Mahindra University Hyderabad

École Centrale School of Engineering
Minor-II exam

Program: B. Tech. **Branch: ALL Year: II** **Semester: I (Fall 2024)**
Subject: PHYSICS-II (PH 2102)

Date: 23-10-2024 **Start Time: 2:00 to 3:30 PM**
Time Duration: 1.5 Hours **Max. Marks: 35**

Instructions:

1) Answer all the questions.
2) Important: Answer all parts of a given question together. Otherwise, they won't be evaluated!
3) All the best!

Q 1. (a) A hydrogen atom (Bohr radius is half an angstrom) is situated between two metal plates *0.1 cm* apart, which are connected to opposite terminals of a *500 V* battery. If the separation distance between the proton and the electron cloud is *d*, estimate the voltage you would need to ionize the atom. $\frac{\alpha}{4\pi\epsilon_o} = 0.667 \times 10^{-30}\ m^3$.

(b) A sphere of radius **R** carries a polarization **P(r) = kr,** where **k** is a constant and **r** is the vector from the center. Find the field inside and outside the sphere using Gauss law for dielectrics.

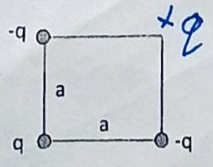
(5+5 = 10 marks)

Q 2. (a) Find the magnetic field a distance '*s*' from a long straight wire carrying a steady current '*I*' *(use Biot-Savart's Law).*

(b) Two parallel wires *d* apart carry currents $I_{1,2}$. What would be the magnitude of the force of attraction?

(5+5 = 10 marks)

Q 3. (a) Three charges are situated at the corners of a square (side a) as shown in the figure. How much work does it take to bring in another charge +q from far away and place it in the fourth corner?



(b) Elaborate, "Every object in this universe has certain magnetic moment" and "Magnetic monopole does not exist".

(5+2+2 = 9 marks)

Q 4. **(a)** Draw the magnetic field lines of a magnetic dipole.

(b) Write utility of the Hall measurement.

(c) Suppose we have a negatively charged ring, which is placed directly above a positively charged ring. If both rings spin in the same direction, magnetic interaction between them would be attractive or repulsive? Explain.

(2+1+3 = 6 marks)