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IMPROTANT QUESTIONS MIT (1st year)

Q1. Define and differentiate between resistance and impedance?

Ans. Resistance is simply defined as the opposition to the flow of electric current in the circuit.

$R = V/I$ unit= ohm

Impedance is opposition to the flow of AC current because of any three components that is resistive, inductive or capacitive. It is a combination of both resistance and reactance in a circuit.

Impedance can also be defined as combined effect of resistance and reactance (Capacitive and Inductance) in an alternating current circuit

$Z = V_{rms}/I_{rms}$ unit=ohm

The various Difference Between Resistance and Impedance are described below in detail.

- The opposition offered to the flow of current in an electric circuit whether AC or DC is known as the Resistance. The opposition offered to the flow of current in an AC circuit because of resistance, capacitance and inductance is known as Impedance.
- Resistance occurs in both AC and DC circuit, whereas Impedance takes place only in an AC circuit.
- Resistance is the contribution of the resistive element in the circuit. whereas the contribution of both resistance and reactance forms Impedance.
- Resistance is denoted by (R) whereas impedance by (Z).
- Resistance is a simple value consisting of only real numbers. Example: 3.4 ohms, 6.2 ohms etc. Impedance comprise of both real and imaginary numbers. Example: R+ij. where R is a real number and ij is imaginary part.
- The Resistance of the circuit does not vary according to the frequency of AC or DC. whereas Impedance varies with the change in frequency.
- Impedance have both magnitude and phase angle, whereas Resistance does not have phase angle.
- Resistance if kept in an electromagnetic field represents power dissipation in any material. Similarly, if Impedance is subjected to magnetic field it represents both power

Q2. Define Law of magnetic force?

Ans.Basic **law of magnetism** is that unlike poles attract each other. Two bar **magnets** can illustrate this. One is hung so that it swings freely. A pole of the second is brought. in turn. near each of the two ends of the hanging magnet.

Q3. Define energy and power also write their units?

Ans.

Q4. What is faraday Law of electromagnetic induction?

Ans. In 1831, Michael Faraday, an English physicist gave one of the most basic laws of electromagnetism called **Faraday's law of electromagnetic induction**. This law explains the working principle of most of the electrical motors, generators, electrical transformers and inductors. This law shows the relationship between electric circuit and magnetic field. Faraday performs an experiment with a magnet and a coil. During his experiment, he found how emf is induced in the coil when flux linked with it changes.

Faraday's First Law

Any change in the magnetic field of a coil of wire will cause an emf to be induced in the coil. This emf induced is called induced emf and if the conductor circuit is closed, the current will also circulate through the circuit and this current is called induced current. Method to change magnetic field:

1. By moving a magnet towards or away from the coil
2. By moving the coil into or out of the magnetic field.
3. By changing the area of a coil placed in the magnetic field
4. By rotating the coil relative to the magnet.

Faraday's Second Law

It states that the magnitude of emf induced in the coil is equal to the rate of change of flux that linkages with the coil. The flux linkage of the coil is the product of the number of turns in the coil and flux associated with the coil.

Q5. Write working principal of electric motor?

Ans.A motor is an electrical machine which converts electrical energy into mechanical energy. The working principal of a DC motor is that "whenever a current carrying conductor is placed in a magnetic **field**, it experiences a mechanical force".

Q6. Discuss properties of Resistance in series and parallel circuits?

Ans. Most circuits have more than one component, called a resistor that limits the flow of charge in the circuit. A measure of this limit on charge flow is called resistance. The simplest combinations of resistors are the series and parallel connections.

Series circuits

A series circuit is a circuit in which resistors are arranged in a chain, so the current has only one path to take. The current is the same through each resistor. The total resistance of the circuit is found by simply adding up the resistance values of the individual resistors:

equivalent resistance of resistors in series: $R = R_1 + R_2 + R_3 + ..$

Ohm's Law: $V = IR$

1. $V_t = V_1 + V_2 + V_3 + V_4$
2. I is the same through all elements.

3. $R_t = R_1 + R_2 + R_3 + R_4$

Parallel circuits

A parallel circuit is a circuit in which the resistors are arranged with their heads connected, and their tails connected together. The current in a parallel circuit breaks up, with some flowing along each parallel branch and re-combining when the branches meet again. The voltage across each resistor in parallel is the same.

The total resistance of a set of resistors in parallel is found by adding up the reciprocals of the resistance values, and then taking the reciprocal of the total:

equivalent resistance of resistors in parallel: $1 / R = 1 / R_1 + 1 / R_2 + 1 / R_3 + ...$

1. V is the same across each circuit element.
2. $I_t = I_1 + I_2 + I_3 + I_4$
3. $1/R_t = 1/R_1 + 1/R_2 + 1/R_3$

Q8. Define Frequency, wavelength and time period?

