ISLAMIC UNIVERSITY OF TECHNOLOGY

Organization of Islamic Cooperation

Board Bazar, Gazipur

Assignment

PHY 4141

Prof. Dr. Firoz Alam Khan

1. A potential difference is applied to a circular cylinder of carbon by clamping it between circular copper electrodes. Discuss the difficulty of calculating the resistance of the carbon cylinder, using the relation .

We know that

, and

Thus, the resistivity can be written as

However, the electric field in carbon is not parallel to its cylindrical surface, and the current density is not parallel to the area vector. This means the equation given is not reliable in this situation, making it difficult to measure the resistance of the carbon cylinder.

2. A closed copper coil with turns and a total resistance of is placed outside a solenoid. The solenoid has , a diameter of and carries a current of . The current is reduced to and then raised to in the other direction at a steady rate over a period of . What current appears in the coil?

Cross-sectional area of the solenoid:

Field in the solenoid:

Rate of change of flux:

The current in the coil is:

3. A stiff wire bent into a semicircle of radius is rotated with a frequency in a uniform field of induction . What ate the amplitude and frequency of the induced voltage and of the induced current when the internal resistance of the meter is and the remainder of the circuit has negligible resistance?

The magnitude of the EMF induced in the loop may be computed from the rate of change of flux through the loop. Let the plane with the normal to the field. Then the flux through the loop is where is the area of the loop.

Thus, the rate of change of flux is

The induced EMF is

where is the angular velocity of the loop and is the number of turns in the loop.

Putting , and ,

where is the minimum value of the induced EMF.

The amplitude of the induced voltage is

where we have set , the area of the loop.

Putting , the area of the semi-circular loop, and , we have,

Amplitude of induced current is,