Optics Exam

Name:
Group:

Number of points:
Mark:

1. A particle with a mass of $m = 10^{-5}$ kg and with a charge of $Q = 6.28 \times 10^{-4}$ C is moving in the presence of uniform magnetic field. The components of the magnetic field and the velocity are $\vec{B} = (0, 0, 10^{-3}T)$ and $\vec{v} = (0, 20\frac{m}{s}, 10\frac{m}{s})$, respectively.

   a. Give the velocity of the particle in 50 s!   8 points

   b. In how many seconds will the particle move with the same velocity as it had at the beginning?   7 points

2. There are two long horizontal straight wire in the presence of vertical magnetic field of 2 T on which a small metal rod with a mass of $m = 10$ g can slide without friction. (see the Figure)
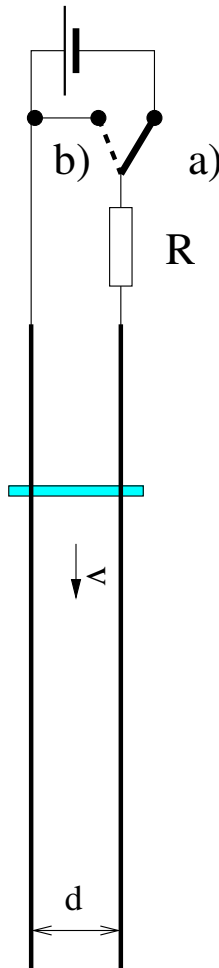
   a. In the first case the rails are connected to a battery through a resistor of $R = 0.1$ Ω. How large should we choose the voltage of the battery in order to keep the position of the rod on the rail?   7 points

   b. In the second case the the resistor connects the pair of rails. Give the maximum of the velocity of the metal rod in this situation! 8 points

3. The RLC system shown by the Figure is connected to a A.C. power supply. The amplitude of the power supply is $311V$. The same voltage can be measured on the resistor.

   a. Give the frequency of the A.C. voltage!   5 points

   b. How large is the impedance of the system?   5 points

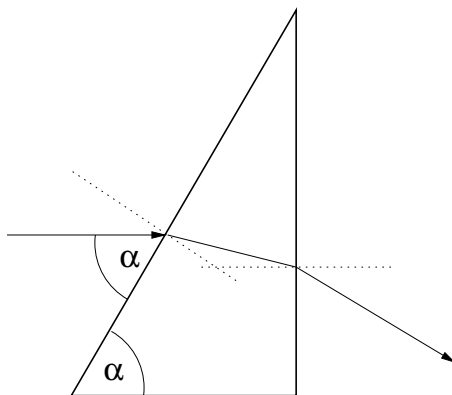   **c.** Give the amplitudes of the voltages on the inductor and the capacitor!   5 points
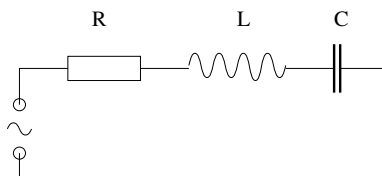
$$R = 100\Omega$$
$$L = 0.04H$$
$$C = 250\mu F$$

4. The angle of incidence in the case given by the Figure is $90^o - \alpha$ where α is the angle of the prism. The index of refraction of the prism is $n = 1.3$, $\alpha = 60^o$.

   a. Give the direction of the outgoing ray!   10 points

0–23	1
24–31	2
32–39	3
40–47	4
48–55	5

Problem	
1	
2	
3	
4	