Ans.

Q9. Differentiate between Mutual and Self Induction?

Ans.

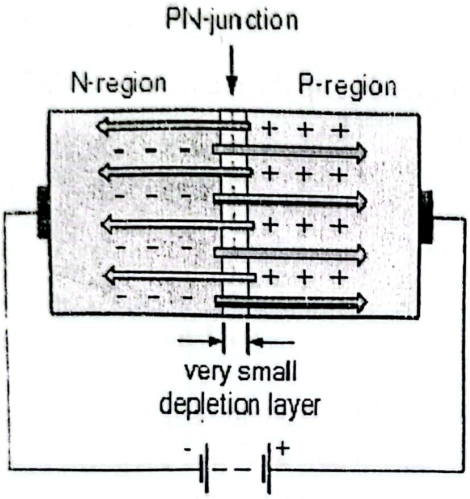
Self-Induction	**Mutual induction**
1. Self-Induction is the characteristic of the coil itself.	1. Mutual induction is the characteristic of a pair of coils.
2. When the main current in the coil decreases, the induced current opposes the decay of current in the coil.	2. When the main current in the coil decreases, induced current developed in the neighbouring coil opposes the decay of current in the coil.
3. When the main current in the coil increases, the induced current opposes the growth of current in the coil.	3. When the main current in the coil increases, The induced current developed in the neighboring coil opposes the growth of current in the coil.

Q10.Explain working principal of transformer?

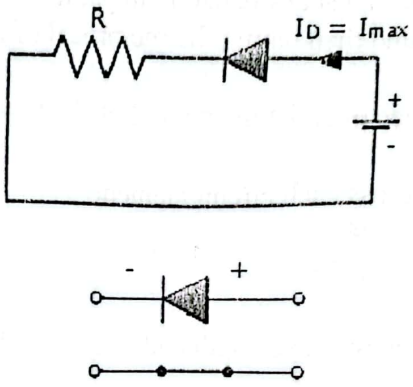
Ans.**Working principle:**It works on the principle of mutual induction . When current in the primary coil is changed the flux linked to the secondary coil also changes. Hence an EMF is induced in the secondary coil due to Faraday laws of electromagnetic induction

Q11. How diode works? or. Explain structure and working of a diode

Ans. A semiconductor device with two terminals, typically allowing the flow of current in one direction only. Two electrodes or terminals are anode and a cathode.



Forward Biasing Voltage



The most common type of diode uses a *p-n* junction. In this type of diode, one material (*n*) in which electrons are charge carriers touches a second material (*p*) in which holes act as charge carriers. At their interface, a depletion region is formed across which electrons diffuse to fill holes in the *p*-side. This stops the further flow of electrons. When this junction is forward biased (that is, a positive voltage is applied to the *p*-side), electrons can easily move across the junction to fill the holes, and a current flows through the diode. When the junction is reverse biased (that is, a negative voltage is applied to the *p*-side), the depletion region widens, and electrons cannot easily move across. The current remains very small until a certain voltage (the breakdown voltage) is reached and the current suddenly increases.

Function of diode

The main function of a diode is to block the current in one direction and allow current to flow in the other direction. Current flowing through the diode is called forward current.

There are several types of diodes:

Rectifier diodes -- these are the most common, with its function described above.

Detector diodes -- these are more sensitive than normal rectifier diodes. They are used in radios and televisions to convert radio signals to audio or television signals.

Zener diodes -- These diodes are the opposites of the normal diodes, because they are designed to conduct current in the backwards (reverse) direction BUT only at a very precise voltage. Zener diodes are used to regulate voltages (to behave sort-of like a battery).
Capacitance diodes act as tunable capacitors and are also used in radios and TVs to allow electronic automatic tuning. Tunnel diodes are used in oscillator circuits.

Q12. Differentiate between ionization and excitation?

Ans.

Q13. Enumerates type of ionizing and non-ionizing radiation or

Enumerates type of ionizing and non-ionizing radiation in electromagnetic spectrum?

Ans. **What is Radiation?**

The energy travelling through space is termed as radiation. Sunshine is one of the common forms of radiation that delivers heat, sunshine, and light. While we enjoy and depending on it, we also control our exposure to it. This is because prolonged exposure to certain radiations can lead to health problems that can eventually lead to death. Beyond ultraviolet radiation, higher-energy radiation exists, and they are used in medicine. We get these radiations in low doses from space. from the air, and from the earth and rocks. In this article, let us discuss the different types of radiation.

Types Of Radiation?

