

CSE 250 FINAL ASSIGNMENT

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SECTION: 06

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CSE250 FINAL ASSIGNMENT

$$(i) (1) I = 2 \cos(\omega t + 10^\circ) \rightarrow 2 \angle 10^\circ$$

$$V = 3 \sin(\omega t - 10^\circ) = 3 \cos(\omega t - 10^\circ - 90^\circ) = 3 \cos(\omega t - 100^\circ) \rightarrow 3 \angle -100^\circ$$

$$\text{phase difference} = 10 - (-100) = 110^\circ$$

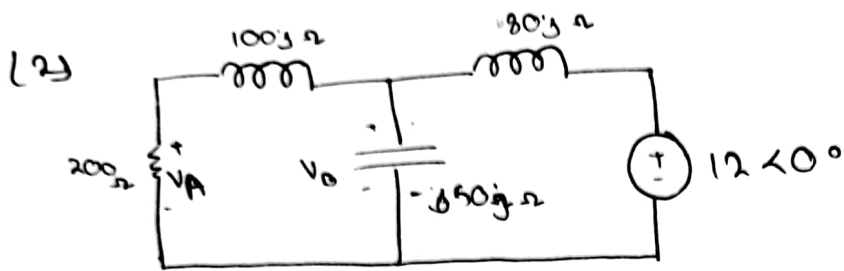
I is leading V.

$$(ii) I = 16 \cos(\omega t + 10^\circ) \rightarrow 16 \angle 10^\circ$$

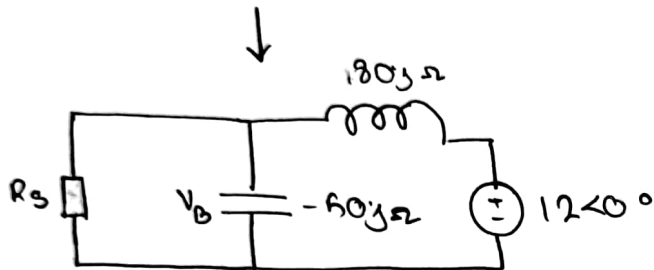
$$\begin{aligned} V &= -20 \sin(\omega t - 10^\circ) = 20 \cos(\omega t - 10^\circ + 180^\circ - 90^\circ) \\ &= 20 \cos(\omega t + 80^\circ) \rightarrow 20 \angle 80^\circ \end{aligned}$$

$$\text{phase difference} = 80^\circ - 10^\circ = 70^\circ$$

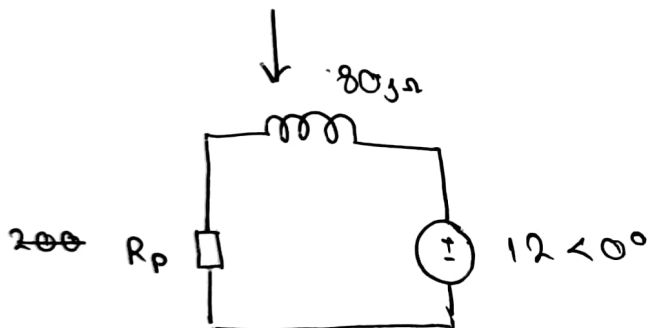
V is leading I.



$$R_B = (100j + 200)\Omega$$



$$\begin{aligned} R_P &= \frac{1}{\frac{1}{-50j} + \frac{1}{R_S}} \\ &= -50j \parallel (100j + 200) \\ &= \frac{200}{17} - \frac{900}{17}j \end{aligned}$$

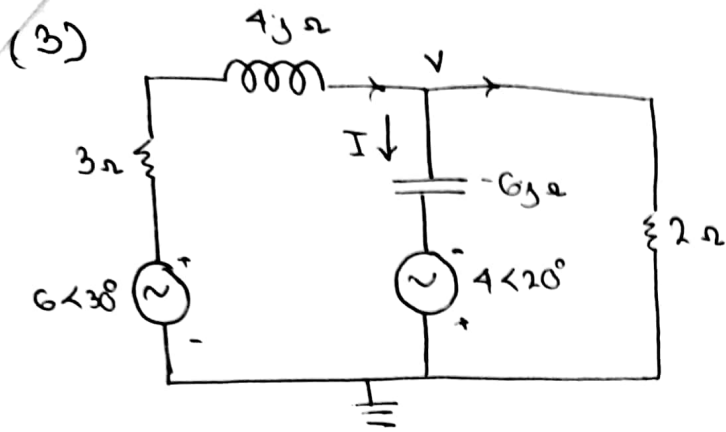


$$V_B = \frac{\frac{200}{17} - \frac{900}{17}j}{80j + \left(\frac{200}{17} - \frac{900}{17}j\right)} \times 12\angle 0^\circ$$

$$V_B = -\frac{660}{37} - \frac{480}{37}j \Rightarrow V_B = 22.06\angle -143.97^\circ$$

$$V_A = \frac{200}{(100j + 200)} \times 22.06\angle -143.97^\circ$$

$$V_A = -\frac{720}{37} - \frac{120}{37}j \Rightarrow V_A = 19.73\angle -170.54^\circ$$



