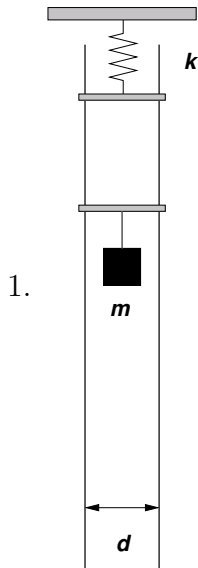


Problems

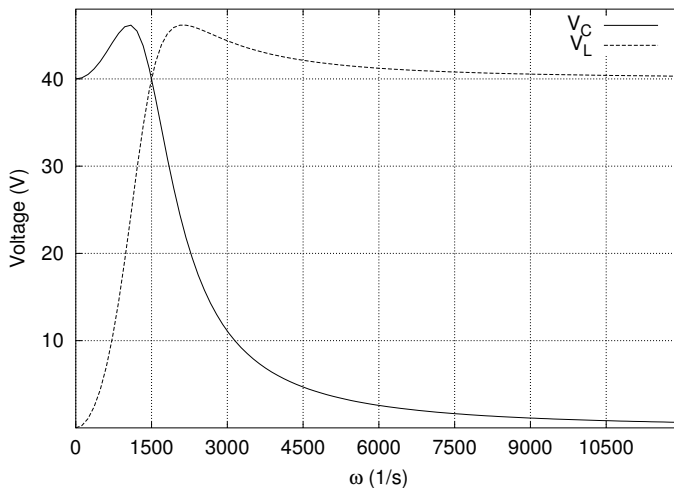


There are a vertical rails in the presence of uniform magnetic field of $B = 0.5 \text{ T}$ perpendicular to the plane of the rails. Two metal rods can slide on the rails without any friction. One of them is connected to the ceiling by a spring and a body with the mass of $m = 10 \text{ g}$ is connected to the other one. The resistivity of the rods is $R = 1 \text{ }\Omega$, the distance between the rails is $d = 0.1m$ and the spring constant is $k = 10 \text{ N/m}$.

a.) Give the maximum of the velocity of the body hanging on the rod! 8 points

b.) Give the elongation of the spring! 7 points

2. On the figure below the voltage on a capacitor (V_C) and the voltage on the inductor (V_L) are displayed in the case of a serially connected resistor capacitor and inductor. The self induction coefficient of the inductor is $L = 10^{-2} \text{ H}$.

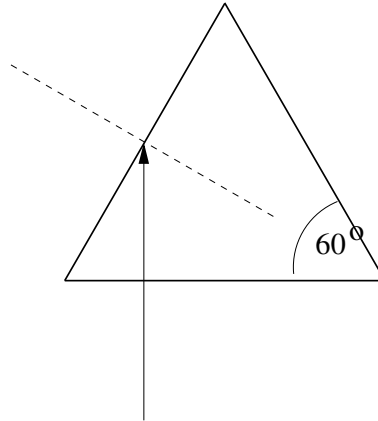


a.) Find the resonance frequency of the system and the voltage of the power supply from the figure! 5 points

b.) Give the capacity of the capacitor! 5 points

c.) Give the resistivity of the resistor in the serially connected the system! 5 points

3. An electric motor can be modeled as a serially connected inductor and resistor. The resistivity of the system is $R = 100 \Omega$. The power dissipated on the motor at 50 Hz is two times as large as the power of the system at 100 Hz .
- a.) Give the self induction coefficient of the motor! 8 points
- b.) Give the impedance of the motor at $f = 50 \text{ Hz}$! 4 points
4. A light beam of the mixture of red and blue colors passing through a prism as it is given on the figure. The index of refraction of the prism for the red and blue lights are $n_r = 1.1$ and $n_b = 1.2$, respectively. Give the angle between the outgoing red and blue beams! 10 points



5. There are 250 lines in 1mm of an optical grating. The wavelength of the incoming beam is $\lambda = 4.4 \times 10^{-7} \text{ m}$.
- a.) Give the position of the first minimum! 4 points
- c.) How many minima are there in the diffraction pattern? 4 points

0-20	21-30	31-40	41-50	51-60
1	2	3	4	5