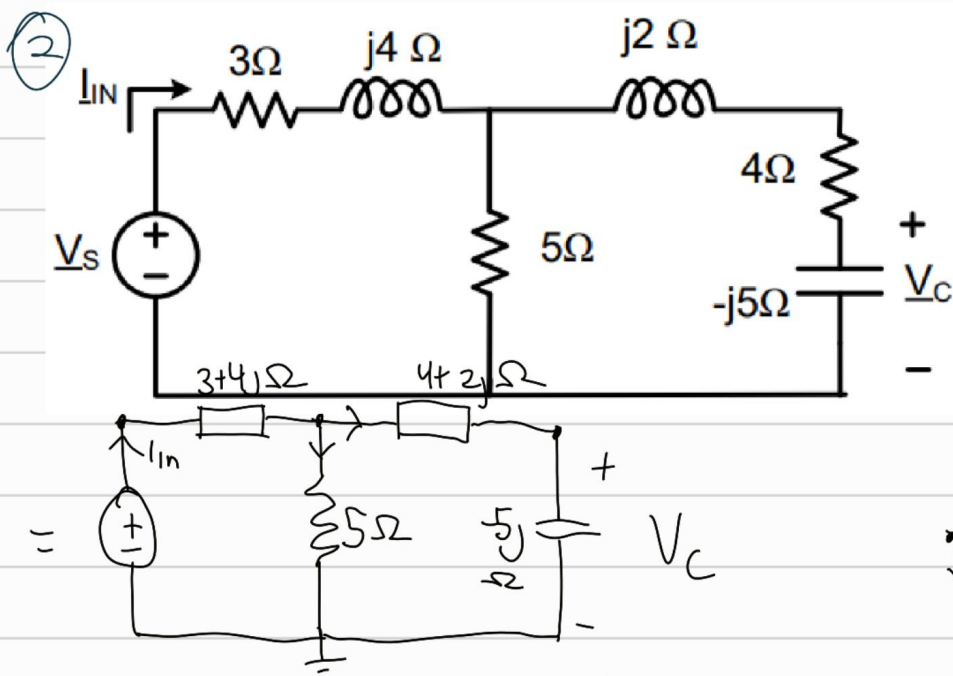
$$12 - jI_1 - 5(I_1 - I_2) = 0 \quad | \quad 12 = jI_1 + 5I_1 + 5I_2 = (5 + j)I_1 + 5I_2$$

$$5(I_1 - I_2) - 5jI_2 - \frac{20}{101}I_2 + \frac{200j}{101}I_2 = 0 \quad | \quad I_2 = \frac{12 - (5 + j)I_1}{5}$$

Solving for I_1 , $I_1 = 1.46 - 3.22j$
 $= 3.54e^{-1.15j}$

$$8I_2 = -0.3 - 2.9j$$

$$V_0 = \frac{20 - 200j}{101}, I_2 = 5.8e^{3.13j}$$



$$I_n = \frac{V_s - V_2}{3 + 4j}$$

$$\frac{V_s - V_2}{3 + 4j} = \frac{V_2}{5} + \frac{V_2 - V_c}{4 + 2j}$$

$$\frac{V_2 - V_c}{4 + 2j} = \frac{V_c}{-5j}$$

$$\therefore V_2 = (4 + 2j) \left(\frac{V_c}{-5j} + \frac{V_c}{4 + 2j} \right)$$

$$V_2 = \frac{(4 + 2j)V_c + 5V_c}{-5j} = \frac{(4 - 3j)V_c}{-5j} = \frac{3 + 4j}{5} V_c$$

$$\therefore V_c = \left(\frac{3 - 4j}{5} \right) V_2$$

$$\rightarrow \frac{V_s - V_2}{3 + 4j} = \frac{V_2}{5} + \frac{V_2}{4 + 2j} + \frac{4 - 3j}{5(4 + 2j)} V_2$$

$$\therefore (3 - 4j)V_s = (12 - j)V_2$$

$$\therefore V_s = \frac{12 - j}{3 - 4j} = \left(\frac{8 + 9j}{5} \right) V_2$$

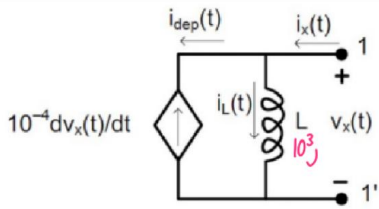
$$\therefore V_2 = \left(\frac{8 - 9j}{29} \right) V_s = \frac{80 - 90j}{29}$$