As we know, radiation is energy, which is emitted by a source, then travels through a medium, such as air, until it is absorbed by matter. Based on the energy of the radiated particles, they are classified as follows:

1. Ionizing radiation
2. Non-ionizing radiation

What is Ionizing Radiation?

Ionizing radiation is radiation with enough energy that produces ions in the matter at the molecular level upon the interaction. In other words, it can remove tightly bound electrons from the orbit of an atom, causing the atom to become charged or ionized. If the interacting matter is a human body, it can result in significant damage including damage to DNA and denaturation of proteins. This is not to say that non-ionizing radiation can't cause injury to humans, but the injury is generally limited to thermal damage i.e. burns. One of the most interesting things is that the visible spectrum is essentially the divide between ionizing and non-ionizing radiation. This makes sense clinically when we think of UV radiation causing skin cancer.

Types of Ionizing Radiation

Ionizing radiation is caused due to unstable atoms that either has excess energy or mass or both. For them to get back to a stable state, they have to release the extra mass or energy in the form of radiation. Given below are the different types of ionizing radiation along with a few of their characteristics:

1. Alpha particles
2. Beta particles
3. Gamma rays
4. X-rays

Non – Ionizing Radiation

Non-ionizing radiation is the term given to radiation that has insufficient energy to cause ionization. These kinds of radiations contradict with ionizing radiation like x-rays, gamma rays, and alpha particles, which are on the other end of the spectrum and are unstable and reactive. Non-ionizing radiation can produce heat, which is how food is cooked in a microwave oven. Humans and other organisms can see some types of non-ionizing radiation, such as visible light and infrared light. Following are the types of non-ionizing radiation:

- Ultraviolet radiation
- Visible light
- Infrared
- Microwave
- Radio waves
- Very Low Frequency (VLF)
- Extremely Low Frequency (ELF)
- Thermal radiation
- Black-body radiation

.Q14. Define Inductance and Capacitance?

Ans. Capacitance, which is measured in **farads**, is the ability to store energy in the form of an electric field. Capacitance exists whenever two conductors are separated by an insulating material; in this context, the insulating material is called the **dielectric**.

Inductance, which is measured in **henries** and denoted by the letter L, is the ability to store energy in the form of a magnetic field.

Q15. Enlist four steps used for film processing in radiography?

Ans.. Processing film basically involves the following five steps.

- Development - The developing agent gives up electrons to convert the silver halide grains to metallic silver. Grains that have been exposed to the radiation develop more rapidly, but given enough time the developer will convert all the silver ions into silver metal.

Proper temperature control is needed to convert exposed grains to pure silver while keeping unexposed grains as silver halide crystals.

- Stopping the development - The stop bath simply stops the development process by diluting and washing the developer away with water.
- Fixing - Unexposed silver halide crystals are removed by the fixing bath. The fixer dissolves only silver halide crystals, leaving the silver metal behind.
- Washing - The film is washed with water to remove all the processing chemicals.
- Drying - The film is dried for viewing.

Q16. Define Laws of resistance and derive relation for them?

Ans. **Laws of Resistance**

The resistance of a material varies depending upon the properties of the material and environmental conditions. Laws of resistance gives the four factors where the material depends.

First Law

The First Law states that " conductive material is directly proportional to the length of the material". According to this law, the resistance of the material increases with the increase in the length of the material and decreases with the decrease in the length of the material. .i.e.

$$R \propto L \text{——(1)}$$

Second Law

The Second Law states that " the conducting material is inversely proportional to the cross-sectional area of the material". According to this law, its material increases with the decrease in the cross-sectional area of the conductor and decreases with an increase in the cross-sectional area. With this, we can conclude that a thin wire has a larger resistance value compared to a broad wire of a larger cross-sectional area. .i.e. $R \propto 1/A$ ——(2).

Third Law

The Third Law states that " the conducting material depends on the nature of the material". According to this law, the resistance value of the material varies depending upon the type of material. Two wires made up of different materials and having the same length and cross-sectional area will have different values. Some materials offer good electrical conducting are have lesser values.

Fourth Law

The Fourth Law states that "the conducting material depends on its temperature". According to this law when the temperature of a metallic conductor is increased, it's value also increases.

From the first, second and third law, the resistance of a material can be given as $R \propto L/A$

$$\text{i.e } R = \rho L/A$$

where ρ is known as the **resistivity** constant or the **coefficient of resistance**. It is also known as the specific resistance of the material. Its units are Ohm-meter. Thus, knowing the length, cross-sectional area and material of the wire, it can be calculated.

Q17.Explain Ohm'slaw ?