KCL at V,

$$\frac{6\angle 30^\circ - V}{3 + 4j} = \frac{V - 0}{-6j} + \frac{V + 4\angle 20^\circ}{2}$$

$$(0.12 - 0.16j)(6\angle 30^\circ) = \frac{V}{-6j} + \frac{1}{6j}(V + 4\angle 20^\circ)$$

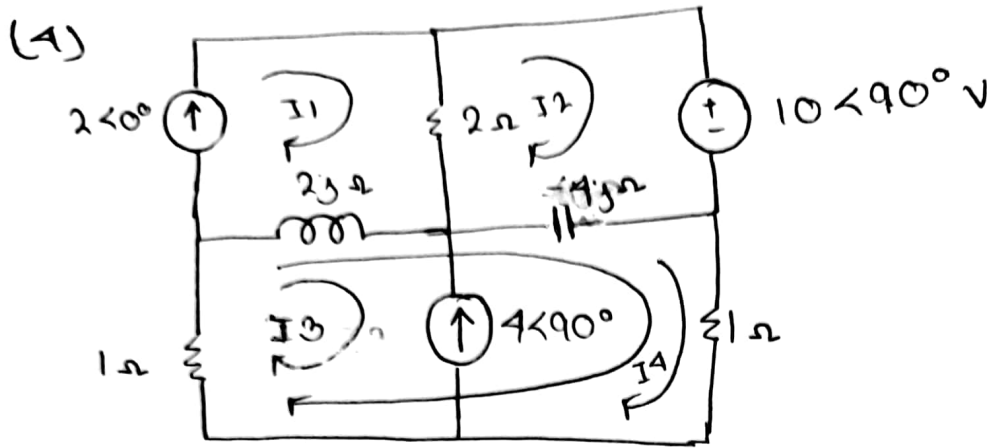
$$\frac{V}{-6j} = \frac{1}{6j}V + V(0.12 - 0.16j) = (0.12 - 0.16j)(6\angle 30^\circ) - \frac{1}{6j}(4\angle 20^\circ)$$

$$V = 2.78 \angle -40.12^\circ$$

$$I = \frac{V + 4\angle 20^\circ}{-6j}$$

$$= \frac{2.78 \angle -40.12^\circ + 4\angle 20^\circ}{-6j}$$

$$I = 0.984 \angle 85.87^\circ$$



$$I_1 = 2 \angle 0^\circ \text{ A}$$

KVL at loop 3 and 4

$$2j(I_3 - 2 \angle 0^\circ) + 1(4) + 1(I_3) - 4j(I_4 - I_2) = 0$$

$$(2j + 1)I_3 + (1 - 4j)I_4 + (4j)I_2 = 4j$$

KVL at loop 2

$$10 \angle 90^\circ + 2(I_2 - 2 \angle 0^\circ) - 4j(I_2 - I_4) = 0$$

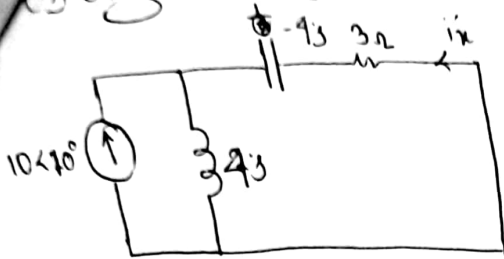
$$(2 - 4j)I_2 + (4j)I_4 = (-4 + 10j) \text{ V}$$