$$I_n = \frac{V_s - V_2}{3 + 4j}$$

$$\therefore V_c = \frac{(3 - 4j)}{5} \cdot \frac{80 - 90j}{29}$$

$$= \frac{-24 - 118j}{29} \approx 4.15 e^{-1.22j}$$

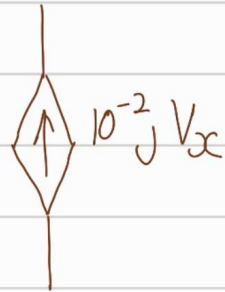
③



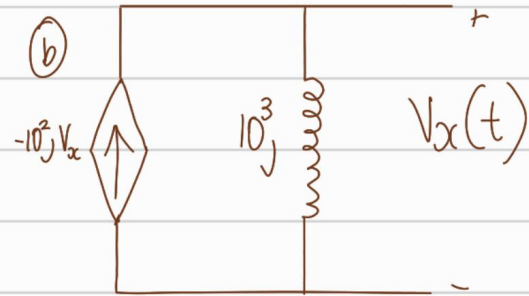
$$V_x = V_L, \quad V_x = V_0 \cos(\omega t)$$

$$V_x' = -V_0 \omega \sin(\omega t) = V_0 \omega_0$$

④



⑤



$$Z_{eq} = 10^2 j \parallel 10^3 j$$

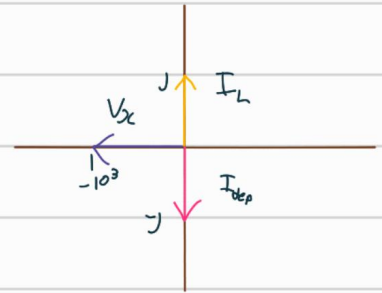
$$= \frac{1000 j}{11}$$

⑥

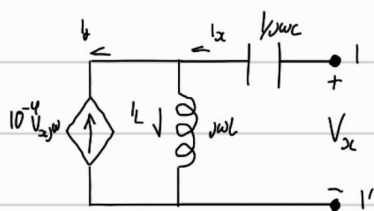
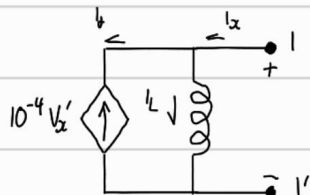
$$I_L = j$$

$$V_x = 10^3 j I_L = -10^3$$

$$I_{dep} = -I_L = -j$$



4



$$Z_{eq} = Z_d || Z_L + Z_C = \frac{10^4 j\omega}{10^3 - \omega^2} - \frac{100}{\omega}$$

① Purely Resistive: $\text{Im} \left\{ \frac{10^4 j\omega}{10^3 - \omega^2} - \frac{100}{\omega} \right\} = 0$

$$\therefore \omega = 3.147$$

$$\therefore F = \frac{2\pi}{\omega} = 2.0 \text{ Hz}$$

② $V_s = 2 \cos(\omega t - \frac{\pi}{6}) = 2 e^{j\frac{\pi}{6}}$, $\omega = 3.147$

$$I_x = I_d + I_L, \quad I_d = 10^4 j\omega V_x, \quad I_x = \frac{V_x}{Z_{eq}}$$

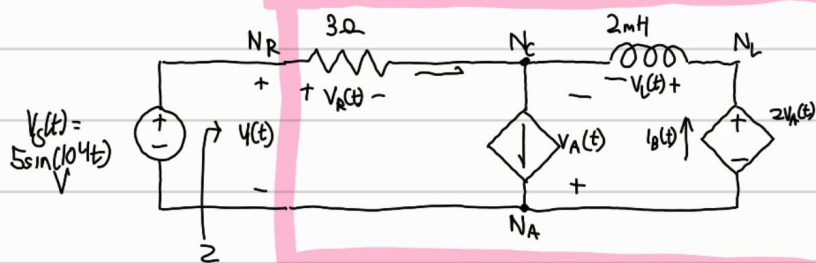
$$V_x = V_s =$$

$$V_x = V_s = 2 e^{j\frac{\pi}{6}}$$

$$I_L = \frac{V_x}{Z_{eq}} - 10^4 j\omega V_x = 6.32 e^{-2.1}$$

$$I_d = 10^4 j\omega V_x = 62940 e^{j1.047}$$

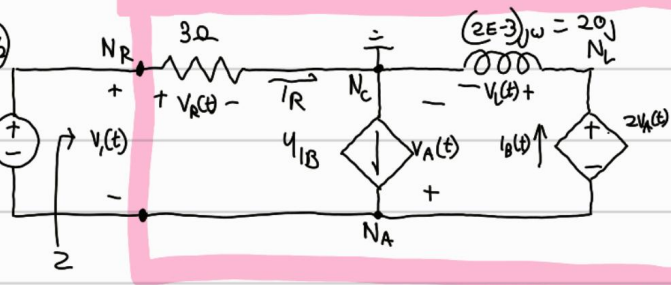
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$$v_s(t) = 5 \sin(10^4 t) \text{ V}$$

