SB/HCV

PHY 103: General Physics 2 (2014 – 2015, Semester – I)

Department of Physics

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**Assignment- 9 (\*ed questions will not be done in tutorial)**

**1\***  A conducting spherical shell of radius R rotates about a diameter, taken as the *z-*axis, with angular velocity  in a uniform magnetic field  Calculate the emf developed between the points with  and .

**2**  Two parallel, thick metallic rods make an inclined track on which a metallic bar slides down. The separation between the rods in L. There is a uniform magnetic field B perpendicular to the plane of the track as shown. To start with the track is open on both sides. The resistance and the friction is to be neglected everywhere. The mass of the bar is m. (a) The ends A and B of the track are joined by a resistance R. Find the velocity as a function of time (t). Show that the bar acquires a terminal velocity and find its value. (b) Instead of resistance, a capacitor of capacitance C is joined across A and B. Show that the rod slides down with a constant acceleration and find its value.



[Ans.  (b)  ]

**3\*** A closed plane loop  moves in a magnetic field. At a certain time , its configuration is  and after a small interval , it is at  (figure). Join each point a on  to the corresponding point  on . This makes a strip with  and  as the edges. Prove that the difference in the magnetic flux  through the plane areas bounded by  and  has the same magnitude as the flux through the strip.



**4(a)** A magnetic field  exists in a long cylindrical region . Consider a rectangular path ABCD in the  plane, with the center of the rectangle at the origin (see figure). Let the length  and. Find (i)  , (ii) , (iii) .



(**b)** Consider the situation described above. Suppose a uniform frame made of copper is placed to fit ABCD. What is the value of . Why is it different from that found in the previous problem? Is  over the rectangle ABCD same or different in the two cases?

[Ans.(ai)(aii)(aiii)where(b), same]

**5\*** A spherical shell of radius  caries a surface current  in spherical coordinates with the center of the shell as the origin. Assume  to be small so that the current varies slowly. Find the vector potential and the induced electric field.

[Ans induced E-field  for  and for  ]

**6** A magnetic dipole with magnetic moment  moves with velocity . At a certain time  it is crossing the origin. Assuming, find the electric field at , created by this magnet at the point  in Cartesian coordinates.