7.0 RESISTANS - SPOLE - KONDENSATOR

7.1 RESISTANS - SPOLE - KONDENSATOR TILKOPLET VEKSELSTRØM ENKELTVIS.

7.1.1

$$R = \frac{U}{I} = \frac{230V}{5A} = \underline{\underline{46\Omega}}$$

7.1.2

a) $X_L = 2 \cdot \pi \cdot f \cdot L = 2 \cdot \pi \cdot 50Hz \cdot 63,7 \cdot 10^{-3}H = \underline{\underline{20\Omega}}$

b) $Z = X_L = \underline{\underline{20\Omega}}$ (for en ideell spole)

$$I = \frac{U}{X_L} = \frac{230V}{20\Omega} = \underline{\underline{11,5A}}$$

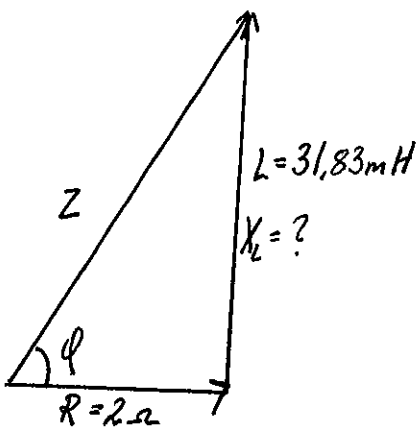
7.1.3

a) $X_C = \frac{1}{2 \cdot \pi \cdot f \cdot C} = \frac{1}{2 \cdot \pi \cdot 50Hz \cdot 45,47 \cdot 10^{-6}F} = \underline{\underline{70\Omega}}$

b) $Z = X_C = \underline{\underline{70\Omega}}$ (for en ideell kondensator)

$$I = \frac{U}{X_C} = \frac{230V}{70\Omega} = \underline{\underline{3,29A}}$$

7.1.4



a) $X_L = 2 \cdot \pi \cdot f \cdot L = 2 \cdot \pi \cdot 50Hz \cdot 31,83 \cdot 10^{-3}H = \underline{\underline{10,0\Omega}}$

b) $\bar{Z} = R + jX_L = 2\Omega + j10\Omega = \underline{\underline{10,2\Omega}} \angle\varphi = \underline{\underline{78,7°}}$

eller:

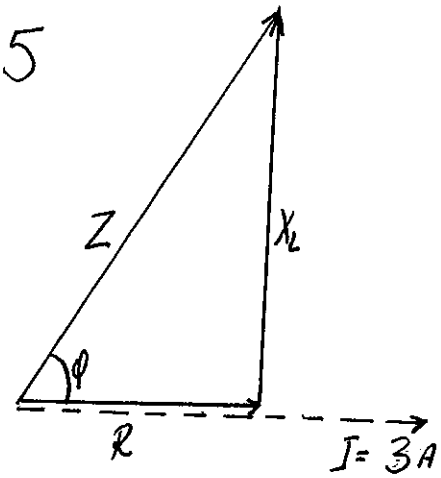
$Z = \sqrt{R^2 + X_L^2} = \sqrt{2\Omega^2 + 10\Omega^2} = \underline{\underline{10,2\Omega}}$ $\cos\varphi = \frac{R}{Z} = \frac{2}{10\Omega} = \underline{\underline{0,196}}$

$\angle\varphi = \underline{\underline{78,7°}}$ ($\angle\varphi = \cos^{-1}0,196 = 78,7°$)

c) $\cos\varphi = \cos 78,7° = \underline{\underline{0,196}}$

d) $I = \frac{U}{Z} = \frac{110V}{10,2\Omega} = \underline{\underline{10,8A}}$

7.1.5



a) Likestrøm gir resistansen i spolen:

$$R = \frac{U}{I} = \frac{100V}{20A} = \underline{5\Omega}$$

b) Vekselstrøm gir impedansen i spolen:

