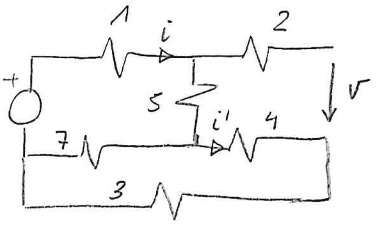
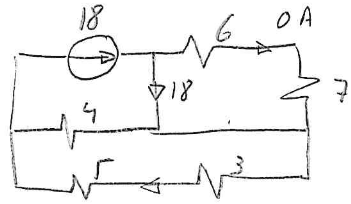
EXAMEN JUNIO 2024

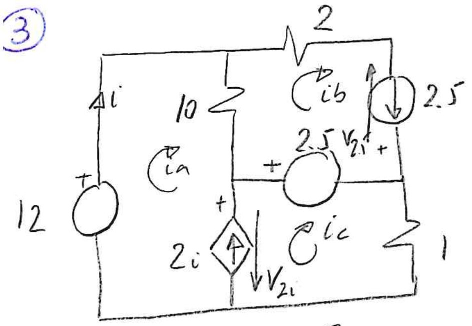
1) 

$i' = i \cdot \frac{7}{7+4+3} = \frac{7 \cdot 5}{14} = 2{,}5A$

$v = 5 \cdot i + 4 \cdot i' \Rightarrow \boxed{v = 35V}$

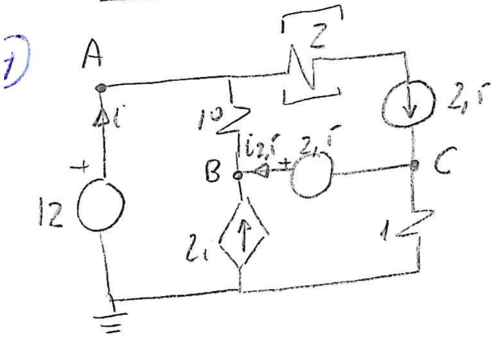
2) 

$i = 18 \cdot \frac{4}{4+5+3} = \frac{18}{3} \Rightarrow \boxed{i = 6A}$

3) 

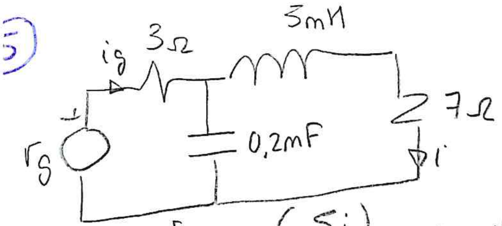
$$\begin{pmatrix} 10 & -10 & 0 \\ -10 & 12 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} i_a \\ i_b \\ i_c \end{pmatrix} = \begin{pmatrix} 12 - V_{2i} \\ 2{,}5 + V_{2,5} \\ V_{2i} - 2{,}5 \end{pmatrix}$$

$i_c - i_a = 2i \qquad i_b = 2{,}5 \qquad i = i_a$

4) 

$$\begin{pmatrix} 1/10 & -1/10 & 0 \\ -1/10 & 1/10 & 0 \\ 0 & 0 & +1/1 \end{pmatrix} \begin{pmatrix} v_A \\ v_B \\ v_C \end{pmatrix} = \begin{pmatrix} i - 2{,}5 \\ 2i + i_{2,5} \\ 2{,}5 - i_{2,5} \end{pmatrix}$$

$v_B - v_C = 2{,}5 \qquad v_A = 12$

5) 

$i(t) = 20\cos(1000t - 100^\circ) \rightarrow I = 20\angle{-100^\circ}$

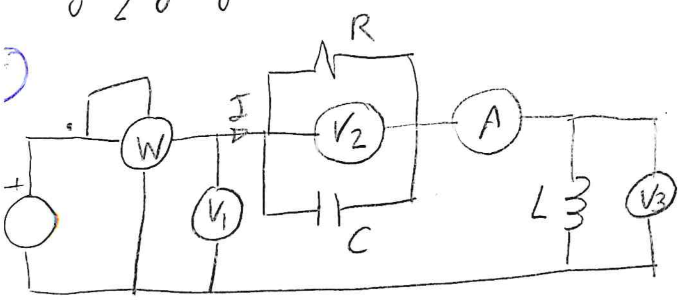
$Z_L = 1000 \cdot 10^{-3} \cdot 5j = 5j \qquad Z_C = \frac{-1}{\omega C} j = \frac{-1}{1000 \cdot 10^{-3} \cdot 0{,}2} j = -5j$

