THE ANSWERS MUST BE ATTEMPTED ON THE ANSWER SHEET PROVIDED

Q.1.   Answer the following short questions. Draw necessary neat diagram were needed: (15x2=30)

(1)-Suppose that an electric field in some region is found to have a constant direction but to be decreasing in strength to that direction. What do you conclude about the charge in the region?

(2)-An electrical dipole of dipole moment $\vec{p}$ is placed in a uniform electric field $\vec{E}$. Write an expression for its potential energy. For what orientation its potential energy will be maximum.

(3)-A capacitor stores charge q at a potential difference V. If the voltage applied by a battery to the capacitor is doubled to 2V, what happens to its capacitance?

(4)-How you conclude that electric potential energy reside in the volume between the plates of the capacitor?

(5)-How does the relation $V = iR$ apply to resistors that do not obey Ohm's law?

(6)-Under what circumstances can the terminal potential difference of a battery exceed its emf? Under what conditions these two are equal?

(7)-Wires that carry equal and opposite currents are often twisted together to reduce their magnetic effect at distant points. Why is this effective?

(8)-Is there any way to set up a magnetic field other than by causing charges to move?

(9)-Is the size of the voltage induced in a coil through which a magnet moves affected by the strength of the magnet? If so, explain how?

(10)-At an instant of time during the oscillations of an LC circuit, the current is momentarily zero. At this instant, what is the value of charge across the capacitor?

(11)-If the electric field in an electromagnetic wave is increasing in magnitude at a particular time, what can you say about magnitude of magnetic field at same time?

(12)-Could the alternating current resistance of a device depend on the frequency?

(13)-How do you distinguish between ϵ_0 and μ_0 ? How are they related with velocity of electromagnetic waves in free space?

(14)-What are uses of a diode in physics?

(15)-What are bias conditions of base emitter and base collector junctions for a transistor to operate as an amplifier?

Answer the following questions.

Q. 2: (a)-Apply Gauss's law to find electric field intensity near a plane non-conducting thin sheet of charge of infinite extent.

(b)-Express Gauss's law in differential and integral forms.   06 + 04

Q. 3: (a)-State Biot-Savart law in vector form. Use this law to find magnetic field due to an infinite straight wire carrying current.   05 + 05

(b)-Calculate energy stored in an inductor. Show that energy stored in magnetic field per unit volume is,

$$u_B = \frac{B^2}{2\mu_0}$$

Q. 4: (a)-Why is Maxwell modification of Ampere's law needed to understand the propagation of electromagnetic waves?   05 + 05

(b)-Define Poynting vector? Find its value for a plane electromagnetic wave. Also, relate electromagnetic energy to intensity of wave.