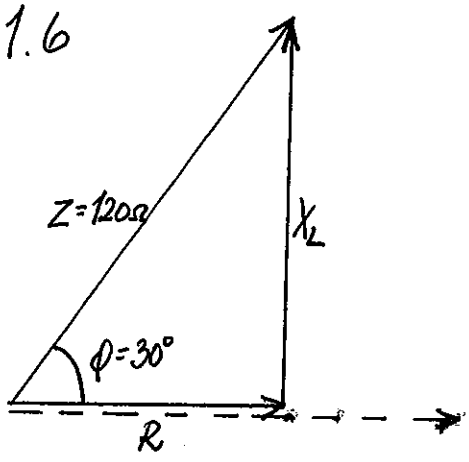
$$Z = \frac{U}{I} = \frac{210V}{3A} = \underline{70\Omega}$$

c) $X_L = \sqrt{Z^2 - R^2} = \sqrt{70\Omega^2 - 5\Omega^2} = \underline{69{,}8\Omega}$

$$X_L = 2 \cdot \pi \cdot f \cdot L \qquad L = \frac{X_L}{2 \cdot \pi \cdot f} = \frac{69.8\Omega}{2 \cdot \pi \cdot 50Hz} = \underline{222{,}2\,mH}$$

d) $\cos\varphi = \frac{R}{Z} = \frac{5\Omega}{70\Omega} = \underline{0{,}0714} \qquad \angle\varphi = \underline{85{,}9°}$

7.1.6



a) $\cos\varphi = \frac{R}{Z}$

$R = \cos\varphi \cdot Z = \cos 30° \cdot 120\Omega = \underline{103{,}9\Omega}$

$\sin\varphi = \frac{X_L}{Z}$

$X_L = \sin\varphi \cdot Z = \sin 30° \cdot 120\Omega = \underline{60{,}0\Omega}$

b) $\cos\varphi = \frac{R}{Z} = \frac{103{,}9\Omega}{120{,}0\Omega} = \underline{0{,}866}$

c) $X_L = 2 \cdot \pi f \cdot L \qquad L = \frac{X_L}{2 \cdot \pi \cdot f} = \frac{60{,}0\Omega}{2 \cdot \pi \cdot 60Hz} = \underline{159{,}2\,mH}$

7.1.7

$$\bar{Z} = R + jX_L = 13\Omega + j25\Omega = \underline{28{,}2\Omega} \quad \angle\varphi = \underline{62{,}5°}$$

7.1.8

$$\bar{Z} = Z \angle \varphi = 10\,\Omega \angle 53{,}13° = \underline{\underline{6{,}0\,\Omega + j\ 8{,}0\,\Omega}}$$

7.1.9

Resistans → Resistans R

Spole → Selvinduktans L

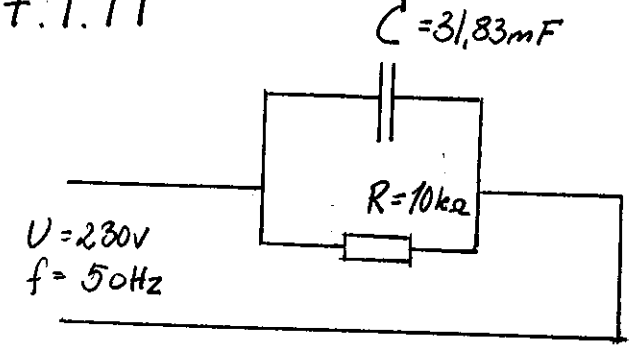
Kondensator → kapasitans C

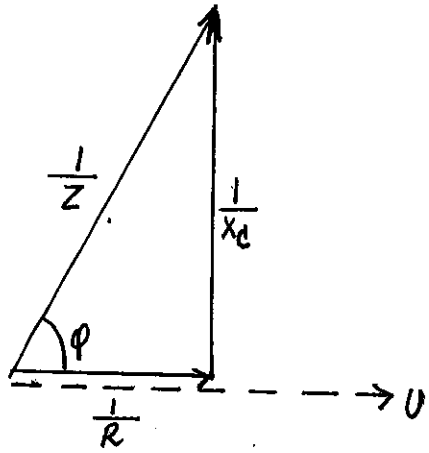
7.1.10

$$X_C = \frac{1}{2 \cdot \pi \cdot f \cdot C} = \frac{1}{2 \cdot \pi \cdot 60\,Hz \cdot 26{,}52 \cdot 10^{-6}\,F} = \underline{\underline{100\,\Omega}}$$

$$I = \frac{U}{X_C} = \frac{440V}{100\,\Omega} = \underline{\underline{4{,}4A}}$$