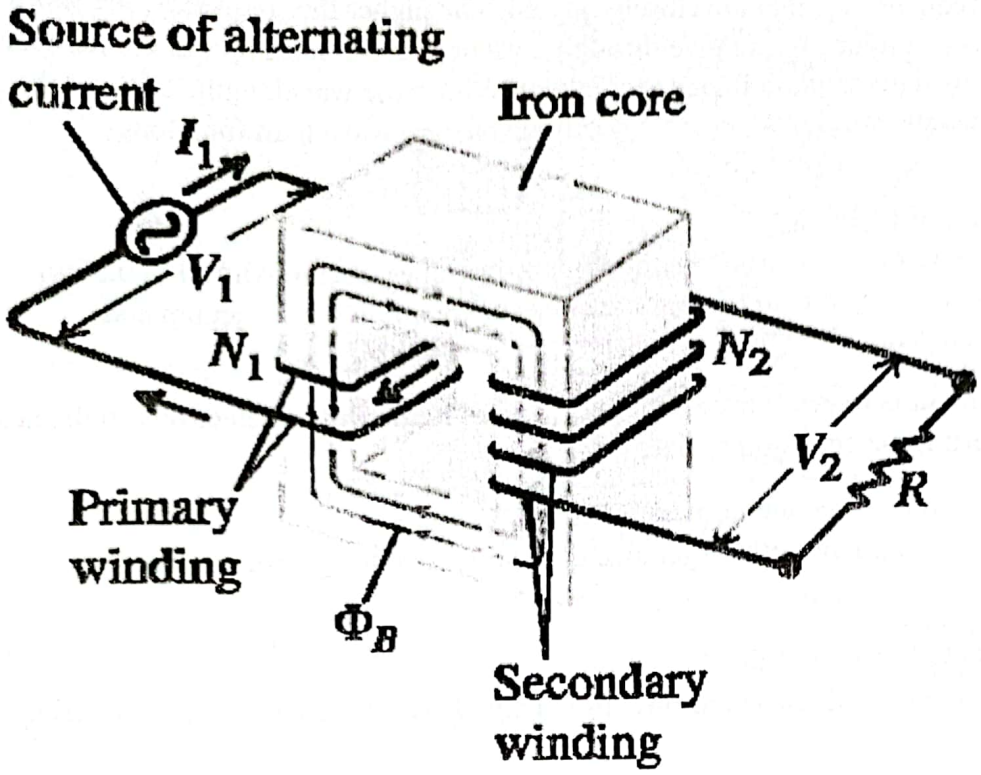
Limitations of Ohm's law :

1. Ohm's law is valid for metal conductors, provided the temperature and other physical conditions remain constant.
2. Ohm's law is not applicable to gaseous conductors.
3. Ohm's law is also not applicable to semi-conductors such as Germanium and Silicon.

Q18. Three resistance of 9,11 and 13 ohm,s are connected in parallel and supplied with 100 volts. Find total resistance and current for ech resistance

Ans.

Q19.Write detail note on transformer?



A transformer is an electrical device used to change a given alternating emf into a larger or smaller alternating emf.

Principle: The transformer works on the principle of mutual induction between two coils.

Construction: Thetransformer consists of two coils of copper electrically insulated from each other, wound on the same iron core. The coil to which AC power is supplied is called primary and that from which power is delivered to the circuit is called secondary.

Working:

Q20. List three primary function of the X-rays tube's protective housing

Ans.Controls leakage and scattering, isolates the high voltage, provide a means to cool the tube

Q21. Explain three causes of x-ray tube failure?

Ans.1. A single excessive exposure

2. Long exposure time causes excessive heating of the anode

3. Vaporization of the filament causes tungsten to coat the enclosure & eventually causes arcing

Q23. What is tube current in an X-ray tube? Or What is the usual tube current range for diagnostic x-ray systems?

Ans.100 to 1200 mA

Q24. How are frequency and wavelength related?

Inversely.

As frequency increases, wavelength decreases proportionately.The equation that relates wavelength and frequency for electromagnetic waves is:

$\lambda\nu=v$ where λ is the wavelength, ν is the frequency and $v$is the speed of light.

The wavelength and frequency of light are closely related. The higher the frequency, the shorter the wavelength. Because all light waves move through a vacuum at the same speed, the number of wave crests passing by a given point in one second depends on the wavelength. That number, also known as the frequency, will be larger for a short-wavelength wave than for a long-wavelength wave.

Q25. What is the function of filament?
Ans. The filament is the source of electrons (cathode) in x-ray tubes. A thin wire (0.1- 0.5 mm, usually tungsten) emits electrons due to thermionic emission, operating in a vacuum and energized with electric current.

The function of the filament is to provide sufficient resistance to the flow of electrons so the heat produced will cause thermionic emission to occur.

Difference between x-ray tube of ct and conventional x-ray?
A CT tube utilizes a larger filament with larger size of the effective focal spot than a conventional x-ray tube.