Module name: **Electrical Circuits 1**
Module ID: **IS-FEE-10070W**
Module type: **Class**
Semester: **winter 2024/2025**
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Class 09 (09.12.2024)

1. Based on phasor representation, express the voltage and current signals as time functions in the form $f(t) = F_m \sin(\omega t + \varphi)$.

a) $\underline{U_1} = 100e^{j30^\circ}\ V$

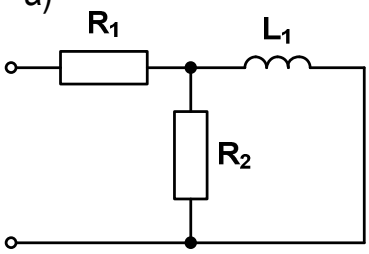
b) $\underline{I_1} = e^{j90^\circ} A$

c) $\underline{U_2} = (20 + j45)\ V$

d) $\underline{I_2} = (5 - j5)\ A$

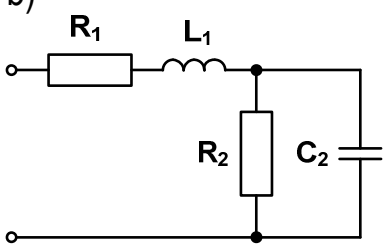
2. Find the equivalent impedance and admittance of circuits shown below.

a)



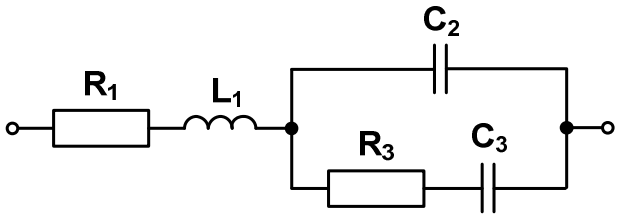
$R_1 = 5\ \Omega$
$R_2 = 20\ \Omega$
$L_1 = 100$ mH
f = 50 Hz

b)



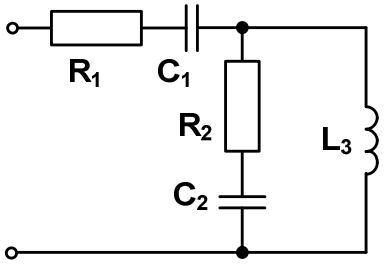
$R_1 = 25\ \Omega$
$L_1 = 50$ mH
$R_2 = 100\ \Omega$
$C_2 = 10\ \mu$F
f = 50 Hz

c)



$R_1 = 10\ \Omega$, $R_3 = 20\ \Omega$
$L_1 = 50$ mH, $C_2 = 2$ mF
$C_3 = 1$ mF
$\omega = 100$ rad/s

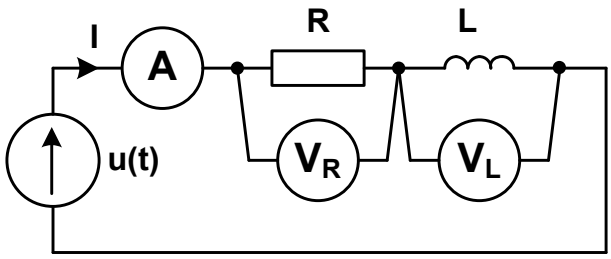
d)



$R_1 = 10\ \Omega$, $R_2 = 5\ \Omega$
$X_{C1} = 20\ \Omega$, $X_{C2} = 10\ \Omega$
$X_{L3} = 20\ \Omega$

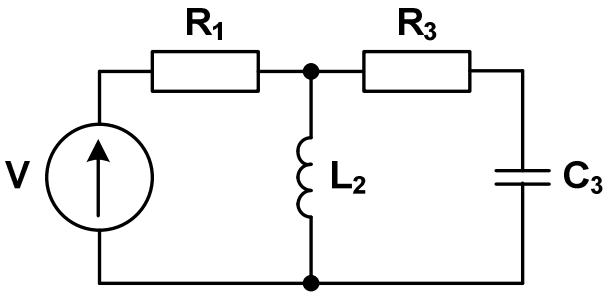
3. Calculate the **meter readings** in the circuit shown in the figure.

$u(t) = 230\sqrt{2}\sin\omega t$ V,
$R = 40\ \Omega$, $L = 0.2$ H, $f = 50$ Hz.



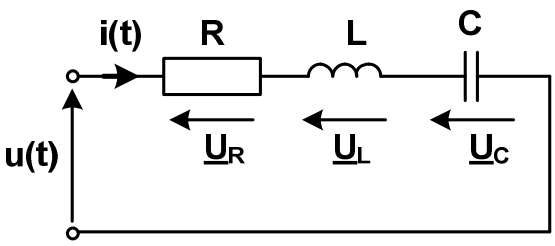
4. In the circuit as shown in the figure, the resistor $\mathbf{R_3}$ has the maximum power of $\mathbf{P_3 = 8\ W}$. Check if this is sufficient for the correct operation of the system.

$V = 24\angle 60°$ V, $R_1 = 4\ \Omega$, $X_{L2} = 6\ \Omega$,
$R_3 = 8\ \Omega$, $X_{C3} = 4\ \Omega$.



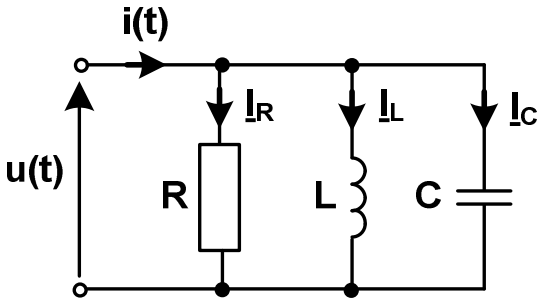
5. Calculate the current i(t) and the voltage drops $\underline{U}_R$, $\underline{U}_L$, and $\underline{U}_C$ in the circuit shown below. Draw a phasor diagram for this circuit.

$R = 20\ \Omega$, $L = 20$ mH, $C = 100\ \mu$F,
$u(t) = 100\sqrt{2}\cos(\omega t)$ V, $\omega = 10^3$ rad/s.



6. Calculate the currents i(t), $\underline{I}_R$, $\underline{I}_L$, and $\underline{I}_C$ in the circuit shown below. Draw a phasor diagram for this circuit.

$R = 20\ \Omega$, $L = 20$ mH, $C = 100\ \mu$F,
$u(t) = 100\sqrt{2}\cos(\omega t)$ V, $\omega = 10^3$ rad/s.



7. Calculate all currents and voltages in the circuit shown in the figure. Determine the active, reactive, and apparent power consumed by the circuit. Design a phasor diagram for the circuit. $\underline{U} = (10 + j10)$ V, $R_1 = 1\ \Omega$, $R_2 = 5\ \Omega$, $X_{C1} = X_{L2} = X_{L3} = 5\ \Omega$