Departement Physik
Universität Basel
Prof. E. Meyer / PD. T. Glatzel
Contact person: Miguel J. Carballido
miguel.carballido@unibas.ch
Office: 1.12
Tel.: +41 (0)61 207 36 91
http://adam.unibas.ch

Exercises and Complements for the Introduction to Physics II

for Students

of Biology, Pharmacy and Geoscience

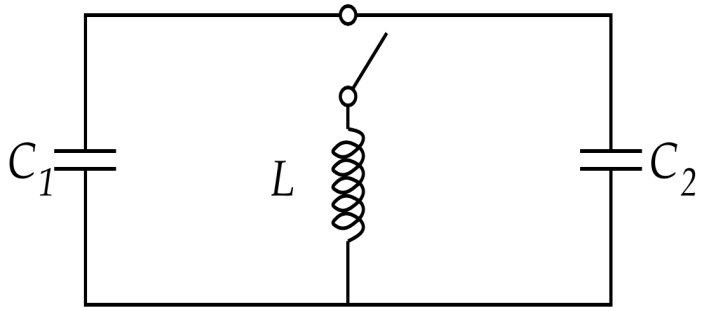
Sheet 6 / 06.04.2022 Discussion: **12.04.2022 / 13.04.2022**

Exercise 21.

In an AC circuit (U_{eff} = 220 V, I_{eff} = 100 A, f = 50 Hz), a coil and an ohmic resistor are connected in series. The time averaged value of the electrical power is $\overline{P} = 15$ kW.

(a) Calculate the power factor $\cos(\varphi)$ and the phase angle φ between current and voltage.
(b) What additional capacitance had to be connected in series to the circuit to bring the power factor to $\cos(\varphi') = 0.9$?

Exercise 22.



A resonant circuit consists of an ideal coil $L = 2,5\,\text{mH}$ and the capacitors $C_1 = 2\,\mu\text{F}$ and $C_2 = 3\,\mu\text{F}$. The capacitors were charged with $U = 180\,\text{V}$. Then, the switch is closed.

a) How large is the oscillation period?
b) Calculate the energies in the capacitors.
c) Determine the maximum current amplitude at the coil.

Exercise 23.

A RLC-circuit is connected to a sine wave-generator with tunable frequency f and constant amplitude $U_m = 10$ V ($R = 1.0 \cdot 10^2\ \Omega$, $C = 0.10\ \mu$F, $L = 0.245$ H).

(a) What does "resonance" mean? At what frequency f_0 will the resonance happen?
(b) How large is the amplitude of the current I_m in the resonant case?
(c) What is the voltage $U_{C,m}$ across the capacitor?

Exercise 24.

On the primary side of a voltage-reducing transformer 2.5 kV are fed, and loaded with 80 A on the secundary side. The ratio of the number of turns/windings on the primary and secundary sides is 20:1. Determine the voltage on the secondary side, the current on the primary side and the power output at an efficiency of 100% (ideal transformer)!

Answers.

Exercise 21. (a) 0.68 and 47.2° (b) 3.6 mF

Exercise 22. (a) $7.02 \cdot 10^{-4}$ s (b) $3.24 \cdot 10^{-2}$ J and $4.86 \cdot 10^{-2}$ J (c) 8.05 A

Exercise 23. (a) 1.02 kHz (b) 100 mA (c) 157 V

Exercise 24. 125 V, 4 A, 10 kW