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On my honor, I have neither given nor received any unauthorized and or inappropriate assistance for this exam. The work done on this exam is totally my own. I understand by school code, violation of these principles will lead to a zero grade and is subject to harsh discipline issues.

Q2)

$$\frac{d^2V_c(t)}{dt^2} + \frac{R}{L}\cdot\frac{dV_c(t)}{dt} + \frac{1}{LC}\cdot V_c(t) = \frac{V_s}{LC}$$

$$\frac{d^2V_c(t)}{dt^2} + \frac{R}{10\cdot10^{-3}}\cdot\frac{dV_c(t)}{dt} + \frac{1}{(10\cdot10^{-3})(10^{-6})}\cdot V_c(t) = \frac{10}{(10\cdot10^{-3})\cdot(10^{-6})}$$

$$\frac{d^2V_c(t)}{dt^2} + 100R\cdot\frac{dV_c(t)}{dt} + 10^8\cdot V_c(t) = 10^9 \qquad R = 200\,\Omega$$

$$\frac{d^2V_c(t)}{dt^2} + 20000R\cdot\frac{dV_c(t)}{dt} + 10^8\cdot V_c(t) = 10^9$$

$$= 0$$

$$s^2 + 20000s + 10^8 = 0 \qquad s = -10000$$

$$V_c(t) = K_1\cdot e^{-10000t} + 10 \qquad V_c(0) = K_1\cdot e^{-10000t} + 10 = 0$$

$$K_1 = -10$$

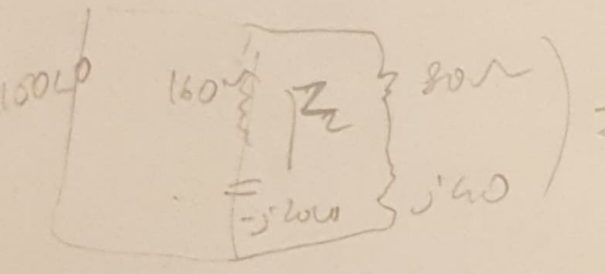
$$= 10^{-6}\left[-10000K_1\cdot e^{-10000}\right] = 0$$

$$\boxed{V_c(t) = (10 - 10\cdot e^{-10000t})\cdot V}$$

Q5)

$$X_C = \frac{-j}{\omega C} = \frac{-j \cdot 10^6}{2000 \cdot 5} = -j100\,\Omega$$

$$X_L = j\omega L = j(2000 \cdot 24 \cdot 10^{-3}) = j48\,\Omega$$




$$Z_1 = 80 + j48$$

$$Z_2 = 160 - j200$$

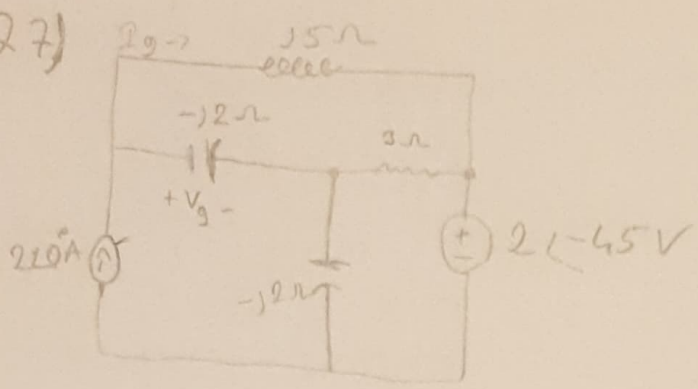
$$I_1 = \frac{(150\angle 0)(80+j48)}{160-j200+80+j48} = \frac{(150)(\sqrt{80^2+48^2}\angle \tan^{-1}(\frac{48}{80}))}{240-j\cdot 52}$$

$$= \frac{(150)(93.3\angle 43.83°)}{245.56\angle -12.22°} = 57\angle 56.05°$$

$$V_0 = (I_1)(160) = (57\angle 56.05°)(160) = 9120\angle 56.05°$$

$$V_0 = 9120 \cdot \cos(2000t + 56.05°)$$

Q7)




$$-2\angle 0^\circ + \frac{V_1 - 2\angle -45^\circ}{j5} + \frac{V_1 - V_2}{-j2} = 0$$

$$V_1\left[\frac{1}{j5} - \frac{1}{j2}\right] + V_2\left[\frac{1}{j2}\right] = 2\angle 0^\circ + \frac{2\angle -45^\circ}{j5}$$

$$\frac{V_2 - V_1}{-j2} + \frac{V_2}{-j2} + \frac{V_2 - 2\angle -45^\circ}{3} = 0$$

$$V_1(0.5i) + V_2[1.0541\angle 71.565^\circ) = \frac{2}{3}\angle -45^\circ$$

$$V_1 = -1.3253 + i(-3.62) \qquad V_2 = -0.2295 + i\,1.2622$$

$$V_g = V_1 - V_2 = -1.3253 - i\,3.62 - (-0.2295 + i\,1.2622)$$

$$V_g = -1.0958 - 4.8822\,i$$

$$\boxed{V_g = 5\angle -102.65^\circ\ V}$$

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