KCL at supermesh

$$I_4 - I_3 = 4 \angle 90^\circ$$

$$I_4 - I_3 = 4j$$

(A) only $10\cos(2t + 10^\circ)\text{A}$ is active



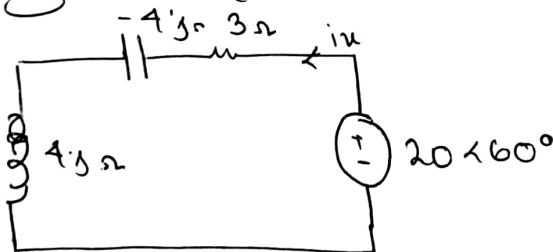
$$2H = (2j)(2) = 4j$$

$$3\Omega \frac{1}{8}F = \frac{1}{(2)(\frac{1}{8}j)} = -4j$$

$$i'_x = \frac{(4j \parallel (3 - 4j)) \times 10\angle 10^\circ}{(3 - 4j)}$$

$$i'_x = 13.333\angle -80^\circ$$

only $20\cos(2t + 60^\circ)\text{V}$ is active



$$2H = 2(2j) = 4j$$

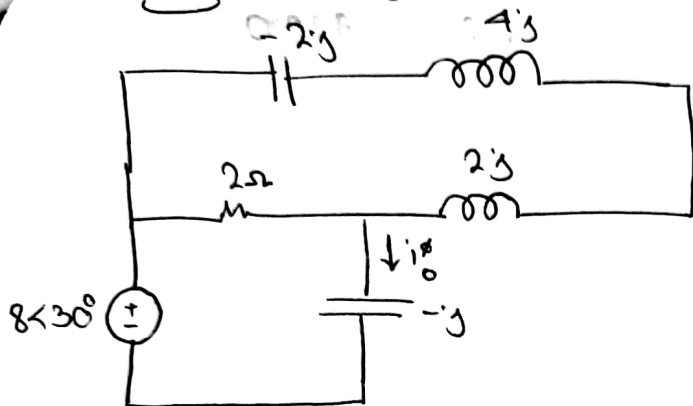
$$\frac{1}{8}F = \frac{1}{(2)(\frac{1}{8}j)} = -4j$$

$$i''_x = \frac{20\angle 60^\circ}{4j - 4j + 3} \Rightarrow i''_x = 6.667\angle 60^\circ$$

$$\begin{aligned} i_x &= i'_x + i''_x = 13.333\angle -80^\circ + 6.667\angle 60^\circ \\ &= 9.276\angle -52.48^\circ \\ &= 9.276\cos(2t - 52.48^\circ) \end{aligned}$$

$$b) \omega_1 = 9 + 8 = 17$$

Only $8 \sin(2t + 30^\circ) \text{ V}$ is active



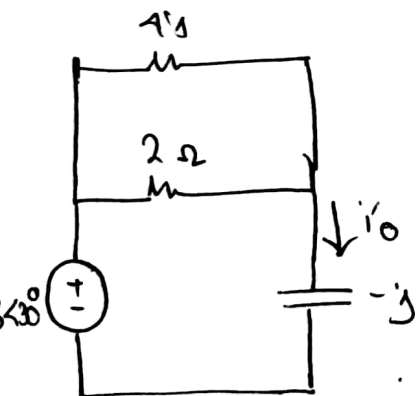
$$R_s = (-2j + 4j + 2j) = 4j$$

$$0.25 \text{ F} = \frac{1}{(0.25)(2j)} = -2j$$

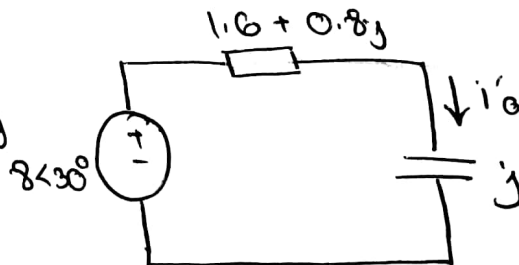
$$2 \text{ H} = (2j)(2j) = 4j$$

$$0.5 \text{ F} = \frac{1}{(0.5)(2j)} = -j$$

$$1 \text{ H} = (1)(2j) = 2j$$

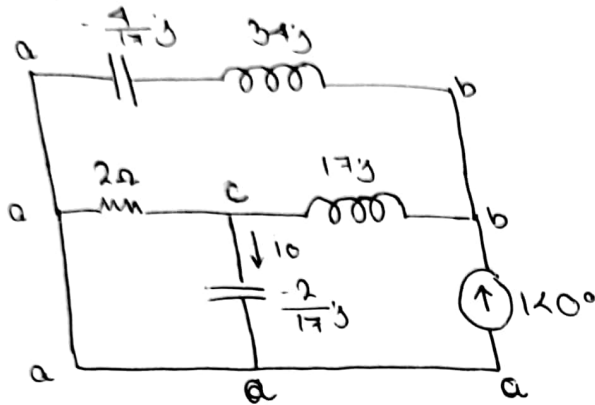


$$R_p = 4j \parallel 2 = 1.6 + 0.8j$$



$$i'_0 = \frac{8 \angle 30^\circ}{(1.6 + 0.8j - j)} \Rightarrow i'_0 = 4.96 \angle 37.1^\circ$$