$$v_s(t) = 5 \cos(10^4 t - \pi/2)$$

$$v_s = 5e^{-j\pi/2} = -5j$$



$$\vec{V}_R + \vec{V}_L = \vec{V}_s$$

$$V_s + V_A = V_R \quad V_R = 3I_R = 3I_B$$

$$V_L = j20 \cdot I_B$$

$$2V_A = V_A - V_L$$

$$\therefore V_A = V_L$$

$$V_s = V_L + V_R$$

$$\therefore V_R = V_L - V_s$$

$$\therefore V_L + V_s = \frac{3V_L}{10}$$

$$\therefore V_s = \frac{3V_L}{10} - V_L$$

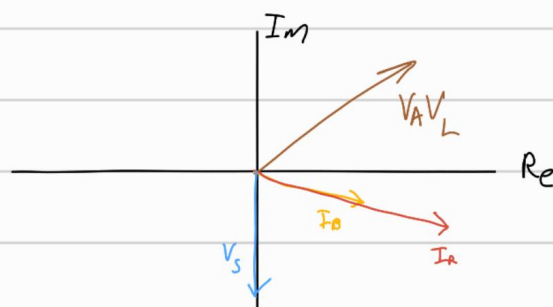
$$\therefore V_s = 3V_L \left(\frac{3}{10} - \frac{1}{3} \right)$$

$$\therefore V_L = \frac{-10 - 9j}{30} V_s = V_A = 2.49 + 2.76j = 3.7e^{j0.84}$$

$$I_R = 1.11e^{-j0.23}$$

$$I_B = 0.37e^{-j0.23}$$

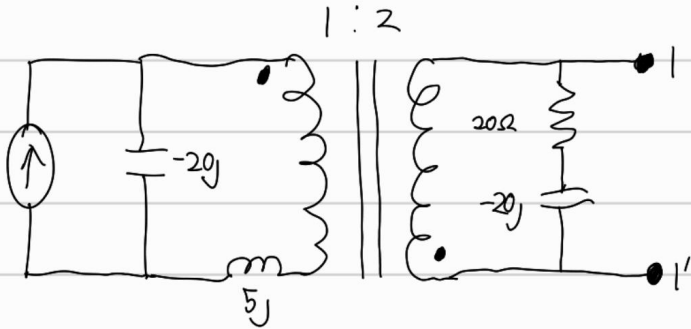
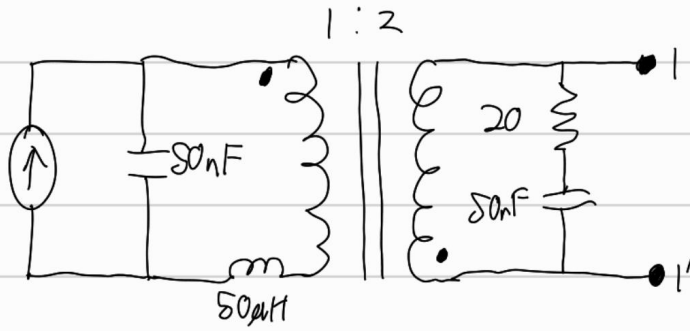
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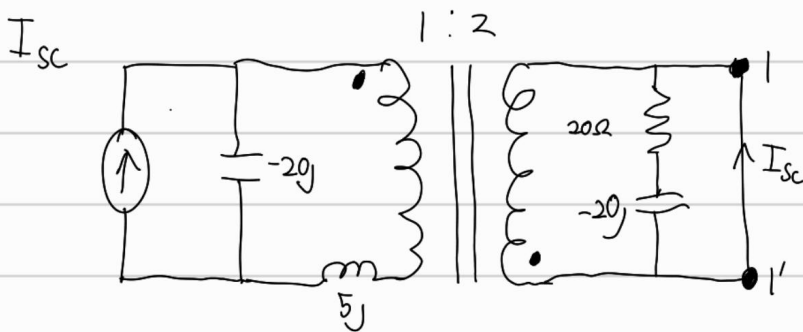
$$\textcircled{a} V_A = 3.7e^{-j0.84}$$

$$\therefore \angle V_A - \angle V_s = (2\pi - 0.84) - \frac{\pi}{2} = 7014 = .73 \text{ or } 41.9^\circ$$

⑥ $i(t) = 2 \sin(10^6 t + 120^\circ)$



$$I_s = 2e^{j\pi/6} \quad \frac{V_1}{N_1} = \frac{V_2}{N_2} \quad I_1 = -2 I_n$$



$$I_n = I_s \frac{Z_c}{Z_L + Z_c} - \frac{I_1}{2} = \frac{-2}{3} (\sqrt{3} + j) = \frac{4}{3} e^{-j\frac{5\pi}{6}}$$

$$Z_{eq} = (20 + -20j) \parallel 4 \left(j\omega L + \frac{1}{j\omega c} \right) = 20.57 e^{-j1.03}$$