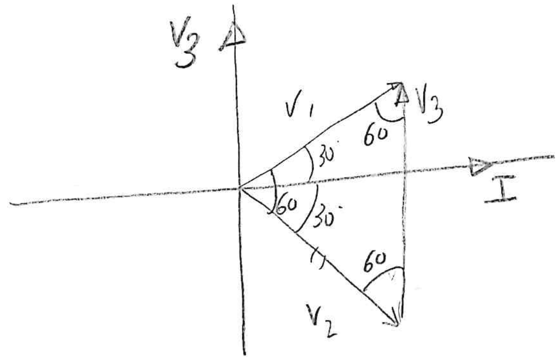
$Zeq = 3 + (-5j) \| (7+5j) = 6{,}5714 - 5j =$

$I = \frac{v_g}{Zeq} \cdot \frac{(-5j)}{7+5j-5j} \Rightarrow v_g = (I \cdot 7 \cdot Zeq)/(-5j) = 156{,}89 - 169{,}82j = 231{,}2\angle{-47{,}26^\circ}$

$v_g(t) = 231{,}2\cos(1000t - 47{,}26^\circ) \qquad I_g = 28\angle{-10^\circ}$

$S_g = \frac{1}{2} V_g I_g^* = 0{,}5 \cdot 231{,}2\angle{-47{,}26} \cdot 28\angle{10^\circ} = 3236{,}8\angle{-37{,}26} = 2576{,}15 - 1959{,}6j$

6) 



$V_1 = V_2 = V_3 = 100V$

$W = 100W = |V_1| \cdot |I| \cdot \cos(\underbrace{V_1, I}_{30}) \Rightarrow \boxed{|I| = 1{,}154A}$

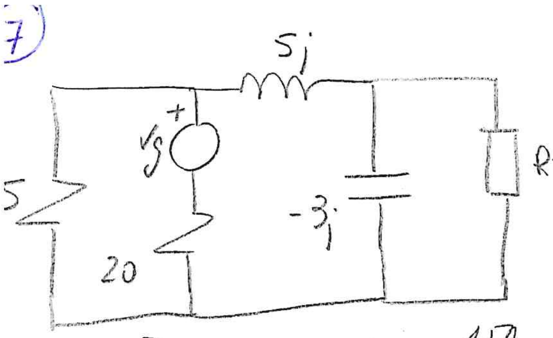
$|Z_L| = \frac{|V_3|}{|I|} = \frac{100}{1{,}154} = 86{,}6 = \omega L \Rightarrow \boxed{L = 0{,}275H}$

$100 = \frac{V_2^2}{R} \Rightarrow \boxed{R = 100\Omega}$

$|Y_{RC}| = \frac{|I|}{|V_2|} = \frac{1{,}154}{100} = \left|\frac{1}{R} + \omega C j\right| \Rightarrow \left(\frac{1{,}154}{100}\right)^2 = \left(\frac{1}{100}\right)^2 + (\omega C)^2 \Rightarrow$

$\Rightarrow \boxed{C = 18{,}37\mu F}$

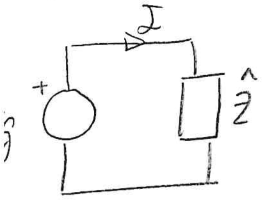
7)



$$Z_{th} = ((5 \| 20) + 5j) \| (-3j) = 1.8 - 3.9j$$

$$\boxed{R^{max} = \sqrt{1.8^2 + (2-3,9)^2} = 2,617\,\Omega}$$

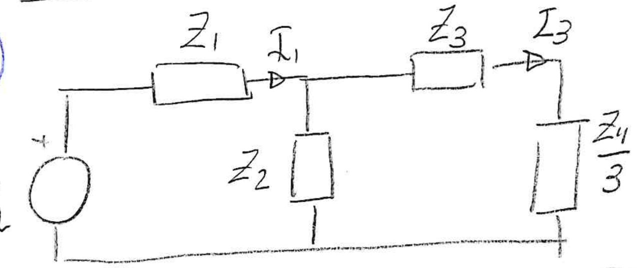
$$\hat{Z} = [(10+2j) \| (-3j) + 5j] \| (5) + 20 = 21,23 + 1.33j$$