Only $\cos 17t$ A is active



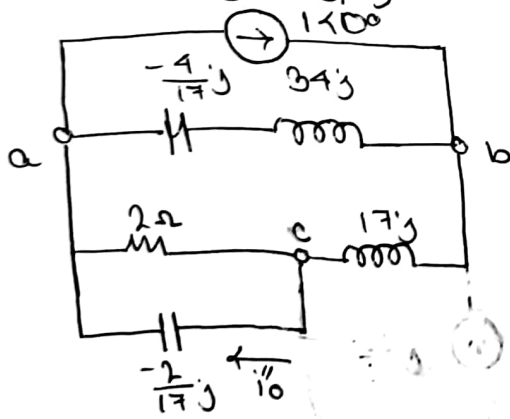
$$\omega_1 = 9 + 8 = 17$$

$$0.25F = \frac{1}{(0.25)(17j)} = -\frac{4}{17}j$$

$$2H = (2)(17j) = 34j$$

$$1H = (1)(17j) = 17j$$

$$0.5F = \frac{1}{(0.5)(17j)} = -\frac{2}{17}j$$



$$i''_0 = -\left(\frac{-\frac{2}{17}j \parallel 2}{-\frac{2}{17}j}\right) \times 0.667 \angle 7.81 \times 10^3$$

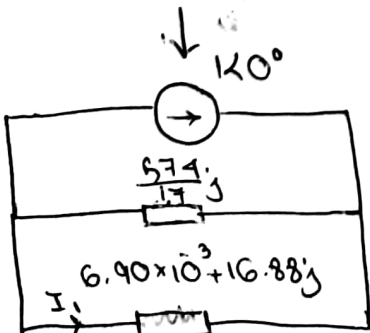
$$i''_0 = 6.66 \times 10^{-4} \angle -168.8^\circ$$

$$i_0 = i''_0 + i'_0$$

$$= (4.96 \angle 37.1^\circ) + (6.66 \times 10^{-4} \angle -168.8^\circ)$$

$$i_0 = 4.96 \sin(2t + 37.1^\circ)$$

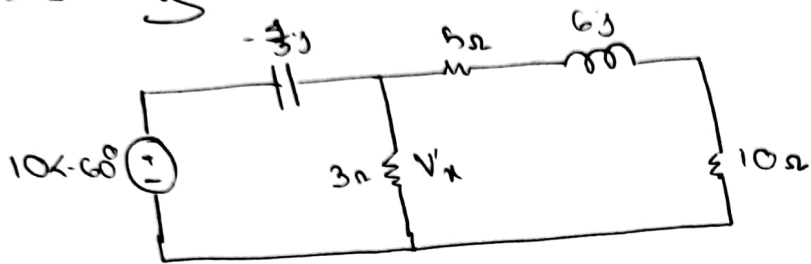
$$+ 6.66 \times 10^{-4} \cos(17t - 168.8^\circ)$$



$$I_1 = \frac{6.90 \times 10^{-3} + 16.88j \parallel \frac{574}{17}j}{6.90 \times 10^{-3} + 16.88j} \times 1 \angle 0^\circ$$

$$I_1 = 0.667 \angle 0^\circ + 9.08 \times 10^{-5}j \Rightarrow I_1 = 0.667 \angle 7.81 \times 10^3$$

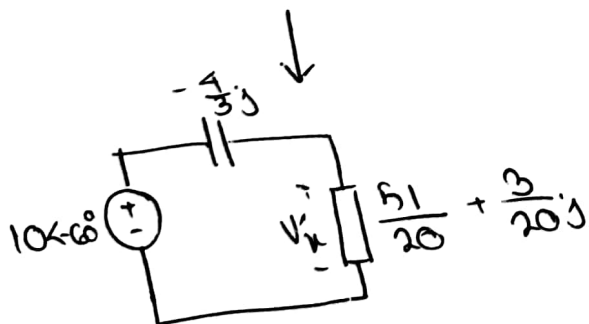
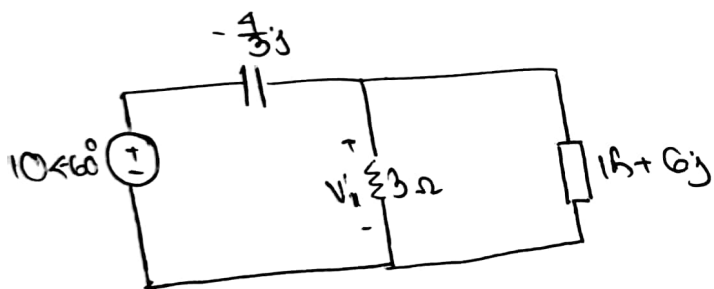
7) Only $10\cos(\omega t - 60^\circ)$ V source is active