7.1.11





$$X_C = \frac{1}{2 \cdot \pi \cdot f \cdot C} = \frac{1}{2 \cdot \pi \cdot 50\,Hz \cdot 31{,}83 \cdot 10^{-3}\,F} = \underline{\underline{100\,\Omega}}$$

$$\bar{Z} = \frac{R \cdot jX_C}{R + jX_C} = \frac{10 \cdot 10^3\,\Omega \cdot j\,100\,\Omega}{10 \cdot 10^3\,\Omega + j\,100\,\Omega} = \frac{0 + j\ 1{,}0 \cdot 10^6\,(\Omega^2)}{10 \cdot 10^3\,\Omega + j\,100\,\Omega} = \frac{1{,}0 \cdot 10^6\,\Omega \angle 90°}{10000{,}5\,\Omega \angle 0{,}573°}$$

$$\bar{Z} = \underline{9999} \approx \underline{\underline{100\,\Omega}}$$

$$\angle \varphi = \angle \varphi_1 - \angle \varphi_2 = 90° - 0{,}573° = \underline{\underline{89{,}43°}}$$

7.1.12

a) $X_C = \frac{1}{2\pi \cdot f \cdot C} = \frac{1}{2 \cdot \pi \cdot 60\,Hz \cdot 53{,}05 \cdot 10^{-6}\,F} = \underline{\underline{50{,}0\,\Omega}}$

b) $\underline{Z} = \frac{R \cdot jX_C}{R + jX_C} = \frac{7{,}0 \cdot 10^3\,\Omega \cdot j\,50{,}0\,\Omega}{7{,}0 \cdot 10^3\,\Omega + j\,50{,}0\,\Omega} = \frac{0 + j\,0{,}35 \cdot 10^6\,(\Omega^2)}{7{,}0 \cdot 10^3\,\Omega + j\,50{,}0\,\Omega} =$

$= \frac{350 \cdot 10^3\,\Omega \angle 90°}{7000{,}18\,\Omega \angle 0{,}409°} = \underline{\underline{50{,}0\,\Omega}}$

$\angle\varphi = \angle\varphi_1 - \angle\varphi_2 = 90° - 0{,}409° = \underline{\underline{89{,}59°}}$ c) $\cos\varphi = \underline{\underline{0{,}00714}}$

7.1.13

$Z = X_L = \frac{U}{I} = \frac{200\,V}{0{,}5\,A} = 400\,\Omega$

$X_L = \frac{1}{2 \cdot \pi \cdot f \cdot C} \Rightarrow f = \frac{1}{2 \cdot \pi \cdot C \cdot X_C} = \frac{1}{2 \cdot \pi \cdot 23{,}87 \cdot 10^{-6}\,F \cdot 400\,\Omega} = \underline{\underline{16{,}67\,Hz}}$

7.1.14

Likestrøm:

$R = \frac{U}{I} = \frac{115\,V}{30\,A} = \underline{3{,}83\,\Omega}$

Vekselstrøm:

$Z = \frac{U}{I} = \frac{350\,V}{35\,A} = \underline{10\,\Omega}$

$X_C = \sqrt{Z^2 - R^2} = \sqrt{10\,\Omega^2 - 3{,}83\,\Omega^2} = \underline{9{,}24\,\Omega}$

$X_L = 2 \cdot \pi \cdot f \cdot L \Rightarrow f = \frac{X_L}{2 \cdot \pi \cdot L} = \frac{9{,}24\,\Omega}{2 \cdot \pi \cdot 58{,}80 \cdot 10^{-3}\,H} = 25{,}0\,Hz$