

Optics Exam

Name:
Group:

Number of points:
Mark:

1. A particle with a mass of $m = 10^{-6}$ kg and with a charge of $Q = 10^{-4}$ C has circular motion with the radius of $r = 10$ m in the horizontal plane in the presence of uniform vertical magnetic field. The velocity of the particle is $v = 20$ m/s

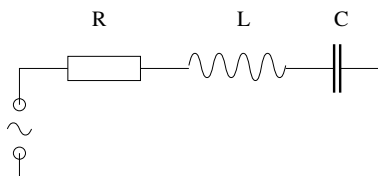
- a. Give the magnetic field! 8 points
b. Give the frequency of the motion in the field which is rotated by 30 degree to the field given in the previous question! 7 points

2. A metal rod can slide on a pair of rails without any friction in the presence of magnetic field of $B = 0.5$ T perpendicular to the plane of the rails. The resistivity of the rod is $R = 0.5 \Omega$ and the resistivity of the rails is negligible. A battery of $V = 1.5$ V is connected to the rails as it is shown by the figure.



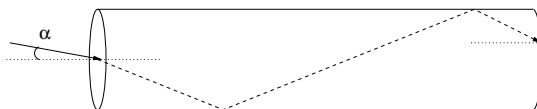
- a. How large force must on the metal rod be exerted in order to keep its position? 7 points
b. Long time after the rod is released it will have constant velocity. Give this velocity and the current through the rod! 8 points
3. The RLC system shown by the Figure is connected to a A.C. power supply. The effective voltage of the power supply is $V_{eff} = 10$ V and the effective value of the current is $I_{eff} = 0.2$ A.

- a. How large is the impedance of the system? 5 points
b. How much power is dissipated on the system? 5 points
c. Give the frequency of the power supply! 5 points



$$\begin{aligned} R &= 30\Omega \\ L &= 0.01H \\ C &= 500\mu F \end{aligned}$$

4. There is an optical fiber as it is given in the figure. The index of refraction inside the fiber is $n_2 = 1.3$ and outside – in the air – it is $n_1 = 1$. Give the largest value of α for which the light will leave the fiber at the other end! 10 points



0–22	1
23–31	2
32–39	3
40–47	4
48–55	5

Problem	
1	
2	
3	
4	