$$\omega_1 = 2 + 1 = 3$$

$$0.25F = \frac{1}{(0.25)(3)j} = -\frac{4}{3}j$$

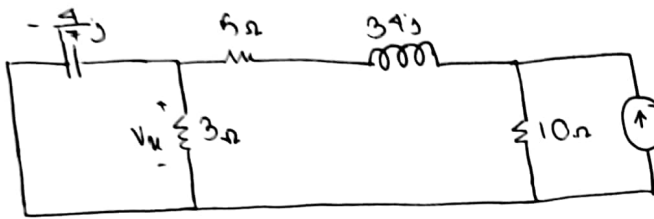
$$2H = (2)(3)j = 6j$$



$$V'_x = \frac{\frac{51}{30} + \frac{3}{20}j}{\left(\frac{51}{30} + \frac{3}{20}j\right) + \left(-\frac{4}{3}j\right)} \times 10\angle -60^\circ$$

$$V'_x = 9.09 \angle -31.74^\circ$$

Only $-4\sin(\omega_2 t + 66^\circ) \text{ A}$ is active

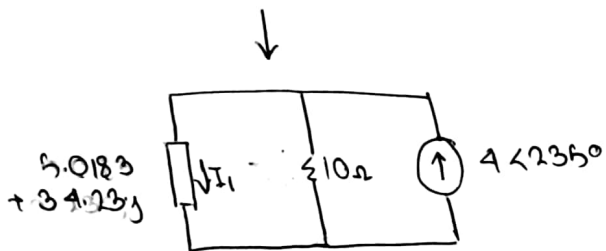
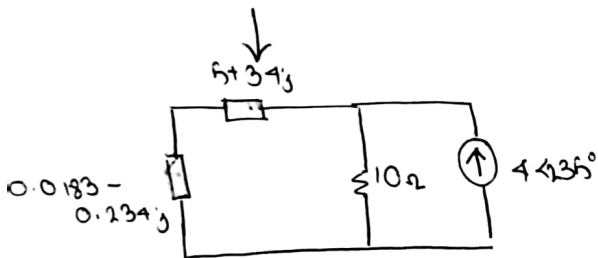
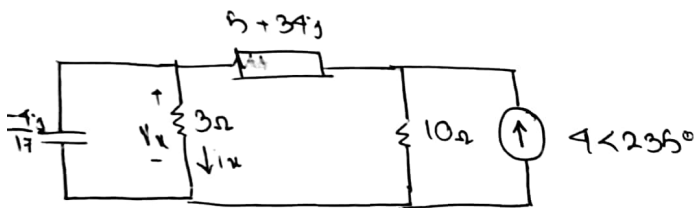


$$-4\sin(17t + 66^\circ) = 4\sin(17t + 236^\circ) = 4\angle 236^\circ$$

$$\omega_2 = 9 + 8 = 17$$

$$0.25 \text{ F} = \frac{1}{(0.25)(17)j} = -\frac{4}{17}j$$

$$2 \text{ H} = (2)(17)j = 34j$$



$$I_1 = \frac{10 \parallel (5.0183 + 34.23j)}{5.0183 + 34.23j} \times 4\angle 236^\circ$$

$$I_1 = 1.07\angle 168.7^\circ$$

$$V_1 = \frac{5.0183 + 34.23j}{3} \times 1.07\angle 168.7^\circ$$

$$V_1 = 12.34\angle -109.65^\circ$$

$$V''_x = (12.34\angle -109.65^\circ)(3)$$

$$V''_x = 37.02\angle -109.65^\circ$$

$$V_x = V'_x + V''_x$$

$$= 9.09\angle -31.74^\circ + 37.02\angle -109.65^\circ$$

$$= 9.09\cos(3t - 31.74^\circ)$$

$$+ 37.02\sin(17t - 109.65^\circ)$$