$$V_g = \frac{150}{\sqrt{2}} \angle 0^\circ \qquad I = V_g / \hat{Z} = 4,97 - 0.31i = 4,986 \angle -3,602^\circ$$

$$S_g = V_g I^* = \frac{150}{\sqrt{2}} \angle 0^\circ \; 4,986 \angle 3,602 = 528,84 \angle 3,602 = 527,80 + 33,22j$$

8)



$$|I_3| = \sqrt{3}\,|I_4| = \sqrt{3} \cdot 10A. \qquad I_3 = 10\sqrt{3} \angle 0^\circ$$

$$I_3 = I_1 \frac{Z_2}{Z_2 + Z_3 + \frac{Z_4}{3}} \Rightarrow I_1 = 24,73 \angle 7,63^\circ$$

$$V_a = Z_1 I_1 + \left(Z_3 + \frac{Z_4}{3}\right) I_3 = 196,9 \angle 61,81^\circ$$

$$\boxed{|V| = \sqrt{3}\,|V_a| = 341,05\,V} \qquad \boxed{A = 24,73\,A}$$

$$P = 3 \cdot |V_a| \cdot |I_1| \cdot \cos(V_a; I_1) = 3 \cdot 196,9 \cdot 24,73 \cdot \cos(61,81 - 7,63) = 8549,20W$$

$$C^\Delta = \frac{P(tg\,\phi - tg\,\phi')}{2\pi f V^2} = \frac{8549,20 \cdot tg(61,81 - 7,63)}{2\pi\, 50\, (341,05)^2} = 324,15\mu F \;\Big|\; \boxed{C^\lambda = 108,05\mu F}$$

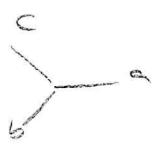
9)

$$C_1 = \begin{cases} P_1 = 11KW \\ \cos\phi_1 = 0,8(ind) \to Q_1 = 8,25KVAr \end{cases} \qquad C_2 \begin{cases} 15KVA \\ \cos\phi_2 = 0,5(ind) \end{cases} \quad \begin{matrix} P_2 = 7,5KW \\ Q_2 = 13KVAr \end{matrix}$$

$$S_{12} = \sqrt{(11+7,5)^2 + (8,25+13)^2} = 28,1746 = \sqrt{3} \cdot |V_1| \cdot |A_1| \Rightarrow \boxed{|A_1| = 42,806A}$$

$$C_3 = \begin{cases} P_3 = 3KW \\ Q_3 = -3,7KVAr \end{cases} \qquad S_{123} = \sqrt{(11+7,5+3)^2 + (8,25+13-3,7)^2} = 27,75KVA$$

$$S_{123} = \sqrt{3} \cdot |V_1| \cdot |A_2| \Rightarrow \boxed{|A_2| = 42,167A}$$



$$P_L = 3 \cdot 0,2 \cdot A_2^2 = 1,066KW \qquad Q_L = 3 \cdot 0,4 \cdot A_2^2 = 2,133KVAr$$

$$P_T = P_1 + P_2 + P_3 + P_L = 22,566kW \qquad Q_T = Q_1 + Q_2 + Q_3 + Q_L = 19,683KVAr$$

$$W_1 + W_3 = P_T \Rightarrow W_1 = P_T - W_3 \Rightarrow \boxed{W_1 = 19,964KW}$$

$$\sqrt{3}(W_1 - W_3) = Q_T \Rightarrow \sqrt{3}(P_T - 2W_3) = Q_T \Rightarrow \frac{P_T - \frac{Q_T}{\sqrt{3}}}{2} = W_3 \Rightarrow \boxed{W_3 = 5,601KW}$$

$$Q_T = +\sqrt{3} \cdot W_2 \Rightarrow W_2 = Q_T/\sqrt{3} \Rightarrow \boxed{W_2 = 11,36KW}$$

$$S_T = \sqrt{3} \cdot |V_2| \cdot |A_2| \Rightarrow \boxed{|V_2| = 409,99V}$$