Electricity Exam

Name: Group:

Number of points:

Problems

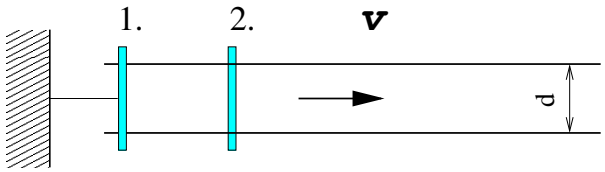
1. A positively charged particle is moving in the presence of uniform magnetic field. The charge of the particle is $Q = 10^{-6}$ C and the magnetic field vector is $\vec{B} = (0, 0, 0.5T)$.

   a.) The velocity vector of the particle at $t = 0$ is $\vec{v}_1 = (3m/s, 4m/s, 0)$ and at $t = 1s$ it is $\vec{v}_2 = (4m/s, -3m/s, 0)$. At what time will the velocity of the particle be the same as it was at the beginning? 5 points

   c.) How large is the angular velocity of the particle? 5 points

   c.) How large is the mass of the particle? 5 points

2. There are two long straight wires on which two metal rods can slide without friction. One of them is connected to the wall by a rope the other one can slide freely on the rail. The resistivity of the 1. and 2. rods are $R_1 = 1\Omega$ and $R_2 = 0.5\Omega$, respectively and the distance between the wires is $d = 0.1m$.



   a.) One of the rods is moving with a constant velocity of $v = 10m/s$ in the presence of uniform magnetic field of $B = 0.5T$ which is perpendicular to the plane of the rail. How much force must on the 2. rod be exerted in order to keep its velocity constant? 5 points

   b.) How large is the current through the rods? 5 points

   c.) Give the voltages on the rods! 5 points

3. An electric motor can be treated as a serially connected inductor and resistor. In our case the resistivity of the motor is $R = 400\Omega$ and its inductivity is $L = 0.954H$. The motor is connected to the 230V, 50Hz power-line.

   a.) Give the power dissipated on the motor ?

   b.) How much power will on the motor be dissipated if a capacitor of $C = 1.05 \times 10^{-5}$ is connected serially to it?

   c.) Give the voltage on the motor in case *b*!

4. There are 250 lines in 1mm of an optical grating. The wavelength of the incoming beam is $\lambda = 4 \times 10^{-7}$ m.

   a.) Give the position of the first maximum! 5 points

   b.) Give the position of the first minimum! 5 points

   c.) How many maximum are there in the diffraction pattern? 5 points

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